



**DISASTER
RELIEF
AUSTRALIA**

Project Resilience
Macleay River Catchment, Kempsey, NSW



Our Intent

“Project Resilience” is a system (like a community) which is used to monitor disturbance and still retain a basic function and structure. Building resilience means intentionally guiding the system’s process of adaptation to preserve some qualities and allow others to fade away, all the while retaining the essence—or “identity”—of the system.

In a community, identity is essentially determined by what people value about where they live. However, what a community of people collectively value, is open to interpretation and subject to disagreement.

Although many resilience frameworks and tools for building community resilience are now available across Australia, no single approach will likely work for all communities and their varied social and economic contexts. Therefore, the Project Resilience Team has identified six foundations that, in our view, are essential—no matter where or how resilience-building efforts are undertaken, or which challenges are of most concern locally. The foundations support building community resilience, rather than achieving resilience as a fixed goal, to emphasise resilience building as an ongoing process.

How DRA Defines Resilience:



People: Resilient people are aware of situations, their own emotional reactions, and the behaviour of those around them. By remaining aware, they maintain control of a situation and think of new ways to tackle problems. In many cases, resilient people emerge stronger after such difficulties.



Making Sense: Making sense of a problem is essential for understanding the bigger picture. Making sense of things is a way to explore and develop effective future plans at a community level.



Bouncing Back: Resilient communities can bounce back from adverse situations. They can do this by actively influencing and preparing for economic, social and environmental change.



Striving Forward: As we look to the future, some challenges will be so big that it won't be possible for the community to simply adapt. Fundamental changes will be necessary, and the community will need to adapt.



Our Human Needs: A sustainable community is a place where people want to live and work, both now and in the future. The community needs of existing and future residents are sensitive to environment and contribute to a high quality of life. These communities are inclusive, well-planned, built and run, and offer equality of opportunity and good services for all.



Courage: Everyone within a community needs the courage to confront challenging issues and take responsibility for a collective future.

Based on: The Community Resilience Leader. Essential Resources for an Era of upheaval 2016

Executive Summary

Building resilient communities in the context of a disaster event integrates prevention, preparation, response, and recovery is a complex and continuous process, rather than a process with a definitive end point or 'destination.' The purpose of the 'Big Map' capability is to combine local knowledge with our disaster management expertise to better understand a community profile based on the community's exposure within an all-hazards environment¹. There is widespread international recognition that engaging communities and supporting place-based solutions and approaches to disaster risk reduction generate system-wide benefits².

Disaster Relief Australia (DRA) in collaboration with the Minderoo Foundation's Resilient Communities Initiative and Allianz Australia Insurance conducted the Big Map exercise in Macleay Catchment, NSW on 27 and 28 July 2023. Attendees for 27 July 2023 included Local Government representatives, operational emergency management staff, key partners, and other stakeholders. A second Big Map exercise was conducted on 28 July 2023 and members of the community were invited to attend.

Within DRA, we believe a resilient community is one whose members are connected to one another and work together in ways that enable it to function in the face of stress and trauma. A resilient community has the ability to adapt to changes in the physical, social, or economic environment, and the potential to learn from experience and improve over time. A resilient community can also be self-sufficient, at least for a time, if external assistance is limited or delayed.

As communities are complex and dynamic social structures, levels of community resilience are not static. It is important that those utilising the concept of community resilience make efforts to regularly measure it. Everyone has a unique combination of capabilities and capacity to prepare, cope and recover from disaster, which means they are vulnerable and resilient in different ways. Each level of society has aspects of resilience or vulnerability nested within it. Central to this is better understanding the systemic nature of risk and Australia's vulnerability³.

The first step towards enhancing the resilience of a community involves understanding the community's strengths and vulnerabilities, as well as its physical characteristics (local infrastructure), procedural characteristics (e.g. disaster policies and plans) and social characteristics (e.g. level of community cohesion).

¹ <https://disasterreliefaus.org/big-map/>

² National Action 20, Second National Action Plan to implement the National Disaster Risk Reduction Framework, https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf [Retrieved 9 September 2023]

³ Risk reduction: A shared responsibility, The Second National Action Plan to implement the National Disaster Risk Reduction Framework, https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf [Retrieved 9 September 2023]

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1. Disaster Relief Australia Resilience Process

The Disaster Relief Australia (DRA) Resilience Process comprises four stages, each of which are broken down into multiple steps. The DRA Resilience Process provides guidance to each Disaster Relief Team (DRT) across Australia. A future DRA Resilience Framework is currently being developed and will function to:

- Support Disaster Relief Team (DRT) Managers in the assessment and prioritisation of community-based resilience projects.
- Establish a consistent approach to recognising what levels of vulnerability may exist within the regional operating areas of each DRT.
- Guide, lead, and mentor the Minderoo Foundation in the development of strategic and detailed analysis of where future resilience projects may be required.
- With DRTs as the strategic lead, create a targeted approach to building resilience through clear principles for decision making and prioritisation of future resilience workshops and adaption that can be applied across the public, private and community sectors.
- Recognise national and international disaster risk reduction, mitigation, and adaptation approaches, including the Sendai Framework for Disaster Risk Reduction.



Figure 1: The Disaster Relief Australia Resilience Process

Increasing our knowledge and awareness of community vulnerabilities, strengthening our capability and capacity to provide relief when required, and tightening our community bonds are all key to DRA and the DRA Resilience Process. As an emerging area of culture and practice, DRA is leading the way in understanding, working with and empowering community-led discussions and community-based forums. For many DRA members, these forms of community-led discussions and forums are second nature due to their previous operational experience within the Australian Defence Force and consequent ability to assimilate risk and operational effectiveness on a battlefield. The Big Map discussion is based on a military wargame theory, serving as a tool for stimulating innovative thought. All the information utilised in the Big Map Capability is available through open sources.

2. Understanding the Bigger Picture

The Australian continent is divided into topographical drainage divisions that are sub-divided into water regions and then into river basins (Figure 2). The data includes the name and number of each of the 245 basins / catchments, 77 regions, and 12 divisions. New South Wales (NSW) is divided into 45 river catchments, some of which encompass multiple Local Government Areas.

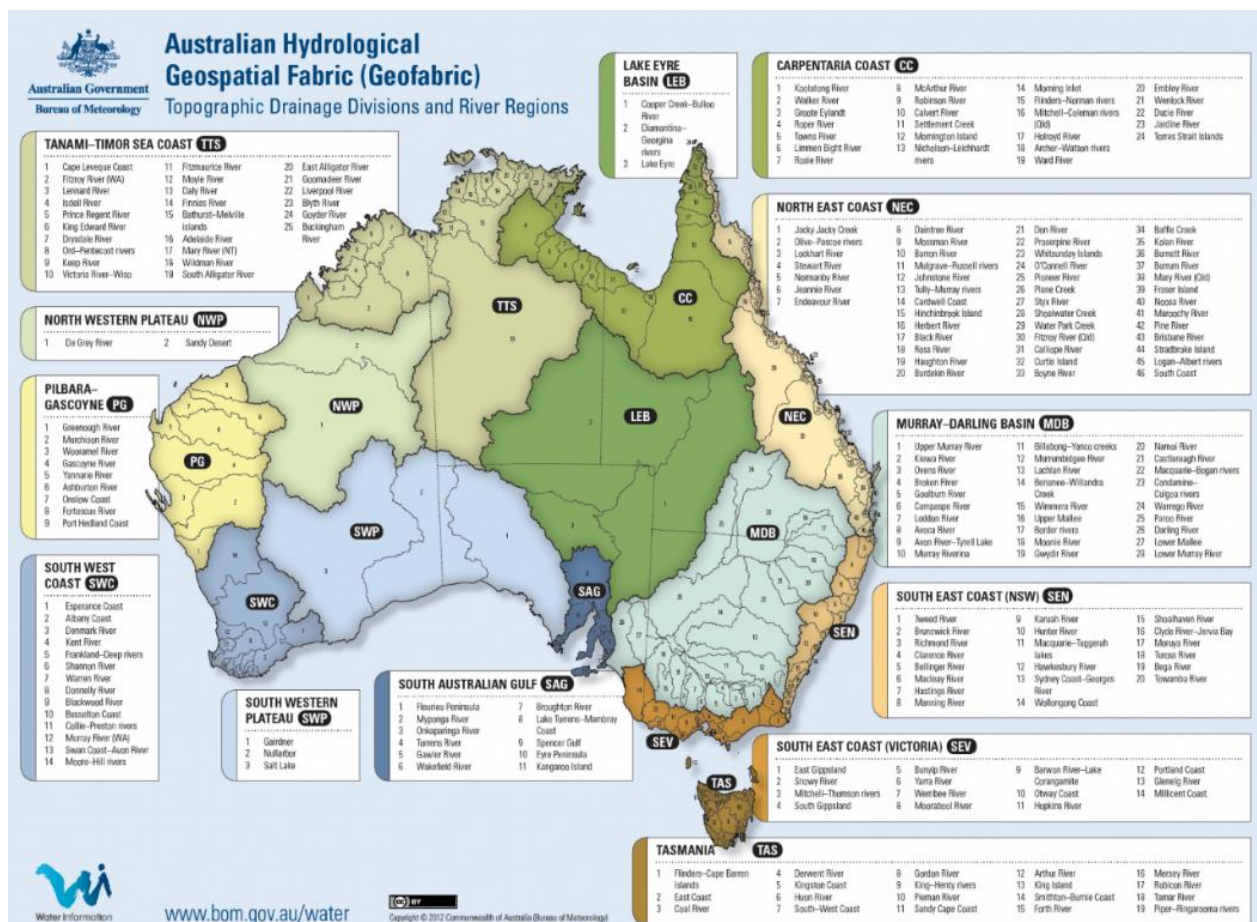


Figure 2: Topographic Drainage Divisions and River Regions of Australia

The Macleay River rises a considerable distance inland within the Great Dividing Range east of Uralla. The river travels some 300 kilometres south-east to reach the ocean at South West Rocks. In its upper reaches, it passes through rugged landscapes and gorges creating spectacular waterfalls in the Cunnawarra and Oxley Wild Rivers National Parks. Today, land use in the Macleay River Catchment is diverse and includes fishing and oyster farming, horticulture and cropping, cattle and sheep grazing, dairying, mining and quarrying, forestry and Agro-forestry, light and commercial industry, urban and tourist development and national parks.

Upper Catchment

The New England Tablelands section

This section is entirely outside the Kempsey Shire and contains principal tributaries.

The Gorge Section

Where the rivers leave the tablelands in a series of waterfalls and joins to form the Macleay River in the well-defined gorge. Here the valleys are steep-sided, stream gradients are steep and flood flow velocities are high. Within this section of the river there are several minor tributaries including the Parrabel, Hickeys, Georges and Nulla Nulla Creeks and Dykes River but no major ones. Below the Hickeys Creek confluence the topography becomes less severe as the river emerges from the gorges⁴.

The Macleay Floodplain

The Lower Macleay River valley consists of primarily one significant landform feature. The lower Macleay River floodplain covers an area of approximately 400 square kilometres which begins at the upper limit of tidal influence. Here there are extensive alluvial flats, and well-defined natural levees along the river and its tributaries (the Belmore River and Christmas, Kinchela and Clybucca creeks). The ground slopes away from the levees to low-lying swamplands (Doughboy, Cooroobongatti and Belmore Swamps and Swan Pool wetlands) which act as storage areas for flood waters.

Its lower reaches on the Mid North Coast are the most well-known and have generated a series of historic river townships with the largest being Kempsey, as well as others at Frederickton, Gladstone, Smithtown and Jerseyville. South West Rocks at the mouth of the river, along with the nearby Trial Bay Gaol, are popular tourist destinations today.

The river flows adjacent to the city of Kempsey and has been ever-present with a number of major flood episodes affecting Kempsey and downstream areas. This area and its problems have been ameliorated by a variety of construction works, including the opening in 2014 of the Macleay River Bridge, the longest road bridge in Australia. It is this downstream flood plain area that has seen the greatest links over time between the river and supporting townships. Visiting places today such as Frederickton, Gladstone, Smithtown and Jerseyville provides an insight into these strong connections to the river, past and present.

⁴ <https://archive.kempsey.nsw.gov.au/environment/floodplain/background-lower-macleay-flood-risk-management.html>
[Retrieved 3 September 2023]

The river reaches the sea via the main entrance (New Entrance, South West Rocks) and during floods may do so through Korogoro Creek, Rowes Cut, Ryans Cut, Killick Creek and Big Hill drains. Water can also flow into the Hastings Catchment via Connection Creek to the Maria River, or even flow from Maria River back into the Macleay catchment⁵. On some occasions, flooding in the lower valley can be exacerbated by very high tides or by ocean storm surge conditions.

Key Information Summary

⁵ Kempsey Shire Local Flood Plan <https://www.ses.nsw.gov.au/media/2328/kempsey-shire-local-flood-plan-all-signed.pdf> [Retrieved 3 September 2023]

Table 1: Macleay Catchment Key Information

| | |
|-------------------------------|--|
| Total length | 298km |
| Formation point | Confluence of Gara River, Salisbury Waters and Bakers Creek within the Great Dividing Range. |
| Termination point | Pacific Ocean at the South West Rocks |
| Tributaries | 26 |
| Major water bodies | <p>Storage Dams – Stuart McIntyre Dam – Kempsey Shire Council.</p> <p>Steuart McIntyre Dam is an off-stream water supply for the town of Kempsey. It consists of a main earthen embankment, spillway and an inlet/outlet structure. The dam has a storage capacity of 2500ML and a catchment area of about 60.5 hectares.</p> <p>Situated approximately 10 km west of Kempsey. Downstream communities are Yarravel and Aldavilla.</p> <p>The time it takes for the initial wave front to reach the first house is within 15 minutes from the commencement of failure of the dam.</p> |
| Major roads | Armidale Road, Princess Highway, multiple local and rural roads |
| Bioregion/s: | NSW North Coast |
| Local Government Areas | Kempsey Shire Local Government Area (LGA) |
| Communities | Bellbrook, Willawarrin, Kempsey (CBD, West, East, and South), Aldavilla, Euroka, Frederickton, Smithtown, Gladstone, Crescent Head and surrounding areas. |
| At-risk | The facilities that are at risk of flooding and/or isolation within the Kempsey Shire LGA including schools, childcare centres, hospitals, aged and infirm, infrastructure and caravan parks. |

The likelihood of a flood is a measure of its relative severity in terms of the annual exceedance probability (AEP) or the average recurrence interval (ARI) of the flood. These terms give a measure of the chance of a flood of a given magnitude being reached or exceeded in any given year⁶.

⁶ <https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Water/Floodplains/flood-risk-management-manual-2023-230220.pdf>

4. Weather Systems and Flooding

East Coast Lows – The floods of August 1949, June 1950 and May 1963 (the most severe) were of this origin.

Rain Depressions – The flood of January 1974 was of this type, the ‘tail’ of ex-Tropical Cyclone Wanda caused heavy falls over south-eastern Queensland and north-eastern NSW. Two months later, flooding occurred from a rain depression, which had originated as Tropical Cyclone Zoe.

Monsoonal Low-Pressure Systems – These move across the Great Dividing Range from northern Australia, usually during the late summer and autumn months. Flooding from this mechanism is rare in the Macleay River valley.

Thunderstorms – Can occur frequently over the Shire, especially during the summer months. The rain from such storms may cause town drainage systems or minor creeks to surcharge, creating local flooding of low-lying areas. No rise in the Macleay River is likely from such events.

Most of the larger floods at Kempsey have resulted from events where significant rain has fallen over the whole of the catchment. About half of the recorded floods on the Macleay River have occurred during summer, between January and March. The incidence of flooding in the winter months is lower but winter floods have tended to be the most severe.



Figure 4: The Macleay River at Temagog

Flooding upstream of Kempsey is confined to areas close to the river and its tributaries, though in more severe events, quite large expanses in Temagog, Mooneba, Sherwood, Turners Flat, Dondingalong and Eureka areas can be inundated. Downstream of Aldavilla the floodplain broadens significantly with many connecting waterways further downstream.

At Kempsey, flow is mostly confined to a narrow area at the Kempsey Traffic Bridge. In floods greater than 7.2 metres, a natural floodway cuts northward through the CBD at the Kempsey Traffic Bridge gauge (the Kempsey gauge). The peak 1% AEP flow in the Macleay River at Kempsey is approximately 15,000 cubic metres a second. At the railway crossing at Kempsey, this flow is predominantly confined to a relatively narrow flow area of the main river channel and part of the left overbank area through the township of Kempsey.

Downstream of the Kempsey Traffic Bridge, the flow spreads out across the floodplain into East Kempsey wetland and Pola Creek area toward the southern Frogmore floodplain, with an extent of approximately 4 kilometres in the vicinity of Frederickton. Under the existing conditions, many properties in Kempsey, Frederickton and the surrounding floodplain area would be inundated in events approaching 8.6 metres on the Kempsey gauge, lasting over 48 hours.

Belmore River

The low-lying floodplains surrounding Belmore River impact significantly on the flooding of the area. As Belmore River diverts from the Macleay River the flood waters travel fast through the river causing it to break its banks. The rate of rise decreases as the flood waters travels along Belmore River.

The Belmore floodway was designed to discharge flow from the main river and thus lower levels in sections of the Macleay River during small or nuisance river rise events. The Kinchela floodways were designed to prevent overtopping of the natural and artificial levee system along Kinchela Creek.



Figure 5: Ocean floodwater outlet discharging flood water from the Belmore area into the ocean.

The Belmore Floodway has a greater effect on levels in the Macleay River than the Kinchela Floodways however, the discharge of flood water through both the Belmore and Kinchela control structures has generally very little influence on flood water levels at Kempsey.

The present scheme protects most rural area up to a 1 in 2.5 year flood event.



Figure 6: Belmore River and Kinchela Creek crossover gates

Kinchela Creek

The river and creeks in the area are the main source of direct flooding of properties. Flood waters coming from the Macleay River, and to some extent Kinchela Creek, are fast, whereas flood waters from overland flow or from the various swamp areas are slow.



Figure 7: Kinchela Creek Right Bank Road, Kinchela

Maria River



Figure 8: Maria River, Crescent Head.

The Maria River is the major tidal tributary and joins the Hastings River about 10 kilometres upstream from the ocean entrance. It drains the northern section of the Hastings catchment that extends along the coastal plain toward Kempsey and during periods of flood flow permits an exchange of water between the adjacent valleys via Connection Creek.

The water level can be partially controlled through the operation of a weir at the Kempsey / Port Macquarie Hastings LGA boundary. It is joined by the Wilson River immediately downstream of Telegraph Point which extends west to Upper Rowland's Plains.

5. Historical Flood Information

There is a reasonable amount of historical flood information available for both the Kempsey township and the broader catchment area. The type of flood data available includes (but is not limited to):

- time-series records of observed river levels at several water level recorders (e.g. at the Kempsey Traffic Bridge),
- historical peak flood height observations at a number of different locations,
- related photographs of flooding and flood damage,
- anecdotal evidence from members of the local community.

Table 2: Approximate Gauge Levels and Indicative Flow Travel time for Georges Creek⁷

| Georges Creek | Bellbrook | Turners Flat | Kempsey | Smithtown |
|---------------|-----------|--------------|---------|-----------|
|---------------|-----------|--------------|---------|-----------|

⁷ Kempsey Shire Local Flood Plan <https://www.ses.nsw.gov.au/media/2328/kempsey-shire-local-flood-plan-all-signed.pdf> [Retrieve 3 September 2023]

| River Height | | | | |
|--------------|----------------|----------------|----------------|----------------|
| 4m | 3.0m (+8hrs) | 2.65m (+16hrs) | 1.4m (+24hrs) | - |
| 8m | 7.0m (+9hrs) | 5.5m (+17hrs) | 4.6m (+25hrs) | - |
| 9m | 7.3m (+9hrs) | 6.0m (+16hrs) | 5.7m (+24hrs) | 4.2m (+29hrs) |
| 11m | 10.65m (+7hrs) | 9.87m (+13hrs) | 6.60m (+20hrs) | 4.3m (+22hrs) |
| 13.8m | 15.5m (+5hrs) | 13.7m (+11hrs) | 8.0m (+16hrs) | 4.5m (+17hrs) |
| 17m | 17.5m (+4hrs) | 18m (+10hrs) | 8.7m (+14hrs) | 4.75m (+15hrs) |
| 20m | 21m | 20m | 12.5m (+12hrs) | - |

Past Major Flood Events

Table 3: Floods which have exceeded 6.0m at Kempsey gauge (post 1945)⁴

| Date | Georges Creek | Bellbrook | Kempsey | Smithtown |
|---|---------------|-----------|---------|----------------|
| Aug 1949 | 14.10 | 17.22 | 8.52 | - |
| June 1950 | - | 18.06 | 8.31 | - |
| Aug 1952 | - | 13.03 | 6.56 | - |
| Feb 1954 | - | 11.23 | 6.36 | - |
| Nov 1959 | - | 9.75 | 6.43 | - |
| April 1962 | - | 8.15 | 6.08 | - |
| May 1963 | 13.50 | 15.54 | 7.68 | Estimated 4.30 |
| June 1967 | - | 10.24 | 6.56 | - |
| Jan 1968 | - | 8.84 | 6.31 | - |
| Jan 1974 | 8.63 | 7.70 | 6.10 | - |
| March 1974 | 6.78 | 7.11 | 6.23 | - |
| Feb 1976 | 8.64 | 7.56 | 6.05 | - |
| May 1977 | 7.60 | 6.75 | 6.11 | - |
| May 1980 | 7.00 | 7.14 | 6.27 | - |
| April 1989 | 6.72 | 6.34 | 6.11 | - |
| March 2001 | 11.90 | 12.80 | 7.44* | Estimated 4.34 |
| May 2009 | 10.77 | 11.40 | 6.90* | Estimated 4.29 |
| June 2011 | 11.00* | 10.65* | 6.70* | Estimated 4.21 |
| Feb 2013 | 12.14 | 11.30 | 7.11 | - |
| *Manual gauge readings only – telemetric failed | | | | |

August 1949 Flood Event – Flood of Record

The river reached a maximum height on the Traffic Bridge gauge of 8.52 metres AHD on 27 August 1949. The flood of August 1949 was originally considered as the "1 in 100 flood", however more recent analysis indicates that it had an average recurrence interval (ARI) of about 1 in 90 years.

June 1950 Flood Event

The peak at Kempsey of 8.31 metres AHD on the gauge occurred on the 25 June 1950. Flood levels in some areas were comparable to or exceeded 1949 event due to local conditions.

May 1963 Flood Event

The peak of the flood at 7.68 metres occurred at Kempsey on 9 May. This flood is now estimated to be a 1 in 15 year ARI event.

March 2001 Flood Event

The flood peaked at 7.44 metres AHD on 10 March. This flood now appears to be about a 1 in 12 year event.

May 2009 Flood Event

This event peaked at 6.9 metres AHD on 24 May.

June 2011 Flood Event

This event was similar to the 2009 event and did not overtop the levee system. Flood water was within 100 mm of the levee crest at Eden Street at the flood peak of 6.72 metres AHD on 15 June.

February 2013 Flood Event

The largest of the peaks was 7.11 metres AHD on 24 February at Kempsey, which was followed by a smaller peak above the moderate level of 5.95 metres AHD on 4 March. The flood on 24 February was estimated to be about a 1 in 11 year event.

Communities

Bellbrook Community

Bellbrook is 54 kilometres west of Kempsey in the Upper Macleay Valley. The village of Bellbrook itself (population less than 200) is flood-free but a small number of farmhouses in lower areas outside the village could be affected by severe floods, however this remains unknown.

The community has a hotel, shop, and community hall. Flooding in the Bellbrook area is confined to areas close to the river and its tributaries, though in more severe events quite large areas can be inundated. Bellbrook is a High Flood Island that is cut off and becomes isolated due to road closures.

Willawarrin Community

Willawarrin is a rural village 35kms west of Kempsey on the Armidale Road, surrounded by grazing land and forests, close to the Macleay River and is predominantly flood free. Flooding is usually confined to areas close to the river and its tributaries though in more severe events quite large areas can be inundated including sections within the village of Willawarrin. Willawarrin is a High Flood Island that is cut off and becomes isolated due to road closures.

Kempsey Central Business District (CBD) Central Kempsey

Kempsey is the main regional centre on the Lower Macleay floodplain, and it has been flooded on several occasions, with loss of life and severe property damage in the CBD and nearby residences.

| Depth at Kempsey Gauge | Impact |
|------------------------|---|
| 2.5m | Flooding confined to low-lying areas adjacent to south of First Lane and around Gladstone Street underpass. |
| 5.97m | Coles car park starts to flood – flows to drainage pit in Belgrave Street and pools behind RSL levee |
| 6.6 – 7.43m | Levee-overtopping – all roads in Kempsey CBD would be cut |

At a level of 2.5 metres at the Kempsey gauge (the gauge), flooding is generally confined to the low-lying areas adjacent south of First Lane and around the Gladstone Street underpass. From around 5.97 metres, the Coles car park starts to flood, and then flows across the footpath in Lower Belgrave Street to a drainage pit in Belgrave Street and pools behind the RSL levee.

Once the Macleay River breaches its banks and overtops the Eden Street and Cochrane Street Levees, flood waters flow back towards Belgrave Street, causing a basin effect within the floodway. All roads within Central Kempsey would be cut in a levee-overtopping flood, which begins from 5.9 metres.

The flood depth on roads in the CBD could reach between 2 and 3.5 metres in an 8.55 metre flood. Belgrave Street and access would be cut to West Kempsey when the levee overtops. Access to East Kempsey via the Traffic Bridge is still available from some areas in the area. Levee overtopping can be expected to occur when the predicted peak water level at the Kempsey Traffic Bridge falls between a range of 6.6 and 7.43 metres AHD. At 7.7 metres, river levels greater than 10 metres depth can be experienced with these depths being confined to the main channel of the river.



Figure 9: The Macleay River at the moderate level (around 5.7m) in Kempsey on the 24th March 2021

West Kempsey

West Kempsey comprises of a commercial hub, schools and residential properties. Also located within this sector are the Police and Fire stations. Flooding in West Kempsey is generally from the Macleay River, and is influenced by the Willow Drain Backwater, Dangar Street Backwater and the Wide Street/Cooks Lane Levee overtopping flow-path.

West Kempsey would be isolated from the CBD with Eden or Cochrane Street levee overtopping and Belgrave Street floods. The Council Depot would be partly flooded. In floods above 8.3 metres, the Fire and Police Stations would be isolated as the Wide Street/Cooks Lane levee overtops and water flows over River Street into the Dangar Street backwater area.

East Kempsey

The majority of properties in East Kempsey are located largely on high land on the eastern side of the Macleay River over the traffic bridge from the CBD. East Kempsey also includes some low-lying land such as East Kempsey Wetland and Pola Creek.

Access to South Kempsey from East Kempsey is cut off from around 8.55 metres on the gauge. East Kempsey can access the Pacific Highway to the south via Macleay Valley Way.

South Kempsey

This is south of the CBD on the southern side of the Macleay River along the highway north to the river including the area of Euroka. The majority of residential properties in South Kempsey are located on high ground. Bloomfield Street may become inundated in events as small as 6.6 metres at Kempsey gauge, although no properties are subject to significant flood damage from mainstream flooding.

Aldavilla Community

Aldavilla is located approximately 10 kilometres from the Kempsey CBD and is situated on the eastern side of the Macleay River. It is comprised of rural and semi-rural properties. The Kempsey Airport is located in Aldavilla. The area is a combination of flood storage, floodway and minor backwater with a large proportion of high hazard areas unsafe for people and vehicles. Stuart McIntyre Dam is located on Fattorini Creek, Link Road Yarravel. Approximately 50 properties in the Aldavilla area would be affected in the event of a dam failure.

Frederickton

A small township which is just north of Kempsey. Most of Frederickton is on relatively high ground with some low-lying houses in the southern portion which were previously affected by floods below 5.97 metres at the gauge.

Lower Macleay – Smithtown, Gladstone, Crescent Head and surrounding areas

Large areas of the Lower Macleay are liable to flooding, roads and bridges can close early, areas then can be isolated and farming operations disrupted even in relatively frequent and low-level events.

The problems are many and the effects in the more severe events can be devastating.

Summary of Isolated Communities and Properties⁸

| Town / Area | Sector | Population / Dwellings | Flood Affect Classification | Approximate period isolation | | | Main Supply Routes | Notes |
|--------------------------------|--------|------------------------|-----------------------------|------------------------------|------------|----------|--------------------|---|
| | | | | Minor | Moderate | Major | | |
| Georges Creek | 1 | 50 (22) | High Flood Island | 1-5 days | 6-9 days | >9 days | Armidale Rd | Resupply likely to be required after 5 days by air. |
| Bellbrook and surrounding area | 1 | 544 (271) | High Flood Island | 1-10 days | 10-16 days | >20 days | Armidale Rd | Resupply likely to be required after 5 days by air. |
| Willawarrin | 1 | 335 (153) | High Flood Island | 5-7 days | 10-14 days | >20 days | Armidale Rd | Resupply likely to be required after 5 days by air. |

| Town / Area | Sector | Population / Dwellings | Flood Affect Classification | 10% | 5% | 2% | 1% | Main Supply Routes | Notes |
|---------------|--------|------------------------|-----------------------------|----------|----------|----------|----------|--------------------|---|
| | | | | 7.24m | 7.70m | 8.24m | 8.55m | | |
| Kempsey CBD | 2 | 1000 (450) | Low Flood Island / Levee | 2-5 days | 5-7 days | >10 days | >15 days | Pacific Hwy | Resupply generally not required - Inundated |
| Kempsey West | 2 | 4740 (2054) | High Flood Island | 2-5 days | 5-7 days | >10 days | >15 days | Pacific Hwy | Resupply likely to be required after 5 days by air. |
| Kempsey East | 2 | 1117 (518) | High Flood Island | 2-5 days | 5-7 days | >10 days | >15 days | Pacific Hwy | Resupply generally not required |
| Kempsey South | 2 | 2467 (1020) | High Flood Island | 2-5 days | 5-7 days | >10 days | >15 days | Pacific Hwy | Resupply generally not required |

⁸ mpsey Shire Local Flood Plan [kempsey-shire-local-flood-plan-all-signed.pdf \(nsw.gov.au\)](https://www.nsw.gov.au/kempsey-shire-local-flood-plan-all-signed.pdf)

| Town / Area | Sector | Population / Dwellings | Flood Affect Classification | 10% | 5% | 2% | 1% | Main Supply Routes | Notes |
|-----------------------------|--------|------------------------|-----------------------------|----------|-----------|------------|----------|---|---|
| | | | | 7.24m | 7.70m | 8.24m | 8.55m | | |
| Frederickton | 3 | 1248 (483) | High Flood Island | - | - | - | >15 days | Pacific Hwy / Bypass | Resupply likely to be required after 5 days by air. |
| Aldavilla | 2 | 1055 (231) | High Flood Island | 2-5 days | 5-7 days | >10 days | >15 days | Pacific Hwy | Resupply generally not required |
| Bellimbopinni, Clybucca | 4 | 100 | Low Flood Island | 5-7 days | 7-10 days | 10-15 days | >20 days | Pacific Hwy, Plummer's Lane | Resupply likely to be required after 5 days to Summer Island Area |
| Smithtown | 5 | 591 (262) | Low Flood Island | 5-7 days | 7-10 days | 10-15 days | >20 days | South West Rocks Rd | Resupply likely to be required after 5 days |
| Gladstone | 5 | 364 (164) | Low Flood Island | 5-7 days | 7-10 days | 10-15 days | >20 days | South West Rocks Rd | Resupply likely to be required after 5 days |
| Kinchela | 5 | 525 (237) | Low Flood Island | 5-7 days | 7-10 days | 10-15 days | >20 days | South West Rocks Rd | Resupply likely to be required after 5 days |
| Jerseyville | 8 | | Low Flood Island | 5-7 days | 7-10 days | 10-15 days | >20 days | South West Rocks Rd | Resupply likely to be required after 5 days |
| Austral Eden, Belmore River | 5 | | Low Flood Island | 5-7 days | 7-10 days | 10-15 days | >20 days | - | Resupply generally not required |
| Hat Head | 9 | 299 (285) | High Flood Island | 5-7 days | 7-10 days | 10-15 days | >20 days | South West Rocks Rd, Hat Head Rd | Resupply generally not required |
| Crescent Head | 6 | 1966 (1100) | High Flood Island | 5-7 days | 7-10 days | 10-15 days | >20 days | Crescent Head Rd | Resupply Local Store |
| South West Rocks | 8 | 4612 (2893) | High Flood Island | 5-7 days | 7-10 days | 10-15 days | >20 days | South West Rocks Rd, Plummer's Lane to Gregory Street | Resupply to supermarket |
| Maria River | 7 | 100 (55) | Low Flood Island | 5-7 days | 7-10 days | 10-15 days | >20 days | Maria River Rd | Resupply generally not required |

6. Macleay Catchment Flood Gauges

Forecast Gauges⁹

| Location | BOM No | AWRC No | Station Operator | Flood Classification | | | Station Type |
|----------------------------|--------|---------|---------------------------------|----------------------|----------|-------|--------------|
| | | | | Minor | Moderate | Major | |
| Armidale (Stephens Bridge) | 556017 | 206032 | Water NSW | 2.9 | - | - | Automatic |
| Georges Creek | 557001 | 206204 | Kempsey Shire Council Water NSW | 6.0 | 8.0 | 10.0 | Automatic |
| Bellbrook | 59122 | 206019 | Kempsey Shire Council | 6.5 | 10.5 | 13.5 | Automatic |
| Kempsey | 59127 | 206402 | Kempsey Shire Council NSW OEH | 4.5 | 5.7 | 6.6 | Automatic |
| Smithtown | 559040 | 206406 | NSW OEH | 3.4 | 4.0 | 4.2 | Automatic |

Data Gauges¹⁰

| Location | BOM No | AWRC No | Station Operator | Flood Classification | | | Station Type |
|------------------------------------|----------|---------|---------------------------|----------------------|----------|-------|--------------|
| | | | | Minor | Moderate | Major | |
| Aldavilla (Downstream) | 559151 | 206459 | Kempsey Shire Council OEH | | | | Automatic |
| Apsley Falls | 557012 | 206018 | WaterNSW | | | | Automatic |
| Apsley Gorge | 557013 | 206033 | WaterNSW | | | | Automatic |
| Belmore River Entrance | 559003 | 206405 | Kempsey Shire Council | | | | Automatic |
| Belmore River Upstream Floodgates | 559029 | 206604 | Kempsey Shire Council | | | | Automatic |
| Clybucca Creek Upstream Floodgates | 559032 | 206620 | Kempsey Shire Council | | | | Automatic |
| Coninside | 557006 | 206014 | WaterNSW | | | | Automatic |
| Collombatti | 559037 | 206907 | Kempsey Shire Council | | | | Automatic |
| Dumaresq Dam (Downstream) | 556022 | 206037 | WaterNSW | | | | Automatic |
| Glen Forrest | External | 206906 | WaterNSW | | | | Automatic |
| Jeogla | 557002 | 206001 | WaterNSW | | | | Automatic |
| Jerseyville | 559013 | 206408 | Kempsey Shire Council | | | | Automatic |

⁹ Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory – Version 3.13 http://www.bom.gov.au/nsw/NSW_SLS_Current.pdf

¹⁰ As detailed above

| Location | BOM No | AWRC No | Station Operator | Flood Classification | | | Station Type |
|--------------------------------------|--------|---------|-----------------------|----------------------|----------|-------|--------------|
| | | | | Minor | Moderate | Major | |
| Kinchela Creek Downstream Floodgates | 559031 | 206611 | Kempsey Shire Council | | | | Automatic |
| Macleay River at Kinchela Creek | 559010 | 206426 | Kempsey Shire Council | | | | Automatic |
| Kirby Farm | 556016 | 206027 | WaterNSW | | | | Automatic |
| Kogal | 059056 | 206900 | Kempsey Shire Council | | | | Automatic |
| Malpas Dam (Downstream) | 556034 | 206039 | WaterNSW | | | | Automatic |
| Moparrabah | 059128 | 206904 | Kempsey Shire Council | | | | Automatic |
| Newholme | 556020 | 206026 | WaterNSW | | | | Automatic |
| Plummers Lane | 559035 | 206910 | Kempsey Shire Council | | | | Automatic |
| Rainbow Reach | 559036 | 206908 | Kempsey Shire Council | | | | Automatic |
| Seven Oaks | 559034 | n/a | Kempsey Shire Council | | | | Automatic |
| Seale Road | 559026 | 206601 | Kempsey Shire Council | | | | Automatic |
| South West Rocks | 559041 | 206456 | Kempsey Shire Council | | | | Automatic |
| Tia | 057112 | 206009 | OEH | | | | Automatic |
| Castle Doyle | 556021 | 206008 | WaterNSW | | | | Automatic |
| Toorooka | 559038 | 206907 | WaterNSW | | | | Automatic |
| Turners Flat | 559002 | 206011 | Kempsey Shire Council | | | | Automatic |
| Urandangie | 556033 | 206038 | WaterNSW | | | | Automatic |
| Willow Glen | 556031 | 206035 | WaterNSW | | | | Automatic |
| Wittitrin | 059125 | 206903 | WaterNSW | | | | Automatic |
| Dangars Falls | 556012 | 206205 | WaterNSW | | | | Automatic |
| Sherwood Bridge | 559067 | - | Kempsey Shire Council | | | | Automatic |
| Malpas Dam | 556032 | 206036 | WaterNSW | | | | Automatic |
| Wollomombi | 057079 | 206905 | Kempsey Shire Council | | | | Automatic |

8. Flood Structures of Note¹¹

Ryans Cut – Ryans Cut is essentially a channel cut directly through the sand dunes on Killick Beach. A floodgate on Loftus Road controls the use of the cut. Ryans Cut traverses a back swamp area between the flood gate and the ocean. After flood waters are released from the Belmore River into Belmore Swamp, Ryans Cut is then used to drain the remainder of flood waters into the ocean.



Figure 10: Ryans Cut, Crescent Head

Big Hill Cut Floodgates – This cut consists of an excavated channel adjacent to Big Hill Headland, with a flood gate at the ocean entrance on the southern side of Delicate Nobby Beach. The floodgates are used in events greater than 10% AEP after other flood mitigation works have been used. The gates relieve flooding to around 30-40 properties and roads including Maria River Road. Sand builds up on the floodgate must be excavated prior to operating the gate.

Killick Creek Floodgates – Killick Creek Floodgates are used to reduce flooding on the Belmore River, including when Connection Creek joins the Belmore River (Connection Creek connects the Macleay and the Hastings River catchments in large floods).

Korogoro Creek Floodgates – Korogoro Creek Floodgates are located on Hat Head Road; the floodgates are manually wound down and are used to slow flood water down to minimise damage to the levees on either side of the river protecting the village of Hat Head as its outlets to the ocean. A 2-kilometre control levee is also in place upstream of Hat Head Road bridge, referred to as ‘the choke’.

Rowes Cut – Rowes Cut is a swale cut from Korogoro Creek through Hat Head dunes to the ocean. The swale is between Korogoro Creek Floodgates and ‘the choke’. Rowes Cut has not been used in a very long time and it is uncertain if the channel would be usable at the present time

Fredericktown Floodgates – automatic floodgates under the Pacific Highway

¹¹ Kempsey Shire Local Flood Plan. <https://www.ses.nsw.gov.au/media/2328/kempsey-shire-local-flood-plan-all-signed.pdf>

Kinchela and Belmore Floodgates – manual floodgates in Belmore and Kinchela. They have little benefit in floods greater than 7.24 metres at the Kempsey gauge.

Willow Drain – consists of six 1.8 by 1.8 metres high culverts that allow water to drain from the CBD post event in the vicinity of the Cochrane Street.

9. Flood Mitigation Function and Operation

There is a lot of misunderstanding by the general community about the function, capabilities and protection measures afforded by the existing flood mitigation system, with particular emphasis on the operation and capabilities of the flood control structures located on the Belmore River and Kinchela Creek systems. The Kempsey township area is sited on a natural overbank flow path of the Macleay River in flood and is typically prone to flooding during flood events that exceed the 1 in 10 year flood level.

Currently four main levees protect Kempsey CBD; Eden Street, First Lane, RSL Wall and Wide Street, with a major floodway identified through the middle of the commercial district. A full description of the Kempsey flood protection infrastructure is provided in the Kempsey CBD Floodplain Risk Management Study¹² (WMAwater 2017)

There are approximately 177 floodgates within the Kempsey Shire, including at Kinchela and Belmore. While some operate automatically, others require manual opening. Council considers operating the floodgates at around 5.1 metres on the Kempsey gauge but is dependent on daylight to ensure the farmers have maximum time to evacuate. Once the gates open, water spills out into the floodplain and wetlands to reduce flood levels in Kempsey and small rural settlements. In larger floods, the floodgates do not significantly change the flood levels.

Extensive rural flood mitigation works have been completed since the 1950s on the floodplain of the lower Macleay River. These comprise levees, barrages, drains, floodgates, floodways, training walls, ocean cuts and riverbank stabilisation works. They are designed to reduce the frequency and real extent of flooding in small events and to facilitate drainage after inundation.

In small floods, around 6 metres on the Kempsey gauge, the flood mitigation works contain flood waters in the major streams and prevent flood waters spilling onto the floodplain. This minimises the frequency of inundation, which is the major cause of agricultural damage, and maximises the time available for moving stock during major events.

By 7.24 metres at the Kempsey gauge, many floodgates are opened to let flood waters spill into the floodplain and wetland areas throughout the floodplain. This action helps to reduce flood levels experienced by Kempsey and small rural settlements at the expense of agricultural losses.

¹² [Kempsey CBD Flood Risk Management Study and Plan | Your Say Macleay \(nsw.gov.au\)](#)

In larger floods, greater than 7.24 metres at the Kempsey gauge, the operation of the floodgates does not significantly change flood levels. During non-flood times the floodgates are left open to allow normal flushing.

There are 15 levee systems within the Kempsey Shire LGA, with the majority designed to minimise residential and agricultural damages during small floods:

1. Short Street/Wide Street/Cooks Lane Levee located between Short Street and Cooks Lane. 8.3m Kempsey gauge
2. Cochrane Street Levee located north of First Lane, runs between the railway embankment at Broughton Street and the high bank of the Macleay River. 6.6 – 7.43m Kempsey gauge
3. Eden Street Levee located along the northern side of Eden Street between the railway embankment and the high ground in the CBD. 6.68 – 6.9m Kempsey gauge
4. RSL Levee located along the riverbank opposite the RSL tying into the high ground at the northern end and free standing at the southern end. 7.12m Kempsey gauge
5. Frederickton Interchange Levee located along the bank of the Macleay River at Lawson Street and the Pacific Highway. 9.05m Kempsey gauge
6. Kempsey to Frederickton Levee system located on the left bank of the Macleay River between Kempsey and Frederickton.
7. Smithtown Levee begins at the southern end of Belmore Street in Smithtown and extends around the left bank of the Macleay River to the Smithtown boat ramp.
8. East Kempsey to Gladstone Levee system located on the right-hand bank of the Macleay River (looking downstream) and is made up of 3.3 kilometres of constructed levees.
9. Hat Head Levee System: The Control Levee located approximately 2 kilometres upstream of the Korogoro Creek Bridge, Village Levee located along the northern bank of Korogoro Creek and South West Levee is the embankment for Gap Road.
10. Christmas Creek Levee system on the left and right banks of Christmas Creek.
11. Frederickton to Smithtown Levee located on the left bank of the Macleay River stretching between the northern embankment of the Kempsey Bypass Bridge at Frederickton and Smithtown.
12. Belmore River Levee system located on the left and right banks of Belmore River commencing at the Macleay River junction and terminating at the Belmore River head works structure. The Belmore floodway was designed to discharge flow from the main river, lowering the levels in sections of the Macleay River during small or nuisance river rise events.

The Belmore Floodway has a greater effect on levels in the Macleay River than the Kinchela Floodway. However, the discharge of flood water through both the Belmore and Kinchela control structures has generally very little influence on flood water levels at Kempsey.

13. Kinchela Creek Levee system located on the left and right banks of Kinchela Creek commencing at the Macleay River junction and terminates at the Kinchela head works structure. The Kinchela floodways were designed to prevent overtopping of the natural and artificial levee system along Kinchela Creek.
14. Rainbow Reach Levee located on the left bank of the Macleay River at Rainbow Reach.
15. Smithtown to Jerseyville Levee system extends 31.2 kilometres along the left and right banks of the Macleay River.

10. Government and Stakeholders Involvement in Flood Management

Flooding results in significant risk to many communities across New South Wales. This risk stems from human interaction with flooding through the occupation and use of floodplains.

Since 1984 the NSW Flood prone land policy (the policy) has set the direction for flood risk management (FRM) in New South Wales. In 1986 the NSW Government released the first Floodplain Development Manual to support policy implementation. The policy and manual have since evolved in response to significant flood events, reviews, and improvements in national and international flood risk management practice.

On 30 June 2023, the NSW State Government Department of Planning and Environment released the newly revised Flood Risk Management Manual¹³. This Manual provides for the development and implementation of sustainable strategies for managing human occupation and use of the floodplain, in accordance with section 733 of the *Local Government Act 1993* (LG Act). It provides for the evaluation of strategies and formulation of plans that achieve effective flood risk management outcomes accounting for social, economic, ecological, and cultural factors, together with community aspirations for the use of flood prone land.

¹³ 2023 Flood Risk Management Manual, <https://www.environment.nsw.gov.au/research-and-publications/publications-search/flood-risk-management-manual>

The new Manual (including the policy) replaces the Floodplain Development Manual (DIPNR 2005) as the NSW Government's manual relating to the management of flood liable land. This provides councils, statutory authorities, and state agencies and their staff, with indemnity for decisions they make and information they provide in accordance with the manual.

Other related documents include:

- Administration Arrangements guideline AG01
 - This guideline provides supplementary advice to the Flood Risk Management Manual. It outlines the current guidance and tools in the flood risk management toolkit to support councils to understand and manage flood risk through the flood risk management framework. It also provided advice on current state agency flood risk management roles and responsibilities, relevant legislative links and a glossary of additional terms used in guides in the toolkit.
 - <https://www.environment.nsw.gov.au/research-and-publications/publications-search/flood-risk-management-guide-administration-arrangements>
- Delivery under the flood risk management framework FG01
 - This guideline describes delivery of the flood risk management framework as well as key steps in undertaking flood risk management projects under the flood risk management process and identifies how other flood risk management guides and tools can assist.
 - <https://www.environment.nsw.gov.au/research-and-publications/publications-search/delivery-under-the-flood-risk-management-framework>
- Understanding and Managing Flood Risk FB01
 - This guideline provides advice on how the flood risk management process can assist in understanding and managing existing, future, and continuing risk to reduce the residual risk to the community.
 - <https://www.environment.nsw.gov.au/research-and-publications/publications-search/understanding-and-managing-flood-risk>
- Flood Function FB02
 - This guideline provides advice on the categorisation of areas of the floodplain into floodways, flood storage areas and flood fringe based on their flood function. This information can inform flood risk management, emergency management and land use planning.
 - <https://www.environment.nsw.gov.au/research-and-publications/publications-search/flood-function>
- Flood Hazard FB03
 - This guideline provides advice on flood hazard categorisation so this information can inform flood risk management, emergency management and land use planning.
 - <https://www.environment.nsw.gov.au/research-and-publications/publications-search/flood-hazard>

- Flood Risk Management Measures MM01
 - This guideline aims to support effective consideration and decision-making for recommendation of flood risk management measures as part of the flood risk management process.
 - <https://www.environment.nsw.gov.au/research-and-publications/publications-search/flood-risk-management-measures>

- Support for Emergency Management Planning EM01
 - This guideline provides advice on how the flood risk management process can provide advice to support flood emergency management planning by the NSW SES.
 - <https://www.environment.nsw.gov.au/research-and-publications/publications-search/support-for-emergency-management-planning>

- Flood Impact and Risk Assessment LU01
 - This guideline provides advice on the scope and scale of a flood impact and risk assessment. It does not replace the processes or requirements of the consent authority. It should be read in conjunction with and address any other assessment requirements for the development proposal/application.
 - <https://www.environment.nsw.gov.au/research-and-publications/publications-search/flood-impact-and-risk-assessment>

The management of flood risk in NSW is a partnership across governments, with local government generally leading FRM in their LGA. The NSW Government provides councils with technical and financial support for eligible FRM activities under the FRM framework under funding programs. Funding applications are considered on a statewide priority basis. The NSW Government may consider taking on an expanded role in high priority areas.

The NSW Government also has an expanded FRM role in regional planning and in specific rural areas of the Murray–Darling Basin, as outlined in Section 5.2.3. The development of rural floodplain management plans in these specific areas is led by the NSW Government. It generally follows a process similar to the FRM process but differs in focus.

11. Kempsey Development Control Plan 2013, Chapter B7: Flood Hazard Area Management

Over the past decade, 19 natural disasters have been declared in the region. While a single catastrophe can involve years of recovery, the residents of this shire have dealt with multiple floods, fires, storms, and intense drought. Floods are natural phenomena where water inundates land that is usually dry, generally due to weather systems that generate a high amount of rainfall. Flooding can be due to water flowing within, out of, or towards a waterway.

In line with the Kempsey Local Environmental Plan 2013, the Development Control Plan aims to make local environmental planning provisions for land in Kempsey in accordance with the relevant standard environmental planning instrument under section 3.20 of the Act. Within this development control plan sits the B7, Flood Hazard Area Management.¹⁴ This Chapter applies to all land within the Kempsey Shire LGA, which is identified on the Flood Planning maps on Council's website and other land at or below the Flood Planning Level.

Chapter Objectives:

1. To ensure that development on flood prone land is consistent with:
 - Kempsey Local Environmental Plan 2013;
 - Council's adopted Floodplain Risk Management Plans;
 - NSW Government's Flood prone Lands Policy; and
 - NSW Government's Flood Risk Management Manual.
2. To ensure that new development on flood prone land is compatible with the degree of flood hazard and that adequate flood risk management measures are incorporated in the design of the development thereby minimising the possibility of loss of life and damage to property.
3. To encourage the re-development of existing flood prone lands in a manner that will minimise the chance of loss of life and damage to property by future flooding.
4. To prevent the creation of any 'new area' of urban development on flood prone lands.
5. To prevent any extension of existing urban zoned areas into flood prone lands.
6. To seek the eventual clearance of the Kempsey CBD Floodway Number 1 and its re-development for recreational, agricultural, and limited commercial uses which will only have a minimal effect on the free flow of floodwaters and minimal risk of causing loss of life or damage to property, e.g., sporting fields, picnic grounds, nurseries, recreation facilities with minimal permanent buildings and no residential facilities.

12. Flood and Water Data Collection

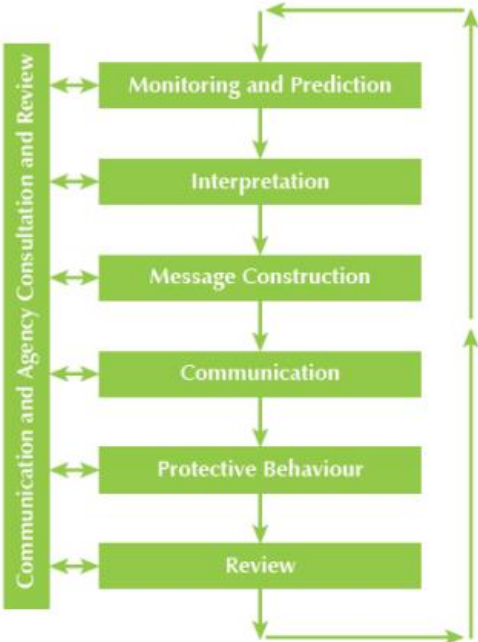
The Bureau of Meteorology

The Bureau of Meteorology (the Bureau) provides generalised, qualitative or quantitative flood predictions for agreed flood forecast locations across Australia. Information on flood conditions, heights and classifications are provided as per the 'Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory – Version 3.13'.¹⁵

¹⁴ Chapter B7: Flood Hazard Area Management, <https://www.kempsey.nsw.gov.au/Plan-Build/Local-planning-zoning/Kempsey-Development-Control-Plan-2013/kdcp-b07-flood-hazard-area-management>

¹⁵ http://www.bom.gov.au/nsw/NSW_SLS_Current.pdf

The Bureau’s flood forecasting, and warning services are provided within the context of the Total Flood Warning System as defined in the ‘Australian Emergency Manuals Series, Manual 21 Flood Warning’ (Australian Government, 2009 and illustrated below)¹⁶:



The components of the Total Flood Warning System (Australian Emergency Manual Series, Manual 21 Flood Warning, Australian Government 2009)

The collection and publishing of rainfall and river level data is an important component of the overall service. Apart from use by the Bureau for data analysis and its hydrological modelling for flood predictions, the data is also used by the emergency service agencies, numerous operational agencies, businesses, and the public to monitor rainfall and river conditions. To assist in describing the service, the locations where river height; dam, weir, or lake level; and tidal observations are made are categorised into three types; namely forecast location (Schedule 2), information location (Schedule 3a and 3b) and data location (Schedule 4).

The Bureau monitors the Macleay River Catchment through several different monitoring stations and publishes this information on its website¹⁷. The below figures show the river gauge monitoring stations with the Macleay River Catchment and the information that they display.

¹⁶ <https://knowledge.aidr.org.au/media/1964/manual-21-flood-warning.pdf>

¹⁷ Macleay River <http://www.bom.gov.au/nsw/flood/midnorth.shtml>

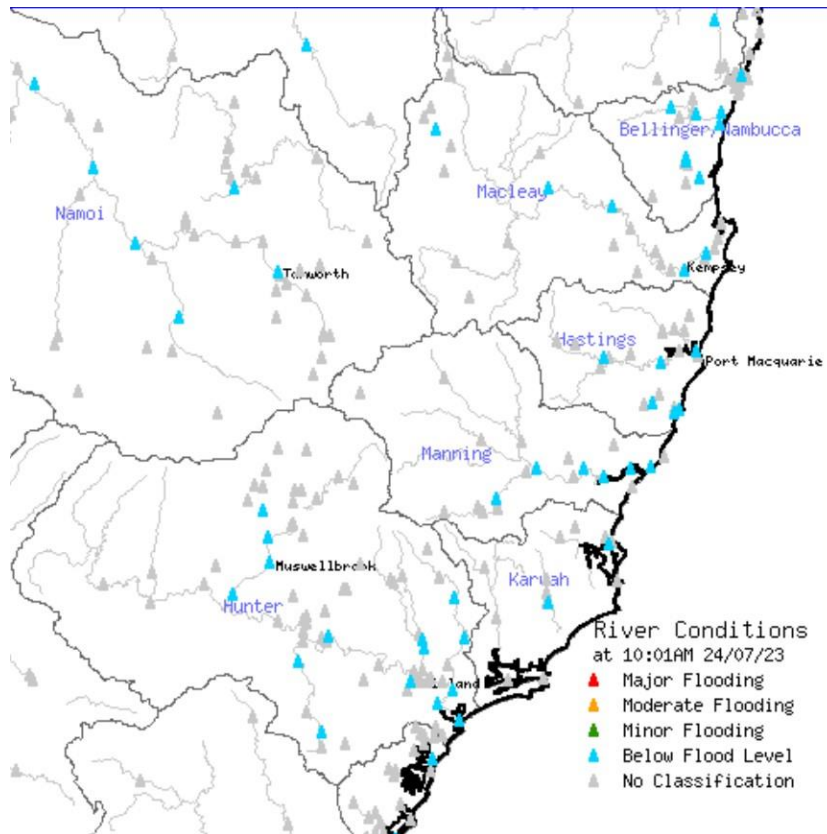


Figure 11: Macleay River Conditions

The blue triangles identify minor, moderate, and or major flood heights at set locations within the catchment.

The river height data is real-time operational data from automated telemetry systems. Most river height data is provided to the Bureau by other agencies.

Latest River Heights for Macleay R at Georges Creek

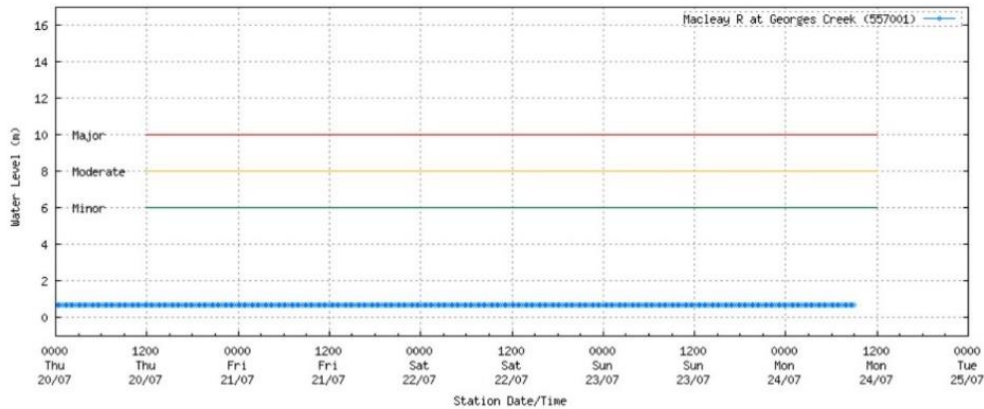
Issued at 9:46 am EST Monday 24 July 2023

[About river height plots](#) | [About this Plot](#)

Station details: Station Number: 557001 Name: Macleay R at Georges Creek

Flood levels: Minor: 6.00 Moderate: 8.00 Major: 10.00

Data from the previous 4 days.



Australian Government Bureau of Meteorology

(Generated: 24/07/2023 09:46:05)

[Data as Table](#) | [Previous Station](#) | [Next Station](#) | [Back to Bulletin](#)

Figure 12: River height data is provided for flood warning purposes.

These stations report their data to the Bureau through a combination of satellite and fixed data infrastructure. They contribute to information collection about the likelihood of a flood event, but they cooperate with other government authorities like the SES and NSW Water to deliver Flood Warnings. These warnings are issued through Flood Warning Centres in Bureau Regional Offices¹⁸.

Flood Warnings and Flood Watch

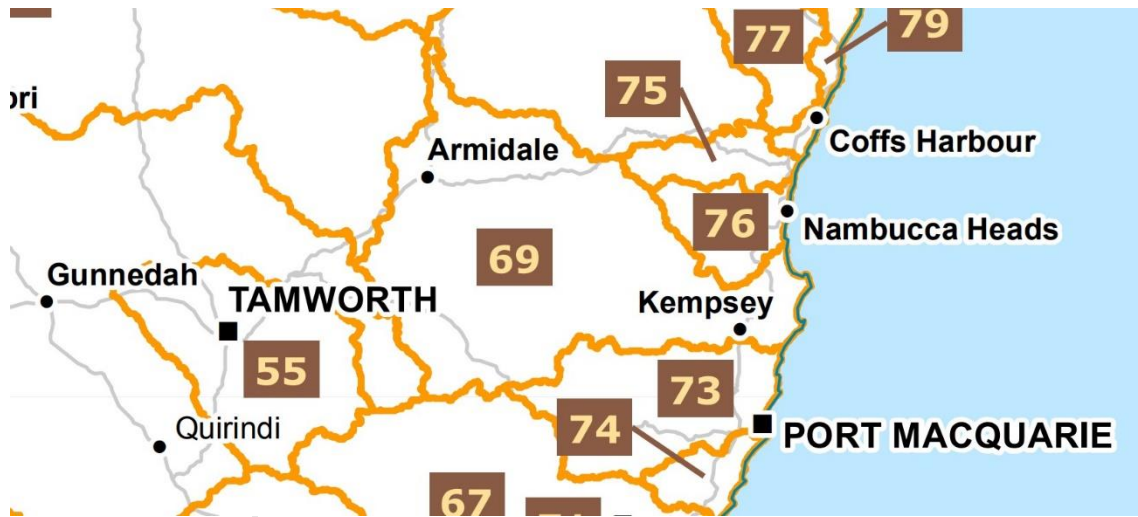


Figure 13: Bureau Flood Watch Areas in NSW. Macleay River Catchment is #69¹⁹

The Bureau issues two kinds of warning, a Flood Warning, and a Flood Watch. A Flood Warning is issued when the Bureau is more certain that flood is expected, often when rainfall has started to fall²⁰. A Flood Warning will generally include specific predictions of the severity of the expected flooding.

A Flood Watch is issued when forecast rainfall information suggest that local and/or riverine flooding is possible across the Flood Watch area²¹. A Flood Watch may cover a large area due to uncertainty associated with the location and amount of forecast rainfall. A flood watch may also refer to the type of flooding that may be experienced in the catchment being highlighted. The Bureau then uses three different types of Flood Classification (also at Annexure A).

These are:

Minor flooding

Causes inconvenience. Low-lying areas next to water courses 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.

¹⁸ [Flood Warning Services: National flood forecasting and warning service: Water Information: Bureau of Meteorology \(bom.gov.au\)](http://www.bom.gov.au/water/floods/image/BOM_Flood_Watch_Areas_map_NewSouthWales_2017.pdf?v3)

¹⁹ http://www.bom.gov.au/water/floods/image/BOM_Flood_Watch_Areas_map_NewSouthWales_2017.pdf?v3

²⁰ [Flood Warning Services: National flood forecasting and warning service: Water Information: Bureau of Meteorology \(bom.gov.au\)](http://www.bom.gov.au/water/floods/image/BOM_Flood_Watch_Areas_map_NewSouthWales_2017.pdf?v3)

²¹ [Flood Warning Services: National flood forecasting and warning service: Water Information: Bureau of Meteorology \(bom.gov.au\)](http://www.bom.gov.au/water/floods/image/BOM_Flood_Watch_Areas_map_NewSouthWales_2017.pdf?v3)

Moderate flooding

In addition to the above, the area of inundation is more substantial. Main traffic routes may be affected. Some buildings may be affected above the floor level. Evacuation of flood affected areas may be required. In rural areas removal of stock is required.

Major flooding

In addition to the above, 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 impacted²².

In addition to warning services for riverine flooding, the Bureau provide technical assistance to Councils establishing local flash flood warning systems through its Flash Flood Advisory Resource (FLARE). The Bureau maintains FLARE, which is an online resource created to assist agencies to design, implement and manage fit-for-purpose flash flood warning systems. Gauges are essential for monitoring stream flow, water levels and rainfall. Data collected from gauges provides real-time data to the Gauge Owner and the Bureau.

13. Kempsey Shire Local Flood Plan

The Kempsey Shire Flood Emergency Sub Plan is a sub plan of the Kempsey Shire Local Emergency Management Plan (EMPLAN). It has been prepared in accordance with the provisions of the *State Emergency Service Act 1989 (NSW)* and is authorised by the Local Emergency Management Committee in accordance with the provisions of the *State Emergency and Rescue Management Act 1989 (NSW)*.²³

This plan covers preparedness measures, the conduct of response operations and the coordination of immediate recovery measures from flooding within the Kempsey Shire LGA. It covers operations for all levels of flooding within the council area.

14. Bushfire

The elevation of the land within the Macleay River Catchment varies greatly, ranging from 200 metres above sea level along the Macleay River to 1,294 metres at Baynes Mountain. This gradient exerts a major influence on climate and weather patterns.

Fire history records for the region dates back to the 1950s but only the last 20 years of records are considered reliable. Bushfires have occurred in the region almost every fire season since 1983 and collectively have burnt at least 55% of the area, or around 90,000 hectares (ha).

²² [Rainfall and Flood Map - additional notes \(bom.gov.au\)](https://www.bom.gov.au/rainfall/flood-map-additional-notes/)

²³ The Kempsey Shire Flood Emergency Sub Plan: <https://www.ses.nsw.gov.au/media/2328/kempsey-shire-local-flood-plan-all-signed.pdf>

Historically, the combination of moderate temperatures, strong winds, and comparatively low relative humidity during late winter and spring is reflected in the fire history of the region, with many bushfires occurring in spring. This has also traditionally coincided with the preferred time for graziers burning the gorge country in association with grazing operations. In most years, subtropical summer rainfall in January brings the fire season to an end. However, in some years the subtropical rains do not occur, and the fire season lasts from September to March.

High frequency burning practices (associated with cattle grazing) occurred in the majority of the Macleay Gorges prior to the larger core areas being acquired by NPWS in 1986. This is a practice that continues on some leasehold areas of the region today however, the practice is much less widespread than it was previously.

Most fires in the last 20 years have been a result of lightning strikes or fires lit by graziers for grazing operations that have escaped from leasehold land. Arson attacks are uncommon as visitation is low and much of the area is inaccessible.

Fire records indicate that the majority of wildfires have resulted from escaped hazard reduction or agricultural burning carried out on private property. On average a vast majority of bush and or grass fires occur outside of the Bush Fire Danger Period and have generally resulted from poorly managed burns, leaving fires unattended, lighting when 'High' or above fire danger is forecast, insufficient preparation of control lines or insufficient resources used to manage the burn.

The 2019–20 bushfire season was the worst NSW has recorded. Higher than average temperatures and low moisture levels in bushfire fuels following several years of drought enabled devastating fires to burn across much of the state, with intense bushfire weather conditions continuing through most of the fire season. Over the course of a few months, 26 lives were lost, 2,448 homes were destroyed, and 5.5 million ha of land was burnt. The impact on NSW communities, farmers, local businesses, wildlife, and bushland was unprecedented.

On Friday 8 November it was Kempsey Cup Day, and the local racecourse was packed by late morning. Although summer had not yet started, fires had been building upriver and as the first race of the day began, smoke and ash were settling kilometres away over the town. Within this region, Fire would burn for two months, and it would take another deluge of rain in late -January to finally extinguish the flames. By then the toll included 67 homes, six bridges and countless outbuildings destroyed, 11 other bridges and kilometres of fencing damaged.

Why do bushfires occur?

Bushfires can be started by natural causes, such as lightning strikes, or by people (accidentally or on purpose). Weather conditions and fuel conditions play a part in bushfires happening.

Materials such as leaf litter, bark, small branches and twigs, grasses and shrubs can provide fuel for bushfires. The type of fuel that is available to burn, how much of it there is, and how dry or moist it is will influence bushfire conditions. Dry fuel is more likely to catch fire and burn easily; damp or wet fuel may not burn.

Hot, dry and windy weather can contribute to fire danger. Specifically, weather-related factors that contribute to an increased risk of bushfire danger include:

- High temperatures
- Low humidity
- Little recent rain
- Abundant dry vegetation
- Strong winds
- Thunderstorms

What are the risks?

Bushfires can cause serious property and infrastructure damage and lead to loss of life. The fire itself is only one element of the danger. Other impacts from bushfires include the effects of radiant heat and smoke.

- Fire embers can spread many kilometres from the location of a large bushfire, causing smaller spot fires to break out.
- Radiant heat can be felt more than 100 metres away from a large bushfire and has the potential to melt or fracture objects including parts of cars, glass windows, etc.

Toxic fumes and heavy smoke produced from bushfires can impair vision and impact on air quality and create difficulties in breathing. Due to the unpredictable nature of fast-moving fires, people are likely to be encouraged to evacuate from their homes as quickly as possible to ensure they are able to reach safety. It is important to follow any local alerts and warnings.

Carrai East Bushfire: “The Perfect Storm”

15. The Lower North Coast Bush Fire Risk Management Plan 2018

The Lower North Coast Bush Fire Risk Management Plan (BFRMP) is a strategic document that identifies community assets at risk and sets out a five-year program of coordinated multi-agency treatments to reduce the risk of bushfire to the assets. Treatments may include such things as hazard reduction burning, grazing, community education, fire trail maintenance and establishing community fire guard groups.

In accordance with Part 3 Division 4 of the *Rural Fires Act 1997*, this plan has been prepared by the Lower North Coast Bush Fire Management Committee (BFMC) and was endorsed at the BFMC meeting on 9 May 2018 for submission to the Bush Fire Coordinating Committee.²⁴

The Draft Lower North Coast Bush Fire Risk Management Plan 2023

Fire agencies, land managers and other stakeholders have been working to identify ways of reducing the impact of fires in the area – protecting lives, homes, businesses, agriculture, the environment and other assets that are important to the Lower North Coast.

The local BFMC has developed a draft BFRMP, which identifies the risks and the plans to protect them. A revised Draft Lower North Coast BFRMP is being evaluated and reviewed after being open for public consultation during August 2023.²⁵

The draft plan identifies the risk to communities and the assets we all value. Using feedback from fire agencies, land managers and other stakeholders, the plan identifies ways of reducing the impact of fires across our area.

Understanding the bushfire risk assessment by Lower North Coast BFMC

Fire is a part of living in the Lower North Coast. It has been a part of this landscape for millions of years. As the population and region changes, the risk of fires impacting on the community has changed.

To understand the bush fire risk in the Lower North Coast and help inform the best ways of managing and reducing the risk, the BFRMP identifies what is important to local communities – including where people live, as well as environmental, economic, and cultural assets.

- **Residential**²⁶: (Annexure B), The residential risk map shows the modelled risk to homes and properties from bush fires. Each coloured square on the map represents the risk to a home or a group of homes. The map displays the comparative risk across the local BFMC area. If your home is in the lowest risk category it can still be damaged in a bush fire, it is just less likely to be damaged compared to other areas.
- **Economic**²⁷: (Annexure C), The economic risk map shows the modelled risk to economic assets from bush fires. The risk is calculated based on the economic loss of the modelled damage assessment and how long it is expected that the asset will return to the pre-fire

²⁴ https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0015/2391/Lower-North-Coast-BFRMP.pdf

²⁵ <https://www.rfs.nsw.gov.au/plan-and-prepare/managing-bush-fire-risk/bush-fire-management-committees/lower-north-coast>

²⁶ Residential Risk - https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0007/251953/LN-Current-Risk-to-Residential-Assets-and-SFPP-Lower-North-Coast.pdf

²⁷ Economic Risk - https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0005/251951/LN-Current-Risk-to-Economic-Assets-Lower-North-Coast.pdf

condition. These are important considerations because if they are destroyed during a fire, they can have long lasting impacts on employment and population in the area.

- **Environmental**²⁸: (Annexure D), This map shows the environmental assets that have been modelled as being at highest risk from bush fire in the area. This includes areas at risk because they contain threatened species vulnerable to fire, vegetation types sensitive to fire e.g. rainforests or land managed for conservation or environmental outcomes that does not include fire.
- **Cultural Predicted Aboriginal Assets**²⁹: (Annexure E), This map shows the predicted Aboriginal cultural assets that have been modelled as being at the highest risk from bush fire in the area.
- **Fuel Management Register and Focus Areas**³⁰: (Annexure F), This map shows the Fuel Management Register – a list of hazard reduction activities identified as strategic treatments in the risk plan. The Fuel Management treatments include prescribed burns, BFMC managed Asset Protection Zones and the development or maintenance of Fire Breaks. This map also displays the areas identified by the BFMC as Focus Areas.

²⁸ Environmental Risk - https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0006/251952/LN-Current-Risk-to-Environmental-Assets_Lower-North-Coast.pdf

²⁹ Cultural Predicted Aboriginal Assets - https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0004/251950/LN-Current-Risk-to-Cultural-Aboriginal-Assets_Lower-North-Coast.pdf

³⁰ Fuel Management Register and Focus Areas - https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0003/251949/LN-Fuel-Management-Register-and-Focus-Areas_Lower-North-Coast.pdf

16. Bushfire Risk Mitigation Focus Areas

Table 4: Mitigation Focus Areas

| Focus Areas | |
|-------------|--|
| 1.1 | Valla Beach |
| 1.2 | Nambucca Heads |
| 1.3 | Scotts Head / Grassy Head / Stuarts Point / Fishermans Reach |
| 1.4 | Arakoon |
| 1.5 | Hat Head |
| 1.6 | Crescent Head |
| 1.7 | Eungai Creek |
| 1.8 | Ngambaa Feral Predator Free Area |
| 1.9 | South Kempsey |
| 1.10 | Kundabung |
| 1.11 | Bellbrook |
| 1.12 | Willawarrin |
| 1.13 | Gondwana Rainforests – New England |
| 1.13 | Gondwana Rainforests - The Castles NR |
| 1.13 | Gondwana Rainforests – Willi Willi NP |

17. The Big Map Exercise

Purpose:

Building resilient communities in the context of a disaster event integrates prevention, preparation, response, and recovery is a complex and continuous process, rather than a process with a definitive end point or ‘destination.’ The purpose of the ‘Big Map’ capability is to combine local knowledge with our disaster management expertise to better understand a community profile based on the community's exposure within an all-hazards environment³¹. There is widespread international recognition that engaging communities and supporting place-based solutions and approaches to disaster risk reduction generate system-wide benefits³².

By understanding how, when and where this region is impacted by flood and fire is vital to those who live here; not just for safety, but for protecting livelihoods, property, and people. Businesses operating within the region also need to know how their business might be impacted, to make risk-informed investment and operational decisions in line with future Local Council objectives.

Managing flood and fire risk is a cooperative and coordinated effort between all sectors of the community including individuals, businesses, non-government organisations and governments. The Big Map Capability aligns with steps contained in the ‘Second National Action Plan to implement the National Disaster Risk Reduction Framework’, aimed at increasing inclusive and diverse community representation, participation, and access to the disaster management system.

³¹ <https://disasterreliefaus.org/big-map/>

³² National Action 20, Second National Action Plan to implement the National Disaster Risk Reduction Framework, https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf [Retrieved 9 September 2023]

Method:

Disaster Relief Australia (DRA) in collaboration with the Minderoo Foundation's Resilient Communities Initiative and Allianz Australia Insurance conducted the Big Map exercise in Macleay Catchment, NSW on 27 and 28 July 2023. Attendees for 27 July 2023 included Local Government representatives, operational emergency management staff, key partners, and other stakeholders. A second Big Map exercise was conducted on 28 July 2023 and members of the community were invited to attend.

The DRA End state:

Locally led and regionally coordinated resilience solutions will always address recent and emerging disaster risks and provide pathways for improving community resilience over time. Flood waters do not respect boundaries. Therefore, it is critical to investigate ways we can better prepare for the future and keep our communities safe by coordinating efforts, sharing knowledge and capability, and setting a proactive agenda for improving resilience over time. It is important to integrate undervalued or non-traditional forms of knowledge and ways of knowing, including traditional knowledge, local knowledge, community feedback, lived experience and transdisciplinary approaches such as sociology, and support the use of scenarios which extend the imagination.³³

Walking the catchment on both days

Prior to both exercises, 5 flood forecast locations (Armidale, Bellbrook, Georges Creek, Kempsey, and Smithtown) and 35 river data locations were identified and placed onto the 'big map'. The Big Map was then used as a focal point for discussion. Attendees were invited to move to the locations of their interests: local government representatives to their LGA, landowners to their property, infrastructure representatives to their applicable structures etc. This enabled attendees to better understand the responsibilities of other people at the event, who they might be representing and what their interests might be. Flood and fire were the two natural hazards discussed during this Big Map event.

³³ The Second National Action Plan to implement National Disaster Risk Reduction Framework, August 2023
https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf



Figure 14: Local Stakeholders on the 'Big Map'

27 July 2023 – Kempsey Shire Council and local emergency service stakeholders

From the start of the first activity, facilitators highlighted the importance of a 'catchment response' to flood preparation, monitoring, and response events. The catchment response sees all partners and stakeholders working together to prepare for flood events, with appropriate mitigations to prevent damage to infrastructure and loss of life, monitoring for the likelihood of a flood event, and then taking evacuation actions accordingly.

Floods are a natural part of the Australian landscape. Floods vary greatly in size, extent, duration, and frequency. No two floods are the same and as such, can have different impacts. Sudden, heavy, and intense rainfall can cause floods to quickly rise in the minutes or hours that follow. These are known as flash floods and are typically associated with small catchment areas. Floods can occur slowly in large catchment areas, where rainfall can build up over hours, days, or weeks. The runoff from this rainfall may create significant floods that inundate large areas of land for days, weeks or months.

Through data collection and analysis, council administrators, hydrologists, engineers and planners identify and delineate those areas likely to be exposed to flood waters and where possible mitigate the impacts of future floods. Therefore, a flood prediction and or warning is of little value unless the community understands what it means with regards to the impact and what they need to do in response to their individual situation.



One of the first topics spoken about concerned the collection of data and dissemination of information, and what that means to catchment stakeholders at various locations through the Macleay Catchment. Data collection during flood events is disjointed and separate and lacking synthesis, with collection methods differing across the partners and stakeholders. Sensors and gauges that remain functional during flooding events measure rainfall and river heights, collecting and collating data for the BOM, Council and the SES. They inform other data collection methods such as satellite imagery which can be used to capture flood event imagery if required.

Stakeholders identified that when sensors or gauge readings indicated a flood was imminent, the warning given to the Council was too slow to be able to effect preparatory actions amongst the Council and emergency services. Some stakeholders at the event said that flood waters move faster than what Kempsey Council data suggests, and some mentioned that 12 hours is the minimum amount of time needed to prepare for floods in Kempsey only. Long-time residents and Council staff have their own data points which could be included into monitoring systems to make projection and anticipation of flooding events more precise. Some community members living upstream and downstream of Kempsey have the ability and the knowledge to significantly contribute if required.

The resilience of local industry to mitigate against flood-imposed losses was discussed. As mentioned earlier in this report, the land uses in the Lower Macleay River Catchment include significant horticultural and agri-business practices which contribute greatly to Kempsey's business sector. Some industry representatives mentioned that it can take up to six months for the industry to recover post

the flood event; recovery efforts can be stymied by damp and flood-affected terrain preventing movement of tractors to remove flood impacts and debris.

Bushfire Discussion

The risk of bushfire was discussed at length during both days. It is important to acknowledge that in accordance with Part 3 Division 4 of the *Rural Fires Act 1997 (NSW)*, the Lower North Coast Bush Fire Risk Management Plan (BFRMP) was recently released in draft on 30 June 2023, and was open for comment at the time of the Big Map event.

The Lower North Coast BFRMP is a strategic document that identifies community assets at risk and sets out a five-year program of coordinated multi-agency treatments to reduce the risk of bushfire to the assets. Treatments may include such things as hazard reduction burning, grazing, community education, fire trail maintenance and establishing community fire guard groups.

28 July 2023 – Community members

Allowing community members to step onto the ‘big map’ and watching them slowly find their home or property is always a highlight of the exercise. The ‘big map’ in Kempsey was no surprise. Community members from all over the catchment attended the activity and readily explained in detail how their patch of the world operates during a flood event and or fire.

Unlike the previous day, the community-led activity was less detailed, but far more informative in terms of local knowledge and community level discussion. The key issue identified very early in the discussion was the level of isolation during a flood or fire event. As the discussion continued some community members acknowledged that across the catchment communities were essentially operating in silos and were not connected at all. Members from the following communities attended the exercise:

- Bellbrook
- Willawarrin
- Frederickton
- Wittitrin
- Kempsey
- South Kempsey
- Pola Creek
- Scott’s Head, and
- South West Rocks

A community member from Scott's Head readily acknowledged that her community had vastly different needs and requirements to other communities across the Macleay catchment, in the lead up to, during and after a significant flood and or even a fire event. Based on the demographics, location, risk and ability to recover from a disaster event it was readily identified that each community within the Macleay was in fact quite different. Each community had its own language, culture and identifier. The Scott’s Head community is very different to the Willawarrin community and the Willawarrin community is very different to those living in Kempsey however they all live along the Macleay River

in the same catchment. Scott's Head is also very transient during the summer months with a large influx of tourist and travellers.

Several community members shared details of the significant physical, emotional, environmental, and financial impacts that a fire and flood event has had on them, their homes and their communities. There was broad consensus from the community about the magnitude of some events, but they all agree that more are still to come, particularly considering many areas had recently been impacted by fire events. Some expressed the view that these repeated impacts had enabled better awareness and therefore higher levels of preparedness for future events however, the community could always do far more. Others suggested the compounding nature of past 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 some previous events. 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. In some areas of the Macleay, it was clear that no messaging was being communicated at all and at a point in time during the event they are just forgotten about. Many expressed the view that with additional time to prepare, the effects of an 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.

Varying views were observed within the community about the level of preparedness information and education available to them that would have enabled them to be more prepared for future flood and fire events. Some expressed disappointment they had not been advised of their risk by a relevant authority prior to moving into the region. 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.

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 act. 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 use of a known bridge height on the BOM hydrograph was a very simple but highly effective visual tool.

Flood classifications allow the expected or observed impact and severity of flooding to be clearly communicated and understood by the:

- a) community
- b) Kempsey Local Government
- c) National Situation Room (NSR) in some situations.

All 5 forecast locations (Armidale, Bellbrook, Georges Creek, Kempsey and Smithtown) exist for the purpose of Kempsey only. No other communities within the Macleay Catchment upstream of Kempsey are afforded timely and accurate situational awareness due to inaccurate flood classifications.

During the discussion it was clear that there was some confusion and, in many cases, a complete lack of knowledge regarding correct flood classifications. There is a risk that incorrect flood classifications can breed complacency in the community – “it’s just another major flood.”

Outside of understanding flood heights and the likely impacts, the ‘Big Map’ discussion identified the following items:

- For residents living in Kempsey there can be elements of complacency and its associated impact as the flood is occurring.
- Flood gauge ownership and maintenance – who is advocating for maintenance/cost-sharing for gauges. When highlighted, stakeholders in the room were silent.
- Some flood gauges are still damaged post the previous flood event and are not reporting.
- Landslides are a common issue for communities living west of Willawarrin along the Armidale Road. Access to lower creek communities becomes difficult. Communities can become isolated for a period of time.
- A lack of connectedness between many communities surrounding Kempsey has created a silo effect. During a flood or fire event, a lack of connectedness leaves communities vulnerable and starving for information and data.
- Communities within the middle and upper catchment generate their own situational awareness via social media. During flood events communities readily share data regarding bridge and road closures due to a lack of publicly available information.
- Information and data captured locally is shared with Kempsey Council for situational awareness purposes, however it is not reshared at a community level.
- The Lower Macleay River has a very detailed and highly resourceful mitigation capability in the form of floodgates, flood barriers and flood levees. Apart from key Kempsey Council staff, very few understand the complexities and operational concepts as a collective.
 - During the Friday exercise, several insightful community members clearly outlined the complexities of the Lower Macleay River and readily introduced valuable information that was not known by Council or select representatives.
 - A community member highlighted that during some flood events water actually flows both ways in the upper elements of the Belmore River. In some floods, Belmore River flows south into the northeastern part of the Hastings catchment.
- The First Nations community at Bellbrook does not have food on hand – only supplies for 24hrs – day-to-day, week-to-week. During and post-disaster this impacts their community significantly.
- Most communities are prepared for 48 hours isolation – anything more becomes an issue.

- Neighbourhood Care Network has established a pilot project - small SMS community network system. Local people are trained in watching weather, primarily landholders not covered by official emergency management framework. They use a weather website which has portal for them to input data into and they have created triggers for when to SMS the rest of the network. Triggers are local landmark indicators.

Key Infrastructure discussion

A central part of the 'Big Map' exercise is the identification of key infrastructure. Local Government and key stakeholders are asked to place a white sticker on what they believe to be key infrastructure.



Figure 15: Self-identified key infrastructure on the Big Map

The same exercise is repeated on the second day however this time it is with community members. The entire exercise outlines the disparity between what Council and stakeholders think critical infrastructure is and what the community believes is critical to them. The following infrastructure was identified:

- Sherwood Bridge – Sherwood Bridge is the main thoroughfare for residents living south of the river.
- Water treatment plants in all locations.
- The Kempsey Airport. The airport sits above the 1 in 100 flood level however, during a major flood event, all roads to it are inundated by water.
- All key infrastructure (Showgrounds, Kempsey CBD, and Regional Emergency Operation Centre (EOC) become cut off and isolated by water.
- Stewarts Point becomes isolated during a flood event.
- Many other locations were identified however have not been included in this report.
- A note of interest is that flood gauges and flood infrastructure was not considered by community members to be critical infrastructure.

Resilience in Action

Some issues for the recovery process were raised, and these refer to clean-up teams and environmental health post-disaster. Clean-up teams formed by groups of well-intentioned citizens (like the “Mud Army” from the 2011 and 2022 Brisbane floods) can throw out personal belongings without the consent of their owners, who may have been evacuated. This can damage the fabric of communities causing resentment and ill-will towards outsiders. Psychological support needs to be made available soon after the disaster event to people harmed and impacted by the flood.

The likely community clean-up response after the flood event will place significant strain on supplies of tools and cleaning supplies – an issue that should be pre-empted and included in the Disaster Response Plan.

Environmental Health post flood event is crucial to the recovery of local agricultural businesses in the Kempsey LGA. Dead cattle and septic tanks pose a significant biohazard and could bring disease into the recovery picture for additional complexity.

Some of the industries and land uses in the Macleay River Catchment include horses, cattle, and household pets. Some of the owners of these animals are cooperating to find evacuation locations for these animals so they can be safe during floods.

18. Critical Infrastructure identified by the community post a disaster event (Recovery)

Participants from the workshops were asked to identify what they believed critical infrastructure was within the Macleay River Catchment. Figure 16 shows how disruption to one essential service can trigger failures in dependent services. For example, a damaged powerline can cause a power outage to a mobile telecommunications tower, which can then cause an outage in mobile telecommunications coverage. Road closures can impede the ability for communities to evacuate during a disaster and disrupt the transportation of essential goods, such as food, across the country – impacting relief and recovery efforts.

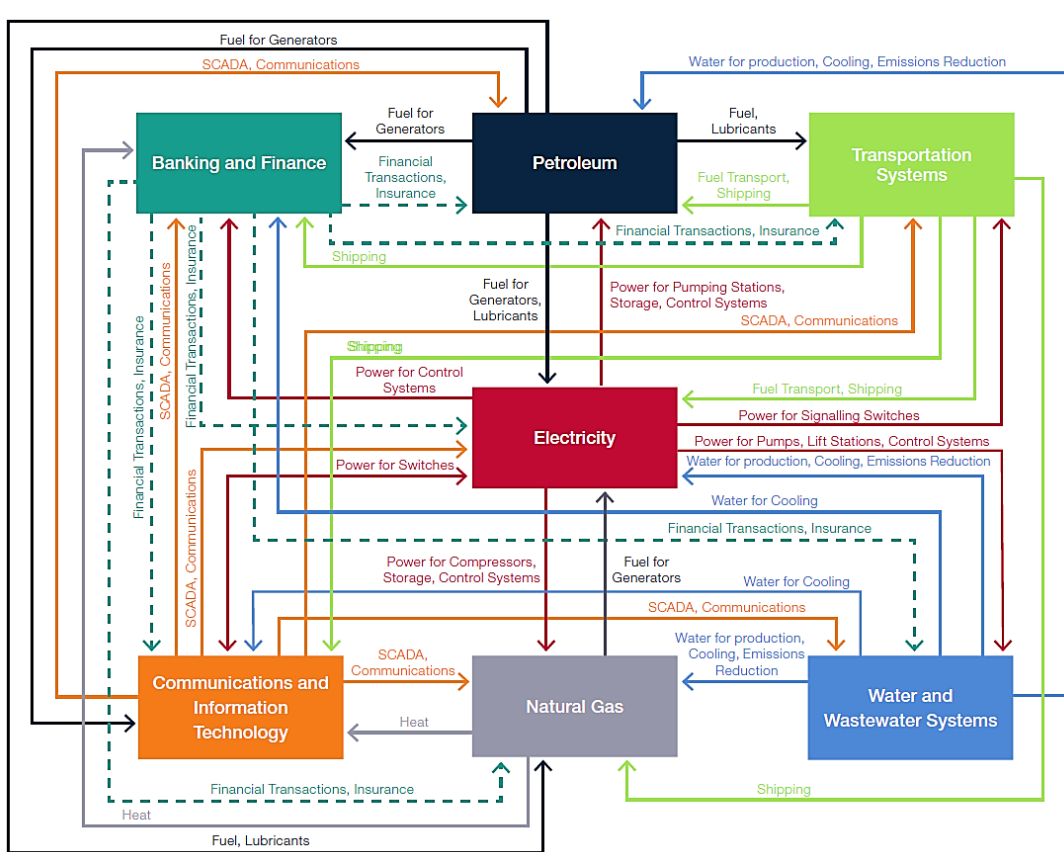


Figure 16: Example of interdependencies post a disaster event³⁴

This sparked several conversations at various levels and to keep it community focussed and at a very localised level the following critical infrastructure was identified by the community post disaster event (the relief and recovery):

Schools

Schools are seen as an essential empowerer immediately following a disaster event. Communities that can immediately start cleaning up and getting on with their life always appear stronger and more resilient. During this clean up phase, having children able to attend school helps re-establish their routine, and eases the burden on parents as they struggle to clean up and deal with the impacts.

Supermarkets / food items

Access to food and essential items is vital in the early recovery phase. Supermarkets become the critical enabler within the community. The sooner these can be up and running, the better the community will be in the long term.

³⁴ <https://naturaldisaster.royalcommission.gov.au/publications/html-report/chapter-09>

Primary Health Care Services

Immediate access to basic medical services is essential to the wellbeing of any community after a disaster event.

In the immediate aftermath of a disaster, it is normal for many people to experience intense stress reactions. These reactions are not necessarily pathological. While most people eventually recover over time, a sizeable proportion will experience mental health problems in the months or years after the initial event. The most common mental health conditions reported across a range of disaster events are post-traumatic stress disorder (PTSD), depression, anxiety, substance abuse, and complicated grief. Some may also experience heightened suicidal risk, intense negative effect, acute stress, physical health or somatic concerns, and poor sleep quality.

Waste Transfer Station

The collection, transport and disposal of solid, liquid and hazardous waste is an essential consideration during a disaster, particularly during the recovery phase. Traditionally, local governments have had the responsibility of managing waste and clean-up operations post-disaster. Typically, local governments manage this service professionally and to a high standard via the engagement of local waste contractors.

The waste streams from commercial and industrial facilities that are likely to require particular consideration following a flood impact are:

- Organic waste. Food waste if not collected early will putrefy and result in public health risks and will become progressively harder to manage. Odour is also a major issue for community reports/complaints which can result in redirecting resources from the vital needs of cleaning up to deal with these complaints. Sources of such waste include supermarkets, poultry farms, food processing operations, abattoirs, meat and freezer stores, cold rooms and organic material stores.
- Liquid waste. A number of sources of liquid waste need to be considered during a disaster response these include, but are not limited to, petroleum waste particularly from petrol station sites and contaminated stormwater from electrical pits.
- Hazardous waste. Although probably already known and identified, the places where hazardous materials are manufactured, stored and disposed of require special attention and management to ensure they are not disposed of in normal waste streams. Strategies need to be developed to identify large volumes of hazardous waste at the initial collection point to ensure the safety of the community and contractors collecting the waste at both the waste collection and receiving ends of the process.
- Domestic Waste. The types of domestic hazardous waste that are typically found following a natural disaster include:
 - Asbestos in buildings damaged by natural disasters, especially older structures, can be released into the environment if asbestos-containing materials are disturbed.
 - Chemicals and household products such as cleaning agents, pesticides, fertilizers, paints, solvents, and other chemical products stored in homes.
 - Electronic devices and appliances damaged in a disaster event may contain hazardous materials like lead, mercury, or other heavy metals.

Drinking water

Access to fresh running water is essential and a key requirement for a community dealing with flood. Water treatment plants were identified as critical infrastructure in all Kempsey Shire communities, but Council advised that plants do not have access to back-up power.

Essential Services

Essential services are relied on by every individual, household and community for meeting basic, everyday needs. The provision of essential services is especially critical before, during and after a natural disaster – when people are at their most vulnerable.

Essential services are especially important in the lead-up to, during and after a natural disaster. For example, electricity and telecommunications outages can prevent communities from receiving timely information, advice or warnings about the threat posed by nearby flood impacts and or fires. They can prevent communities from making informed decisions about how best to ensure their own safety, or the safety of those in their care (e.g. when to evacuate).

Industrial Estate

When flooded, industrial facilities present direct (damage to buildings, tanks, pipes, storage of raw materials and finished products, pumps, electrical, thermal and mechanical equipment) and indirect (business interruption, temporary unemployment, rising insurance premium) consequences. The damage may cause major accidents within industrial plants such as the release of hazardous material, soil or water pollution by substances hazardous to the environment, fires, explosions, dispersion of toxic clouds.

In the preparation and preparedness phase of disaster management, it is vital that industrial plant operators and owners improve their understanding of potential impact of a natural disaster on their facility.

Reserves and parks

Some reserves and or parks within a community may be built within flood prone locations and may well be within river flow diversions, and or the flood impacted area.

Land that adjoins rivers, creeks, estuaries, lakes and wetlands is known as riparian land (often called 'frontage'). Riparian land can vary in width from a narrow strip to a wide corridor and is often the only remaining area of remnant vegetation in the landscape. Riparian corridors provide habitat for rare or threatened species, connecting larger patches of remnant vegetation and a corridor for the movement of animals and native plants.

Supply chains and transport routes

Supply chains, being the distribution of essential goods and services across the country, are critically important to our economy. Working supply chains deliver petrol to service stations, fresh food to

supermarket shelves, household waste to landfill and essential pharmaceuticals to hospitals. In a natural disaster, the continuity, or rapid restoration, of supply chains is vital to the response and recovery phases.

Natural disasters can interrupt transport routes. During the 2019-2020 bushfires, some firefighting assets could not be transported between communities due to fires and road closures, which had a direct impact on the emergency response. Road closures also impeded the ability for communities to evacuate during the bushfires and disrupted the transportation of essential goods, such as food, across the country – impacting relief and recovery efforts³⁵.

19. Community Assessment & Prioritisation

Building Back Better - Looking to the future

We formalise processes and systems to enable effective assessment of post-disaster damages and needs to more accurately quantify and characterise the recovery needs and to formulate broad recovery strategies across all the communities.

Outcomes of the Community Assessment and Prioritisation Activity

The Community Assessment and Prioritisation Activity was designed to shape a holistic conversation and assessment about the communities within Kempsey, and the perceived strengths and weaknesses. This analysis is somewhat flawed however since not all the communities that reside within the Macleay River Catchment could attend.

³⁵ <https://naturaldisaster.royalcommission.gov.au/publications/html-report/chapter-09>

Stakeholders

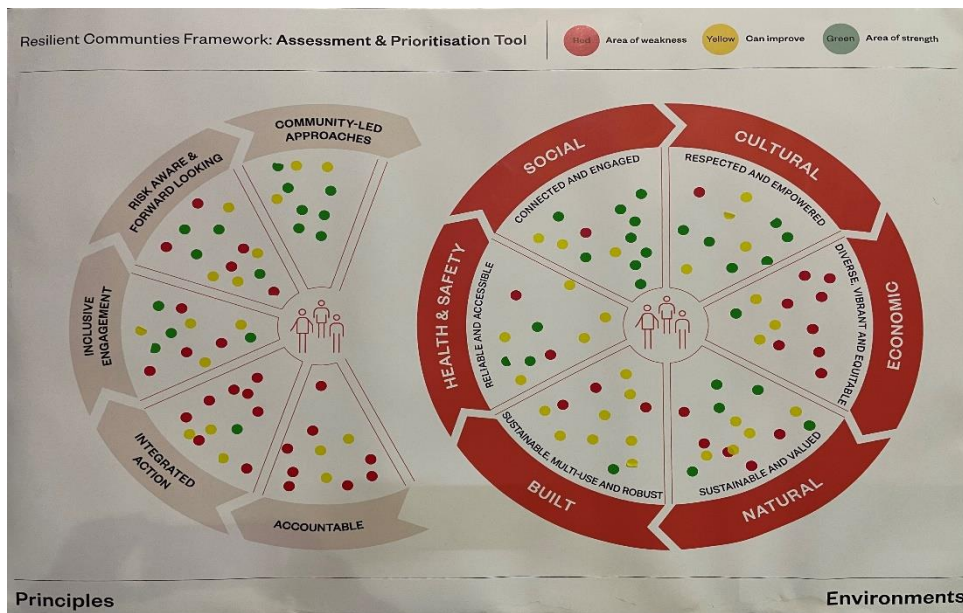


Figure 17: Resilient Communities Framework: Assessment and Prioritisation Tool completed by stakeholders from the Kempsey Shire region at the Kempsey Big Map exercise.

Principles

Community-led approaches are an area of strength for the Kempsey community, with initiatives and events aimed at preparation (e.g., a community play about disaster events).

Mixed results for inclusive engagement, with attendees noting that Kempsey is a big community with lots of pockets. Each pocket functions together well, but are currently independent of each other. Integrated action is also a community weakness with the community, local council, and other governing bodies functioning in silos. In conjunction with this, accountability was also highlighted as an issue. At a stakeholder level, there is a difference in opinion regarding the community's risk awareness and ability to look forward. Accountability is an issue as well.

Environments

Representatives noted that the community is living in a beautiful environment, but there was an equal spread of votes over all aspects. The consensus from the discussion generated was, that while they live in a place of great natural beauty, there could be more done to ensure it is looked after more sustainably. All participants agreed the built environment needs improvement to become more multi-use and robust. A majority of the participants also believed the community is very connected and engaged, and the cultural background of the area is respected and empowered. A significant percentage of the participants see the economic sector as somewhere that needs improvement. Data

from the Australian Exposure Index Platform shows a sizeable percentage of the population is of a low socioeconomic demographic would validate this belief³⁶.

Discussion

While everyone had their own views on how the community rated in the discussion, it is apparent that for every sector there was an alignment of belief. Most of the stakeholders had a similar viewpoint on each sector. The principles of Risk Awareness, Inclusive Engagement, and the Natural Environment however brought an almost even split in beliefs. There are some vastly different beliefs of these three areas.

Community

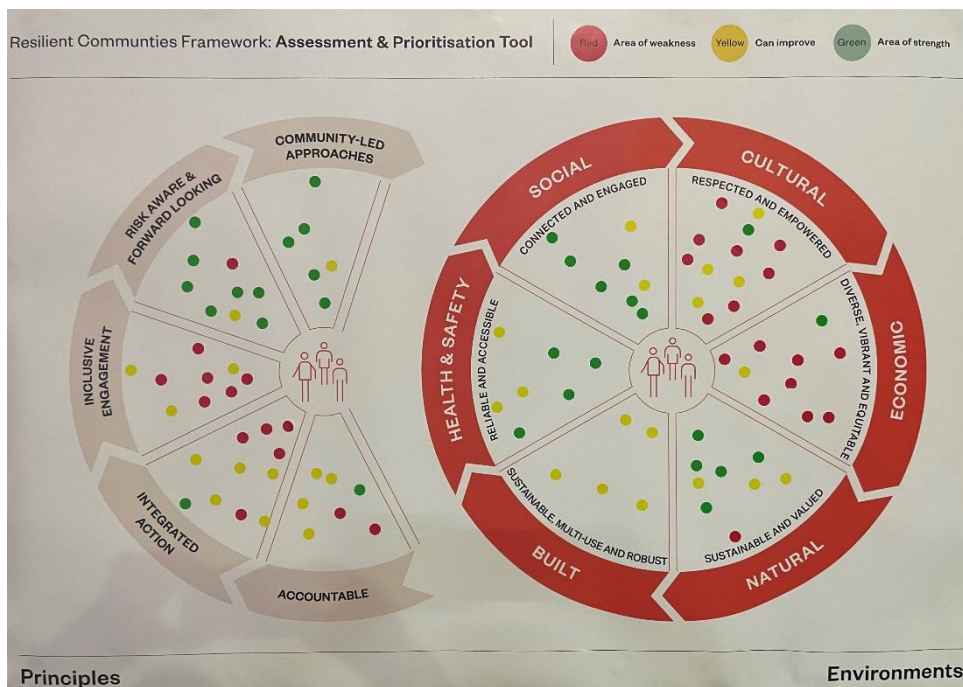


Figure 18: Resilient Communities Framework: Assessment and Prioritisation Tool completed by community members at the Kempsey Big Map exercise.

Principles

While the number of participants in the exercise was lower than the previous day, there were still some clear outcomes and alignments. Those participating believed that community-led approaches was an area of strength, but did not believe these were integrated. Furthermore, integrating these actions was perceived as an area of weakness. They also felt that Inclusive Engagement was an area of weakness or could improve. Most of the participants from the communities felt they were risk aware and forward looking and had a clear understanding of the risks and hazards that they faced, but a few participants disagreed. They also felt that there was a lack of accountability.

³⁶ <https://www.aeip.ga.gov.au/>

Environments

Participants were fairly aligned in the environment section of the activity, with a clear majority believing that the Cultural and Economic sectors are both areas of weakness. It must be noted that there were a few participants who disagreed with the overall majority and felt that they were an area of strength. Everyone agreed that Built Environment was an area that needed improvement. A clear majority believe that the community is connected and engaged, which implies that the communities are more likely to be engaged and take ownership in their preparedness, as they will engage with each other. Leveraging of the social connections of each individual community within the Macleay catchment will not only strengthen community ties but allow those who are respected to continue to speak up about community-led plans to prepare for and mitigate future disaster events. The Health and Safety environment was a clear split between something that was done well and an area of improvement.

Discussion

Again, there was a clear consensus for each sector on this day, with the participants showing their belief in how they rate in each sector to be similar. There was a majority of two ratings for all sectors with the occasional dissenting voice. All participants rated the Built Environment as needing improvement and a clear majority believe that the Economic section is an area of weakness. The even divide in the vote regarding the Cultural Environment is not unsurprising given the demographic of the area.

Comparison

When we look at the two activities side by side, we can see a clear agreement in some of the sectors. The principle of Community-Led Approaches was rated the same by both stakeholders and community. Risk Awareness and Forward Looking had a similar rating on both days. Some participants from the stakeholder's event believe that Inclusive Engagement is an area of strength, but that was not reflected in the Community activity. Again, integrated action was rated similarly on both days. The main area of difference in the principles seems to be the Accountable sector. Participants from the community event felt there was more accountability than those who attended on the stakeholder event.

When looking at the different days of the exercise for the environment sectors there was a clear alignment in many areas. The Social, Built and Economic environments, all had remarkably similar ratings, with a small percentage of those attending having a different view to most participants. The main variation in the exercise was the Cultural sector. The majority of those who attended the stakeholder day felt that the Cultural sector was an area of strength or an area that could be improved, while the majority of those who attended the community event felt it was an area of weakness. This could potentially be due to a differing understanding of the cultural sector, or a reflection of perception. While the stakeholders feel they respect and empower the cultural environment of the area, the community does not see it that way.

Resilience Survey

Stakeholders

| No Understanding | | | Some Understanding | | | | I have a thorough understanding | | |
|---|---|---|--------------------|---|---|---------------------|---------------------------------|------------------|-----------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | | | Stakeholders | | Community | |
| People | | | | | | Score AM | Score PM | Score AM | Score PM |
| I have strong social connections in my community, and I have people I can rely on in times of need. | | | | | | 8.7 | 8.8 | 8.4 | 8.6 |
| I know who the relevant lead agencies are during disaster events | | | | | | 8.8 | 9 | 7.6 | 8.2 |
| I am aware of my vulnerabilities and have plans to mitigate them | | | | | | 8.1 | 8.4 | 8.4 | 8.6 |
| Making Sense | | | | | | Score AM | Score PM | Score AM | Score PM |
| I have a clear understanding of the emergency procedures in my area | | | | | | 8.4 | 9 | 8.2 | 8.8 |
| I have an understanding of the bigger picture around me and that fire and or flood are a natural hazard in the region I live. | | | | | | 9 | 9.2 | 9.2 | 9.4 |
| I have a clear understanding of what alerts and communications may go out in a disaster event and what they mean for me | | | | | | 8.1 | 9.1 | 8.6 | 9.2 |
| I have an understanding of all the risks that could potentially impact me and my community | | | | | | 8.1 | 9 | 8.6 | 9.4 |

| No Understanding | | | Some Understanding | | | I have a thorough understanding | | | |
|--|---|---|--------------------|---|---|---------------------------------|-----------------|------------------|-----------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | | | Stakeholders | | Community | |
| Bouncing Back | | | | | | Score AM | Score PM | Score AM | Score PM |
| My household has an emergency plan, and everybody is familiar with it | | | | | | 8.2 | 8.4 | 6.8 | 7.6 |
| I have a good understanding of what type of Insurance cover there is and how insurers would respond to different disaster events | | | | | | 8.1 | 7.7 | 6.6 | 7.6 |
| I know what to expect from my Insurer if I need to lodge a claim due to a catastrophic weather event | | | | | | 7.1 | 8.2 | 6.6 | 7.1 |
| I am capable of moving forward after adverse situations | | | | | | 8.5 | 9 | 7.6 | 8 |
| Striving Forward | | | | | | Score AM | Score PM | Score AM | Score PM |
| I am open to different ways of doing things | | | | | | 8.4 | 9 | 8.8 | 9 |
| I have a good understanding of what I can do to mitigate the risks to my family and myself | | | | | | 8.2 | 8.7 | 8.3 | 8.8 |
| Our Human Needs | | | | | | Score AM | Score PM | Score AM | Score PM |
| I know what I need to have on hand if there is a need to ride out disaster events | | | | | | 8.5 | 8.8 | 8.1 | 8.6 |
| My household has an emergency evacuation pack ready to go and it is regularly checked | | | | | | 6.8 | 7.1 | 6.5 | 7.6 |
| I know where/who to turn to for any help I may need | | | | | | 8.2 | 9.1 | 7.5 | 8 |
| I know where to go to find information of threats as they arise, and situations change | | | | | | 8.2 | 9 | 7.8 | 8.6 |
| Courage | | | | | | Score AM | Score PM | Score AM | Score PM |
| I have the ability to continue on even in tough times and when things seem overwhelming | | | | | | 8.2 | 8.7 | 8 | 8.5 |
| I know that its ok to have a range of emotions in stressful situations and I know to reach out for help | | | | | | 8.2 | 9 | 8 | 8.6 |

The Survey results highlight a successful growth of understanding across almost every index, with improvement from “Some Understanding” to “I have a Thorough Understanding” being achieved in almost every field. This reinforces the bolstering to community resiliency able to be achieved via Big Map events, but this is the start of a process that has many different facets and component parts. We have learned that place-based, locally-led approaches empower communities and that lived experience and knowledge provide valuable insights to what matters most to different communities and groups. Through improving cooperation at different levels, more meaningful planning and management can take place to break down silos and inform broader scale decisions³⁷.

Establishing a Community Core

The idea of developing a localised community - led Community Core was discussed throughout the exercise. The primary role of the Community Core is to act as the link between the associated Local Government and the community.

Community members run a Core without official assistance – it is essentially a place for neighbours to help neighbours in a coordinated way. Each Core is based at the community level, and it explains how to organise an emergency relief and recovery effort, based on community expectations, needs, and associated local requirements. It also sets out and describes the different roles needed.



³⁷ National Action 23, Second National Action Plan to implement the National Disaster Risk Reduction Framework, https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf [Retrieved 9 September 2023]

Following a disaster event, the community will naturally come together to support one another as required. Strong, connected communities are better prepared to respond to and recover from disasters when they occur. In a major emergency, official responders will always need to prioritise the most urgent issues, so it is likely that for the first few days the community will need to help each other within the disaster. The Community Hub is a designated place where they can gather, connect with one another, and solve problems using the skills and resources which already exist among their community.

Throughout discussions during the 'Big Map' exercise it was clear that if a Community Core was established, the Five Pillars of the DRA Recovery model could easily be lead and fully utilised. The Five Pillars of the DRA Recovery model are as follows:

Human and Social - This relates to the emotional, social, physical, and psychological health and well-being of individuals, families and communities following a disaster. The Human and Social pillar within a community aims to:

- Gain access to timely information from the Local Government
- Aids in providing assistance to reconnect with families, friends, and community networks
- Enables community members to manage their own recovery through access to information and the knowledge of where to find Local, Regional and State services and/or practical assistance, including financial assistance for those individuals and households who are most vulnerable and do not have the means to finance their own recovery.
- Acts as the lead for the community and the vital link between Local Government and the community to access emotional, psychological, and mental health support at individual, family, and community levels (psychosocial support).

Tasks include:

- Identify and select a Community Hub leader
- Identify a suitable location and secondary location to act as a community HUB / community centre immediately post a disaster event
- Understand the roles and responsibilities of the Red Cross, Vinnies, Disaster Relief Australia, other Community Groups, GIVIT, State and Federal Recovery and Funding Arrangements, and Local Government Relief and Recovery arrangements.
- Understand and identify the location of the critical care members of the Community
- Lead and interpret the needs and requirements of the community when outside assistance arrives.

Economic - The effects of a disaster on the economic environment can be classified in terms of direct and indirect impacts. The tangible impacts can usually be given a monetary value and may include loss of tourism, employment opportunities and reduction in cash flow for businesses. Each community has a business lead and chamber of commerce established. A community member from these groups is always very well connected and fully understands the community in which they live. A Community Hub with this type of leading community member is always a great asset to have.

Tasks include:

- Identify and understand the key economic drivers of the community.
- What is unique to this community and if it is impacted, how will this affect the community over the next 3 to 6 months if lost or damaged?
- Understand the [State and Federal Recovery and Funding Arrangements](#).

Environmental – Impacts to the environment may include damage or loss of flora and fauna, poor air quality, reduced water quality, land degradation and contamination, or damage to heritage listed places. A representative from the community who understands these impacts and is willing to step forward and guide the Local Government as required.

Tasks include:

- Identify and understand the environmental impacts across the community
- What do these impacts have on farming, businesses and or private landowners?
- Understand localised flood mitigation options, bushfire mitigation strategies etc

Building - The effects of a disaster on the built environment often result in damage and disruption which inhibits the capacity of essential services such as housing, accommodation, education, and health facilities. A representative from the community (local builder, plumber etc) who understands these impacts and is willing to step forward and guide the Local Government as required.

Tasks include:

- What has been damaged or impacted in the community (Minor, Moderate, Major)?
- Are there likely to be insurance issues?
- Will outside contractors impact the community if utilised?
- What building capabilities exists within the community?

Roads and Transport - The effects of a disaster on transport networks, including road, rail, aviation and maritime normally result in difficulty accessing communities, and disruption to critical supply chains (both within and outside of the impacted area). Restoration of these networks, or the identification of alternatives, is a priority in disaster recovery. A representative from the community who understands these impacts and is willing to step forward and guide the Local Government as required.

Tasks include:

- What local roads, bridges and or access routes have been impacted?
- What is the result of these impacts (cannot access property, roads damaged, bridges damaged etc)?

Utilising the DRA Resilience Framework

In the last decade, resilience has evolved from a specialist term used largely in materials science and environmental studies, to become a concept employed frequently and passionately by policymakers, practitioners, and academics in various disciplines. The concept has become embedded in laws,

government, doctrines, and plans; and universities across the world have established resilience centres, institutes, and research programs.

Within DRA, we believe a resilient community is one whose members are connected to one another and work together in ways that enable it to function in the face of stress and trauma. A resilient community has the ability to adapt to changes in the physical, social, or economic environment, and the potential to learn from experience and improve over time. A resilient community can also be self-sufficient, at least for a time, if external assistance is limited or delayed.

As communities are complex and dynamic social structures, levels of community resilience are not static. It is important that those utilising the concept of community resilience make efforts to regularly measure it. Everyone has a unique combination of capabilities and capacity to prepare, cope and recover from disaster, which means they are vulnerable and resilient in different ways. Each level of society has aspects of resilience or vulnerability nested within it. Central to this is better understanding the systemic nature of risk and Australia's vulnerability³⁸.

The first step towards enhancing the resilience of a community involves understanding the community's strengths and vulnerabilities, as well as its physical characteristics (local infrastructure), procedural characteristics (e.g. disaster policies and plans) and social characteristics (e.g. level of community cohesion).

20. Some ideas going forward:

The development of community action plans. Each community is different. All localised community plans would benefit from further development to ensure appropriate and sufficient consideration is given to disaster recovery. Local Recovery plans established before an event should consider likely effort required across all functional recovery groups at a very localised level.

Returning to traditional methods. 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. This allows people to tap into resources such as community members who can temporarily house people immediately following a disaster event, or loan vehicles in an emergency. Developing connections with the Thunggutti/Dunghutti Nation's people to incorporate their knowledge of land management and recovery practices, based on their connection to country. Co-designing frameworks, policies, and or strategies with First Nations peoples that embed 'Caring for Country' as a first principle in disaster risk reduction efforts³⁹.

³⁸ Risk reduction: A shared responsibility, The Second National Action Plan to implement the National Disaster Risk Reduction Framework, https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf [Retrieved 9 September 2023]

³⁹ National Action 4 in The Second National Action Plan to implement the National Disaster Risk Reduction Framework, https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf [Retrieved 9 September 2023]

Developing, funding and empowering community-led groups. Adopting and empowering a locally-led community action group as the source of emergency information for their neighbourhood. This could lead to the development of locally-led flood groups within flood-prone areas, or bushfire groups in bushfire-prone areas. If supported and empowered these groups could facilitate the following:

- An evacuation exercise involving community members to help them understand what is required and be better prepared for the next flood and fire event.
- Adopting the activities used for annual bushfire awareness to increase flood preparedness including street meetings and letterbox drops.
- Bespoke communities establishing relationships with local government.
- Local governments holding annual seminars on planning and preparedness or providing local businesses and new residents with information about potential flood or fire risk.
- Develop a localised register of vulnerable community members (Note: This may have privacy implications.)
- Installation of more flood gauges positioned further upstream of communities to potentially provide earlier warning.
- Maintaining a network of key community contacts for community-initiated recovery after a disaster event.
- Helping community members to establish their own 'go bag' in the event an evacuation is required.

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.

Educating the next generation. Utilise the DRA 'Big Map' to lead and manage a campaign to educate and mentor the next generation across and schools and high schools within the Macleay Catchment. Identify ways to communicate with this age bracket via social media and other outlets. A better understanding of how younger community members want to be communicated with during a disaster event. The Youth Affairs Council of Victoria have written a Youth Focused Disaster Recovery Protocol which provides guidance on key matters for consideration and inclusion of young people in post-disaster recovery and rebuilding. This aims to ensure positive outcomes for young people who have been affected directly and/or indirectly by a disaster⁴⁰. A similar approach can be applied across the aged care fraternity.

Publicly available information. Further work be undertaken to develop effective public flood risk messaging and community education materials that are easy to understand and tested with the

⁴⁰ Youth-Focused Disaster Recovery Protocol, February 2020. <https://www.yacvic.org.au/assets/Uploads/Youth-Focused-Disaster-Recovery-Protocol-February-2020.pdf>

community to ensure flood risk is understood. Also, of importance is ensuring a local connection with platforms and frameworks for delivery and understanding of integrated early warning and evacuation advice⁴¹. The 'big map' discussion on the second day highlighted the fact that different communities within the Macleay catchment required different communication methods.

The development of a Catchment profile for disaster management needs to be linked to State authority's triggers for federal response options, and to compel coordination across subsequent local governments and State authorities. This includes integration of LGAs (Local Government Areas) with the Local Government Response Group to assist them in recovery following a disaster event. In our experience, effective mitigation of flood risks requires coherent planning and preparedness at a catchment level. In the case of floods, what occurs in higher points of a catchment (creeks, tributaries or upstream) will have consequences for downstream communities. A catchment-based approach to information sharing, intelligence, planning and the dissemination of public warnings is critical.

Developing a catchment approach for the entire Macleay Catchment. As detailed in the newly released NSW Flood Risk Management (FRM) Guideline AG01, flood risk management is a partnership across governments, with primary responsibility resting with local councils in their service areas. Local government responsibilities for FRM are outlined in the guideline. These responsibilities are derived from both the Local Government Act 1993 (LG Act) and the policy. Local government also has responsibilities for considering flooding in decisions that come through other Acts and documents.

Bridge heights on the Bureau of Metrology (BOM) hydrograph. A deck height on the associated hydrographs in all three locations (Bellbrook, Toorooka, and Sherwood) will provide significant situational awareness to all communities living upstream of Kempsey. The MINOR flood Classification in Bellbrook is currently set at 6.5 metres however this is 4 metres over the bridge (Bellbrook) when flooding. This flood classification has not been set locally; the data is provided for flood warning purposes downstream at Kempsey. The three bridge heights to be displayed on a BOM hydrograph are detailed below:

- Bellbrook Bridge - Station Number 059122 - Deck Height - 2.80m not (mAHD)
- Toorooka Bridge - Station Number 559038 - Deck Height - 3.50m not (mAHD)
- Sherwood Bridge - Station Number 559067 - Deck Height - 3.00m not (mAHD)

⁴¹ National Action 1, the Second National Action Plan to implement the National Disaster Risk Reduction Framework, https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf [Retrieved 9 September 2023]

On 15 August 2023, after consultation with the BOM from DRA, the BOM updated all three hydrographs with a bridge height at (Bellbrook, Toorooka and Sherwood). This simple but highly effective piece of communication and information will increase the situational awareness of all communities living in the upper reaches of the Macleay River.

Latest River Heights for Macleay R at Bellbrook

Issued at 10:16 am EST Friday 18 August 2023

[About river height plots](#) | [About this Plot](#)

Station details: Station Number: 059122 Name: Macleay R at Bellbrook

Flood levels: Minor: 6.50 Moderate: 10.50 Major: 13.50

Data from the previous 4 days.

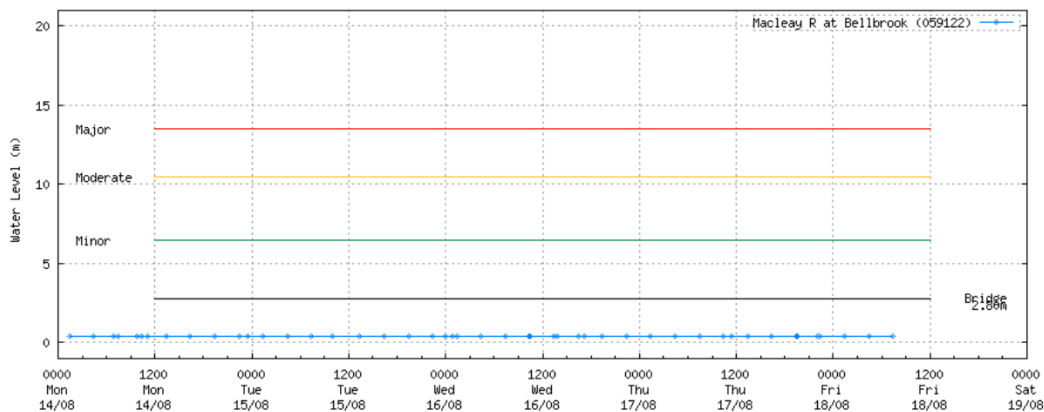


Figure 19: Example hydrograph with Bellbrook bridge height added. ⁴²

Improving the flood warning infrastructure network. In conjunction with the Bureau, engage the other local governments across the Macleay Catchment to identify and produce a future network investment plan to identify gaps and recommend improvements to flood warning systems, and design improved networks for the river systems and sub catchments in which they are located.

Flash Flood. 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’⁴³.

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.

⁴² <http://www.bom.gov.au/fwo/IDN60232/IDN60232.059122.plt.shtml>

⁴³ <https://federation.gov.au/about/agreements/intergovernmental-agreement-provision-bureau-meteorology-hazard-services-states>

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 will always result in inconsistent standards for delivery of both tasks.

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.

Combination of data-driven flood monitoring and local knowledge. There may be an advantage for all stakeholders in the Macleay Catchment to meaningfully combine local knowledge across all regions of the catchment. An opportunity exists for local council representatives, landowners, emergency services and Bureau representatives to discuss how this may occur to inform preparation, monitoring and anticipation of future flood events. Within the catchment communities convening regular forums to create, reinforce and sustain relationships to share knowledge, including outcomes from research and reflections from community disaster experiences will help build resilience and inform effective approaches to risk reduction.

Review the flood classifications at all 5 forecast locations. The Kempsey Shire Council should first check the current flood classifications and when they were last reviewed / updated. Once this has been identified, the council should then determine, if possible, how the existing flood classifications were established (i.e. based on past floods, survey details, or detailed flood mapping). The flood classifications require regular review to ensure they continue to reflect the expected or known flood impacts. Local development or changes to infrastructure (e.g. bridges/levees) are common reasons that flood classifications may require review. Flood classifications (Minor, Moderate, Major) should be set based on common, widely known criteria set by the BOM (Annexure A).

Refinement of flood warning timeliness. There appears to be an issue with flood alert timeliness, specifically, that notification of a flood event is not sent out with enough time for stakeholders to prepare. It is difficult to discern when conditions are going to cause a flood, or if the weather will change and preparatory actions will occur without a flood happening. A solution may be refinement of the notification systems (i.e who is told, and under what conditions, that a flood may be likely with enough time to allow for preparations). This will require multiple stakeholders from Council to the BoM (Bureau of Metrology) and SES.

Synthesis of different data collection sources to include local knowledge of river heights and likely implications would improve the precision and quality of the flood predictions made by the Bureau, and Kempsey Council. The current flood classifications provide very little situation awareness to all communities living east of Kempsey. In some locations along Armidale Road, roads are inundated before bridges are therefore impacting mobility and routes in and out during flooding.

Local Government Disaster rehearsals to include liaison with SES representatives and community leads. Councils in the Macleay River Catchment need to conduct liaison with other agencies as part of

the disaster Prevention, Preparedness, Response and Recovery (PPRR) model. When rehearsals and exercises to refine procedures are conducted, the involvement of the SES and lead community members will be crucial to ensure their support can strengthen the disaster PPRR model. Creating opportunities for people to work in partnership with emergency management agencies, their local authorities, and other relevant organisations before, during and after emergencies will assist the community in developing a high level of resilience.⁴⁴

Social media is another way to inform people before and during a fire and or flood emergency. Social media and the communications infrastructure in the catchment is one of the most accessible means for Kempsey Local Government, the SES and the State Emergency Centre to distribute information to communities on the flood and or fire situation and what actions they should take to protect themselves, their families and their property. Media and communications advice should be sought on the most suitable means for mass communications.

Landowners in the catchment need to be engaged about how they can assist in flood and water management. Landowners interact with the Macleay River catchment as part of the use of their property. Construction of dams and rural levees, use of the water for irrigation and recreation are all ways that the Macleay River interacts with landowners – but their uses also affect how the river can behave during floods.

Recovery efforts have to prioritise services, power and communications towers for mobile communications. Any damage to communications infrastructure will slow the rate of response and affect the coordination of the response and emergency services. Accordingly, communications sites need to be in areas without floodwater impact, and if they are impacted, need to be hardened to mitigate the risk of the destruction or damage during a flood.

⁴⁴ National Action 12, the Second National Action Plan to implement the National Disaster Risk Reduction Framework, https://nema.gov.au/sites/default/files/inline-files/28605%20NEMA%20Second%20Action%20Plan_V10_A_1.pdf [Retrieved 9 September 2023]

Annexure A

Flood Classifications

The Bureau uses a three-tiered classification scheme that defines flooding as minor, moderate or major at key river height stations. Each classification is defined by the water level that causes certain impacts upstream and downstream of the station. These levels have been determined based on standard descriptions of flood effects (see below), historical data and relevant local information. The classifications are revised from time to time by the Bureau's partner agencies and affected communities.

Minor flooding

Causes inconvenience. Low-lying areas next to water courses 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 flooding

In addition to the above, the area of inundation is more substantial. Main traffic routes may be affected. Some buildings may be affected above the floor level. Evacuation of flood affected areas may be required. In rural areas removal of stock is required.

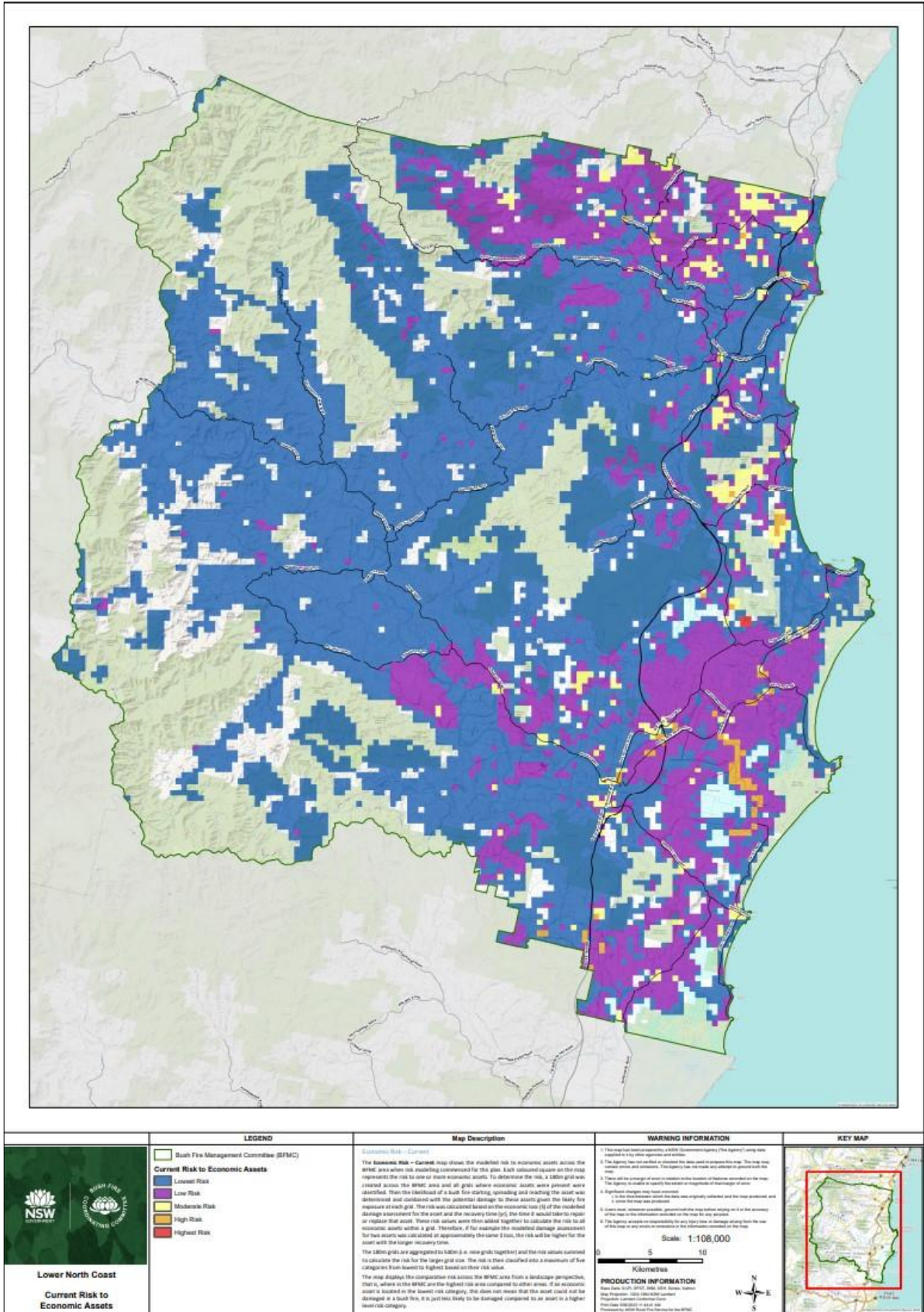
Major flooding

In addition to the above, 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.⁴⁵

⁴⁵ <http://www.bom.gov.au/water/floods/floodWarningServices.shtml>

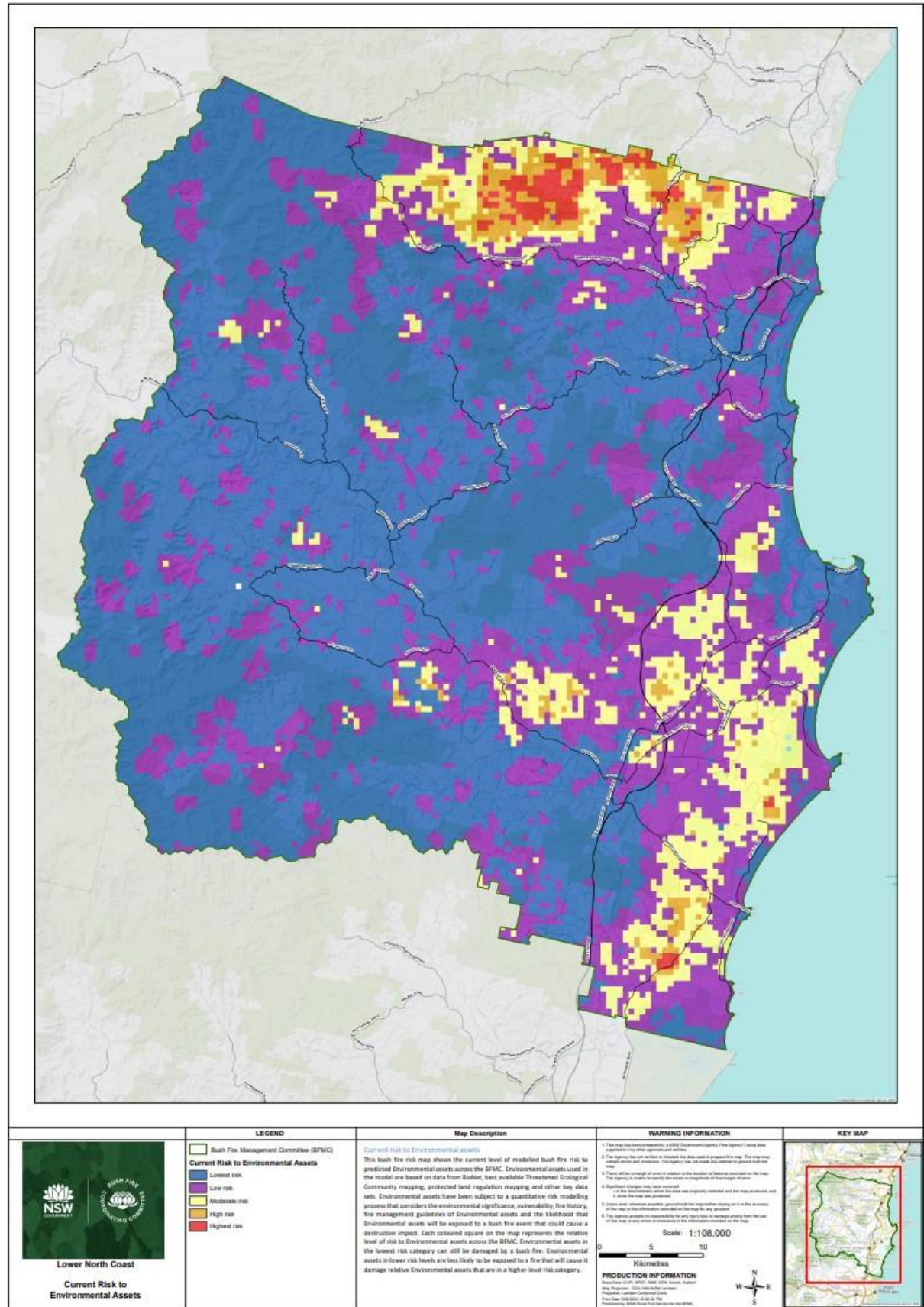
Annexure C

Economic Bushfire Risk



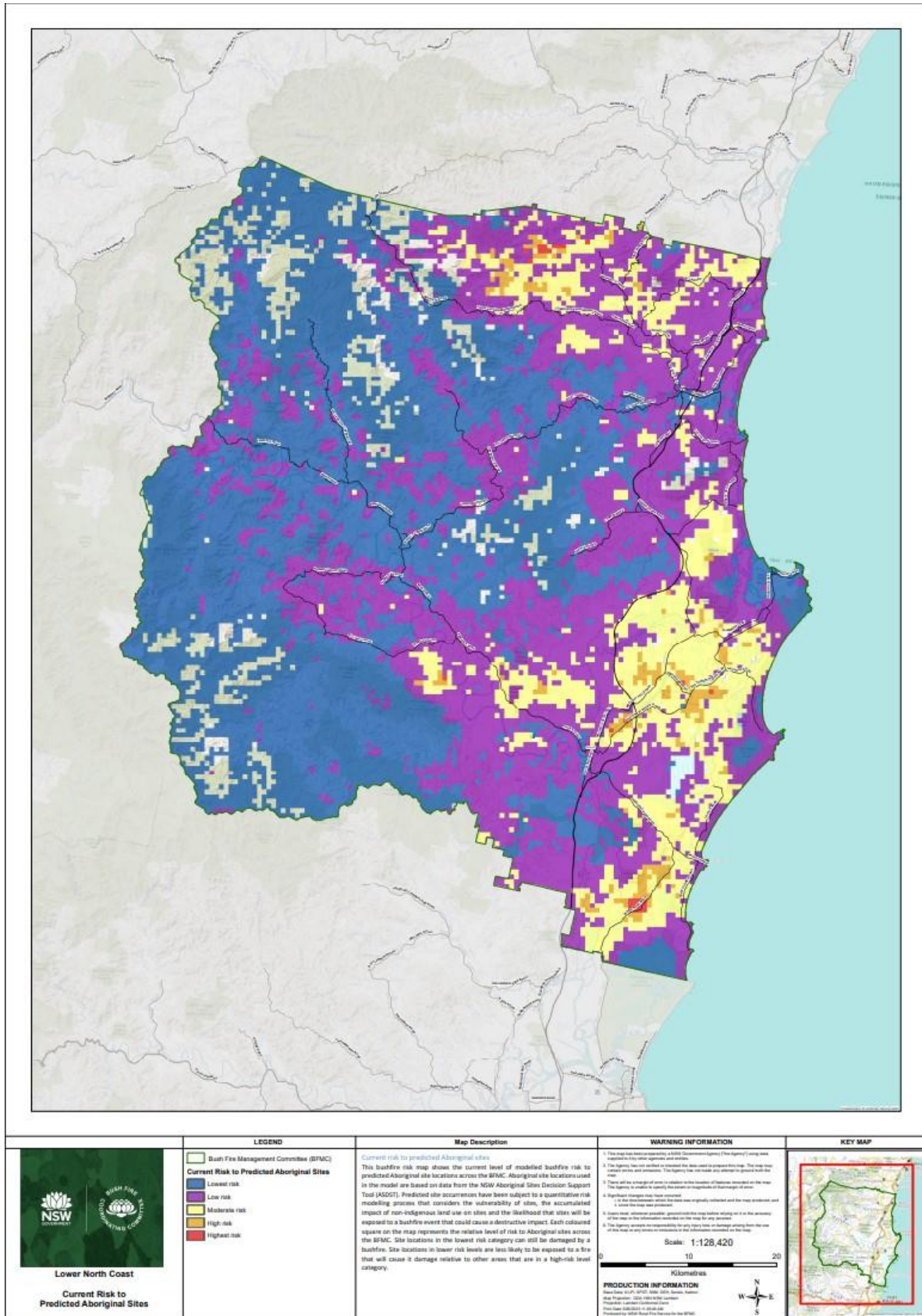
Annexure D

Environmental Risks



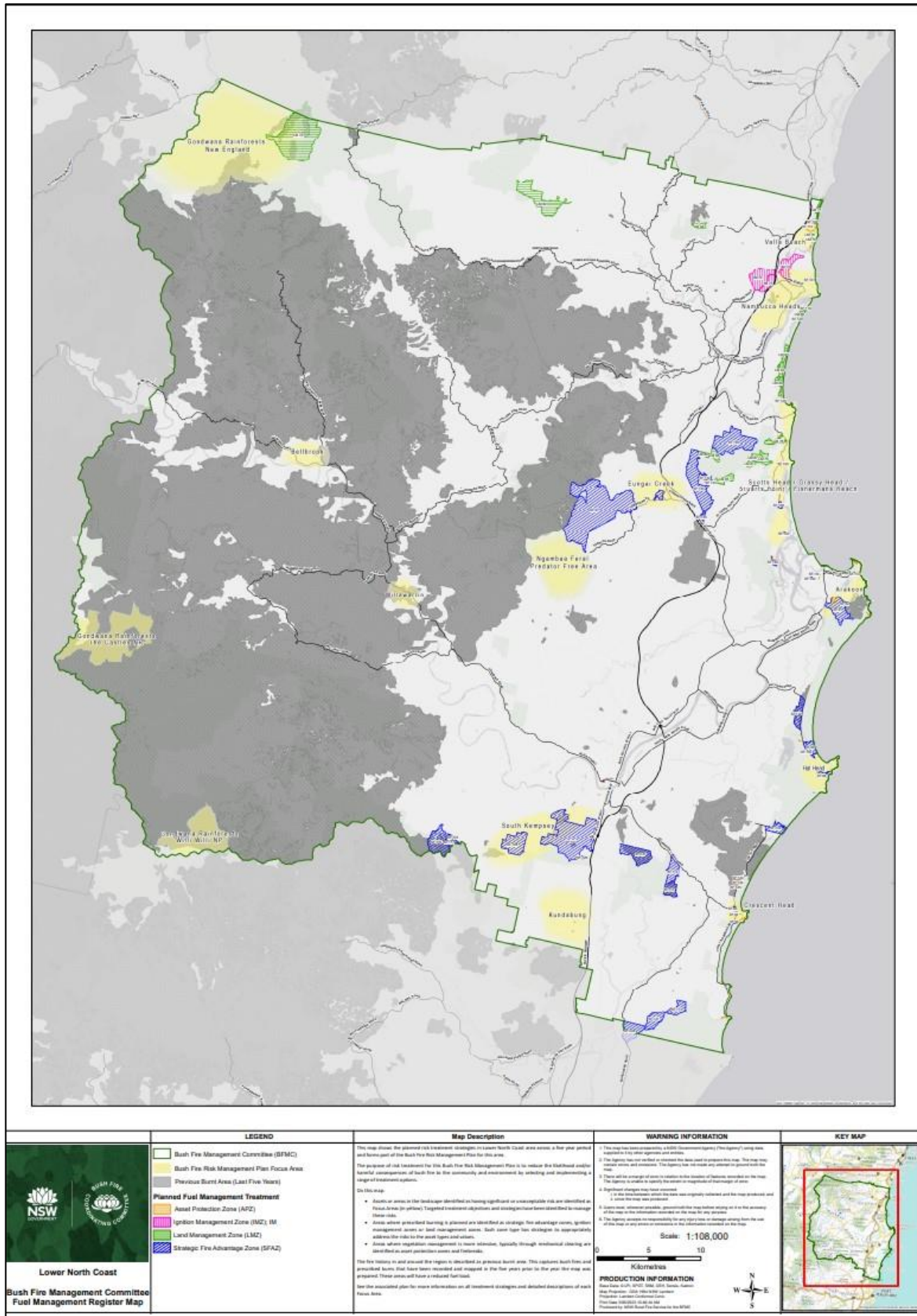
Annexure E

Cultural Predicted Aboriginal Assets









Annexure F

Fuel Management Register and Focus Areas



Annexure G

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|  | <p>People - Resilient people are aware of situations, their own emotional reactions, and the behaviour of those around them. By remaining aware, they can maintain control of a situation and think of new ways to tackle problems. In many cases, resilient people emerge stronger after such difficulties.</p> |
| <p>What does success look like</p> | <p>We are resilient within a community when: We have access to people that can assist when required and provide situational awareness when we need it We understand the weaknesses and vulnerabilities across our community Our community understands and is involved in disaster risk management Our community is at its strongest when we work together</p> |
| <p>Our commitments to the community</p> | <p>We act with every possible kindness and humanity, and no matter what, hold ourselves to a higher standard. Be respectful: Be respected. Swift mobilisation to rapidly deploy Disaster Relief Teams in the wake of a natural disasters to assist the community Increase community awareness and preparedness for all hazards through community engagement Show, through action, how the latent leadership and service potential of our nation’s veterans and emergency service specialists can be harnessed to build disaster resilience and relief capability.</p> |
|  | <p>Making Sense – Making sense of the problem is essential for understanding the bigger picture. It can be used as a way of exploring and developing effective future plans at the community level.</p> |
| <p>What does success look like</p> | <p>We are resilient within a community when: We know that beyond the next hill is a river and beyond the river another hill. Yet we will march undaunted until we reach those who need us. We understand that the community is connected and or influenced by internal and external factors We understand the Local economic activity, relationships among different social groups, local cultural patterns... they all influence the community from the inside out. The challenges we face are complex, we understand that we cannot approach them as if they were linear problems. Systems thinking helps us understand the complex crises before us.</p> |
| <p>Our commitments to the community</p> | <p>Identify and connect with change leaders in the NGO and disaster relief sectors to ensure we are constantly at the cutting edge of both technology, practice, and the community. The conduct of disaster risk mitigation and preparedness activities in Australia and overseas, particularly in under resourced and high-risk areas of operation. Recognised leader in spontaneous volunteer management throughout Australia and a proven track record of connecting businesses to communities through corporate volunteering.</p> |
|  | <p>Bouncing Back - Resilient communities can bounce back from adverse situations. They can do this by actively influencing and preparing for economic, social, and environmental change.</p> |
| <p>What does success look like</p> | <p>We are resilient within a community when: Our disaster management systems are scalable to accommodate the future changes and risk. Our community looks to the future and continuous improvement. we take a proactive approach to resilience building, rather than a reactive one</p> |
| <p>Our commitments to the community</p> | <p>Operating within existing international disaster relief frameworks across the Asia Pacific Region, supported by established relationships with government, industry, and local communities. We act without fear or favour in the best interests of the communities we serve and each other. We embrace a culture of ongoing improvement through regular monitoring and information sharing.</p> |

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|  | <p>Striving Forward – As we look to the future, some challenges will be so big that it will not be possible for the community to simply adapt; fundamental, changes will be necessary, and the community will need to adapt.</p> |
| <p>What does success look like</p> | <p>We are resilient within a community when: We know that transformation must occur. Our ability to transform as a community will not be successful unless the community involved recognise the need for it. We will need options for change. New ideas for dealing with new situations will only be available if there is room for them to be developed and tested. Transformative change needs support from higher scales and depends on having high levels of all types of capital—natural, human, built, financial, and social.</p> |
| <p>Our commitments to the community</p> | <p>We serve without expectation of personal gain, recognition, or reward. Provide a steady-state engagement model that provides continuous touch points with our Tribe between disaster relief missions. Deploy highly trained personnel in the wake of natural disasters to deliver timely and effective disaster relief wherever and whenever it is needed.</p> |
|  | <p>Our Human Needs - A sustainable community is a place where people want to live and work, now and in the future. The community needs of existing and future residents are sensitive to their environment and contribute to a high quality of life. These communities are inclusive, well planned, built and run, and offer equality of opportunity and good services for all.</p> |
| <p>What does success look like</p> | <p>We are resilient within a community when: Sustainability helps us understand in a more general sense our extremely complex relationship with the natural world, and the consequences of getting that relationship wrong. Identify adaptation opportunities following disasters and in anticipation of climate change We explore how our actions impact the biosphere, how the biosphere in turn impacts us, and how our actions need to change over the long term</p> |
| <p>Our commitments to the community</p> | <p>Promote a culture of creativity, continuous learning, a bias for action and trust over control. Ensure we have mechanisms to listen to the views of our stakeholders, communicate effectively and continuously learn to improve our performance. A world class provider of Remotely Piloted Aircraft capability, aerial damage assessment, mapping, and Geographic Information Systems (GIS), in Australia and overseas.</p> |
|  | <p>Courage – Everyone within a community needs courage, we need courage to confront challenging issues and take responsibility for our collective future.</p> |
| <p>What does success look like</p> | <p>We are resilient within a community when: We know that we need to face problems head on. Resilience building makes us grapple with complex problems that do not have easy or obvious answers We know it is hard enough to work on these issues as individuals and households; it is harder still to work on them as a community, with people who may see things differently.</p> |
| <p>Our commitments to the community</p> | <p>We act without fear or favour in the best interests of the communities we serve and each other. we embrace a culture of ongoing improvement through regular monitoring and information sharing. Courage brings us back around to the first foundation, People, because it is the people of the community who will build resilience—and they are the ones who need courage for all the pieces of resilience building.</p> |