



---

## Project Resilience

Richmond Catchment  
Northern Rivers, NSW



## Our Intent

“Project Resilience”, is a system (similar to a community) that is used to monitor disturbance and still retain a basic function and structure. Building resilience means to intentionally guide the system’s process of adaptation to preserve some qualities and allow others to fade, 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 collectively values, is open to interpretation and subject to disagreement.

Although many resilience frameworks and tools for building community resilience are now available across Australia, it is unlikely a single approach will work for all communities and their varied social and economic contexts. The Project Resilience Team has identified six foundations that it considers essential, no matter where or how resilience-building efforts are undertaken, or what challenges are of most local concern.

These foundations support building community resilience rather than achieving resilience. Resilience is an ongoing process.

## What DRA thinks Resilience is:



**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



<b>1. Disaster Relief Australia Resilience Process</b> .....	<b>5</b>
<b>2. Our (DRA) contribution to the communities of Northern Rivers</b> .....	<b>6</b>
Operation Kelliher (2nd March – June 2022).....	6
Operation Riordan (12th August – 26th September 2022).....	6
<b>3. Richmond Catchment, Northern Rivers NSW</b> .....	<b>7</b>
Restoring the Richmond River (NSW Marine Estate Management Strategy 2018-2028).....	10
The Richmond Floodplain and floods.....	10
Floods.....	10
A disjointed approach to flood risk management.....	12
<b>4. Data collection across the Richmond catchment</b> .....	<b>12</b>
<b>5. Key stakeholders and their role</b> .....	<b>14</b>
The Bureau of Meteorology (The Bureau).....	14
NSW State Emergency Service (NSW SES).....	14
NSW Local Government (Council).....	15
NSW Office of Environment and Heritage (OEH).....	15
Water NSW.....	15
Dam Owners and Operators.....	15
<b>6. Flood Infrastructure</b> .....	<b>16</b>
Data Collection – River Gauges.....	16
<b>7. Geoscience Australia – Exposure Reports (Local Government Areas)</b> .....	<b>19</b>
<b>8. The Richmond River Catchment Resilience Activity</b> .....	<b>20</b>
Purpose:.....	20
Method:.....	20
The DRA End state:.....	20
The Intelligence Picture.....	21
Major local and widespread flooding – Northern Rivers, NSW.....	22
<b>9. Response to major flooding within the Northern Rivers and New South Wales</b> .....	<b>23</b>
The Whole of Catchment Approach to Flood Mitigation.....	24
Outcomes of the Workshops (Walking the map).....	25
The Use of local knowledge.....	25
<b>10. Critical Infrastructure identified by the community post a disaster event (Recovery)</b> .....	<b>28</b>
Supermarkets/food items.....	28
Doctors.....	28
Hospital.....	29
Waste Transfer Station.....	29
Industrial Estate.....	29
Reserves and parks.....	29
Drinking water.....	30
Essential Services.....	30
Community Assessment and Prioritisation Tool.....	31
People.....	31
Making Sense.....	31
Bouncing Back.....	32
Striving Forward.....	32
Our Human Needs.....	32
Courage.....	32
<b>11. The DRA Environments</b> .....	<b>32</b>
Human & Social – Engaged & empowered.....	32
Building – Community linked, locally sourced, and owned.....	32
Economic – Diverse, Vibrant and Equitable.....	33
Environment – Respected, Valued, Understood.....	33
Transport and Roads – Community driven, well understood, future focused.....	33



Innovation – Thinking outside the square .....	33
Forward Thinking – Positive & open-minded .....	33
Building Back Better – Looking to the future .....	33
Outcomes of the Community Assessment and Prioritisation Activity.....	33
Progress thus far.....	36
Historical Construct of Activities in the Richmond River Catchment.....	37
Establishing a Community Core .....	37
Human and Social.....	38
Economic.....	38
Environmental.....	38
Building.....	38
Roads and Transport .....	39
Group Activities.....	39
Utilising the DRA Resilience Framework.....	39
<b>12. Our recommendations .....</b>	<b>42</b>
<b>13. Your Feedback and what we learned.....</b>	<b>45</b>



## 1. Disaster Relief Australia Resilience Process

The Disaster Relief Australia (DRA) Resilience Process is a four-stage process. Each stage broken down into various steps. Overall, the DRA Resilience Process provides effective guidance and direction to each Disaster Relief Team (DRT) across Australia. A future DRA Resilience Framework is in development (yet to be drafted). The purpose of the DRA Resilience Framework is to:

- Support DRT Managers to assess and prioritise community-based resilience projects
- Establish a consistent approach across each DRT to recognise what vulnerabilities may exist within their regional operating areas
- 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 build 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.



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 lead discussions and community-based forums. For many DRA members, these forms of community led discussions and forums are often second nature. This is because of their previous operational experience within the Australian Defence Force and trained ability to assimilate risk and operational effectiveness on a battlefield. For example, the large map discussion is based on a military wargame theory. The purpose of using wargaming models is to not emulate reality but to serve as a device for stimulating innovative thought.







## 2. Our (DRA) contribution to the communities of Northern Rivers

### Operation Kelliher (2nd March – June 2022)

DRA has developed a significant bond within this region after we conducted our largest disaster response activity since the inception of the organisation in 2016.

As families came to grip of the catastrophic flooding in Coraki (NSW) on the morning of the 2nd of March 2022, our specialist Operational Recce Team (ORT) picked their way through receding floodwaters to respond and establish our Forward Operating Base (FOB) in Coraki.

Over the next 13 weeks, DRA deployed 714 volunteers from across the country, logging 25,767 hours, completing 526 work orders saving the community \$1.4 Million. Our entire operation was funded by charities, donations, and federal government grants.

	25,767 volunteer hours logged
	714 volunteers deployed
	\$1.4 million community costs saved
	218 ADAT Flights
	526 Work orders completed

### Operation Riordan (12th August – 26th September 2022)

After a break in operations allowing us to make repairs to and service our equipment, restock supplies and assess work completed to date, we deployed back into Lismore (Operation Riordan) on the 12<sup>th</sup> of August until the 26<sup>th</sup> of September 2022 where we recommenced further flood recovery operations in Northern NSW.

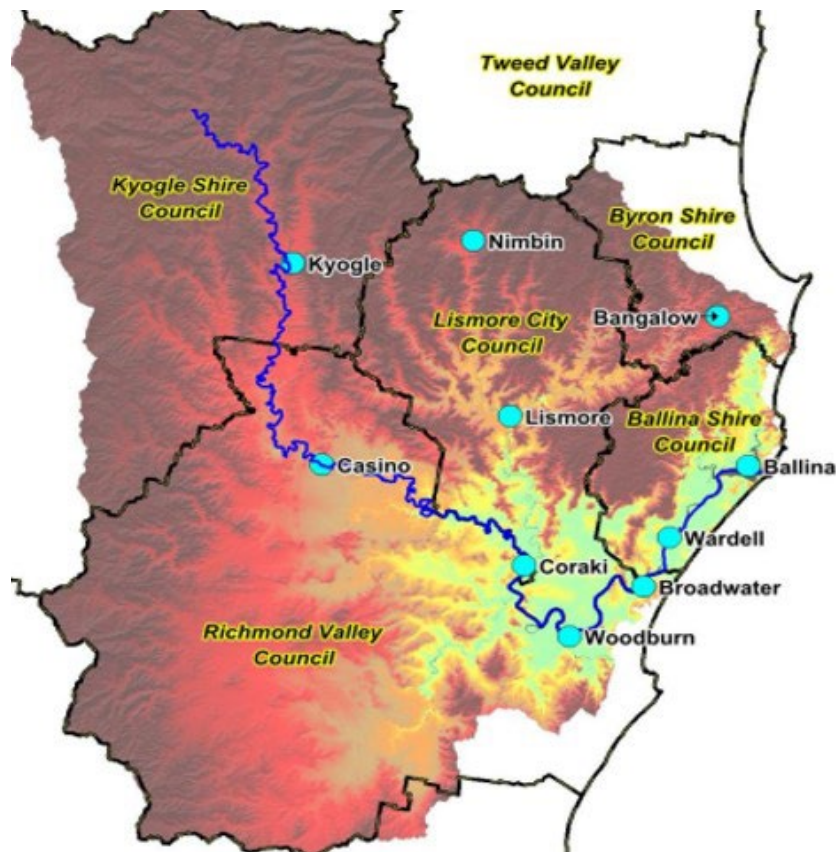
	13,949 volunteer hours logged
	172 volunteers deployed
	\$727.190 million community costs saved
	7 ADAT Flights
	126 Work orders completed



### 3. Richmond Catchment, Northern Rivers NSW

A drop of water landing near the highest level of the Richmond River will descend hundreds of metres as it travels more than 200km to enter the sea at Ballina.

On its way it will be joined by water from multiple tributaries including the Wilsons River and Leycester Creek that contribute so much to the flooding of Lismore. On its journey south to the sea, the Richmond, and its tributaries (creeks and smaller rivers) pass through Kyogle, Casino, Coraki, Woodburn, Broadwater, Evans Head and many smaller locations. The Richmond catchment is 6862 square kilometres and it has a floodplain of more than 1000sq km.



The lands and waterways of the Richmond Catchment and beyond, are the unceded territories of the peoples of the Bundjalung and Githabul Nations. We pay our respects to their Ancestors, who cared for Country since time began, and to all communities of the Bundjalung and Githabul Nations, to all Traditional Custodians, who continue to speak and care for their Country and Water.

The Richmond catchment comprises a variety of landscapes from world heritage rainforests to rich agricultural valleys and coastal estuaries. In the north of the catchment lie the Border Ranges National Park and other reserves associated with the World Heritage listed Tweed volcanic caldera and its associated Gondwana rainforests<sup>1</sup>.

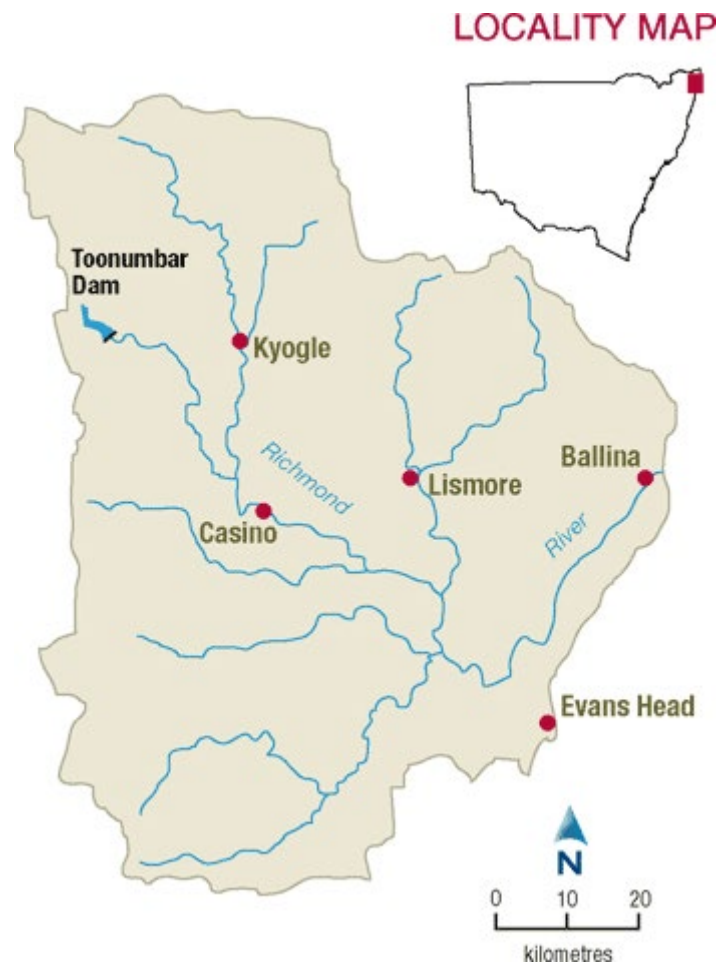
<sup>1</sup> <https://www.industry.nsw.gov.au/water/basins-catchments/snapshots/richmond>



The catchment sits in far north NSW. The Richmond River begins at the NSW-Queensland border and flows south-east for around 170 kilometres to the ocean at Ballina. The coastal extent of the catchment reaches from Evans Head in the south, to just south of Cape Byron in the north.

The Richmond drains an area of over 7,000 square kilometres from the Border Ranges in the north to the Richmond Range in the west and south. The upland ranges and the plateau north of Lismore remain mostly forested while the lower coastal plains are cleared for agriculture. Elevations range from over 1,000 metres in the Border Ranges to near sea level on the coastal floodplain.

The catchment includes popular tourist destinations such as Ballina, and supports a high residential population attracted by the region's coastal lifestyle. Lismore and Ballina are the largest urban centres in the catchment. Other towns include Casino, Lennox Head, Alstonville, and the smaller centres of Coraki, Evans Head and Kyogle.



The Richmond River rises in the Border Ranges National Park and flows south through an extensive coastal floodplain to Ballina, where it enters the Pacific Ocean. The main tributary of the Richmond River is the Wilsons River, which contributes around 60% of the flows in the lower river. The Wilsons River enters the Richmond on the coastal plain at Coraki. Other important tributaries are Eden Creek west of Kyogle, and Shannon Brook and Bungwalbin Creek, which drain the southern part of the catchment and enter the tidal reach of the river.





The Richmond has an extensive tidal zone which extends beyond Tatham on the Richmond River and Lismore on the Wilsons River.

The small coastal catchment of the Evans River is connected to the Richmond River at Woodburn by a canal. This canal is operated to mitigate flooding and improve drainage in the mid-Richmond River area. The Evans River flows for around 20 kilometres and enters the ocean at Evans Head.

A small section of the Richmond River is regulated by Toonumbar Dam on Iron Pot Creek, which is part of Eden Creek catchment. It stores water from a 98 square kilometres catchment for irrigation, stock, domestic, and town water supplies. Two other storages in the Wilsons River catchment – Rocky Creek Dam and Emigrant Creek Dam – are operated by Rous Water to provide town water for Lismore and Ballina.

The Richmond catchment supports a diverse range of land use, including livestock grazing (dairy and beef), horticulture, dryland agriculture (including sugar cane), forestry, and irrigated agriculture. On the Alstonville Plateau, a significant horticultural industry uses groundwater to irrigate fruit and nut crops. Dairy farms on irrigated pastures are found along the alluvial flats of the Richmond and Wilson Rivers. Rous Water is a major water user, extracting water to supply the urban centres of Ballina, Lismore, and Lennox Head.

Due to a high density of rural settlement, the region's rivers and estuaries tend to be affected by changed run-off conditions caused by land clearing, agricultural use, urban development, and recreation. Many streams on the coastal floodplain have been straightened and channelised affecting natural habitat values.

Toonumbar Dam supplies water to a small number of users along the Richmond River. However, most of the rivers and creeks within the catchment are unregulated, and pressure from extraction can occur in times of low flow. Water sharing plans have been introduced to balance the needs of water users and the environment.

Around 800 square kilometres of the Richmond catchment is protected within national parks and reserves, much of this being in the Border Ranges in the north. Three of these parks – Border Ranges, Toonumbar and Nightcap – form part of the Gondwana Rainforests of Australia World Heritage Area, as well as part of the geologically significant Tweed Caldera (an ancient volcano centred on Mount Warning).

The lower Richmond River supports some extensive wetland complexes. The largest of these are Tuckean Swamp on the Richmond floodplain and Ballina Nature Reserve which protects extensive areas of mangroves and saltmarsh communities.

The Big Scrub is a lowland rainforest community that once covered approximately 75,000 hectares of the Richmond catchment. Now endangered, less than one per cent of this ecological community remains. The small remnants constitute one of the most diverse ecosystems in NSW supporting more than 300 plant species and an equally diverse fauna population.



## Restoring the Richmond River (NSW Marine Estate Management Strategy 2018-2028)<sup>2</sup>

Within the NSW Marine Estate Management Strategy 2018-2028, Integrated initiatives to restore the NSW sixth-largest catchment in NSW, the Richmond River was noted as a vital environmental and community asset. Despite more than a century of modification and misuse, it provides habitat for fish and birds. It supports agriculture, fishing, recreation, and tourism activities. It is a spiritual place for Aboriginal people, who have relied on its resources for thousands of years.

The past century has not been kind to the river and its floodplain. It is now in worse ecological health than most estuaries in NSW. Water quality is 'very poor', with high nutrient concentrations and excessive turbidity. The floodplain habitat has been degraded by an extensive artificial drainage system that was installed in the 1900s and extended 50 years later.

Drainage of the area has resulted in the floodplain vegetation now dominated by dryland species. A direct result of these changes has been extensive fish kills and diseased fish and oysters due to low dissolved oxygen levels after even a moderate flood and exposed acid sulphate soils discharging acidic water into the river. The Richmond River experienced widespread fish kills affecting 30km of river in 2001 and 2008 as dissolved oxygen levels crashed to levels lethal to aquatic life. Some of the drained former wetlands on the coastal floodplain are at, or below, sea level. Farmers that maintain these areas in a drained state for agricultural purposes will see high environmental and financial costs that will increase into the future.

Land use is already changing throughout the Richmond River catchment. The urban area is expanding, and agricultural land practices and crops are changing. The new land uses present an opportunity to improve floodplain management and planning.

Better planning, coordination and on-ground action will help restore the health of the Richmond River. These measures can help restore water quality in the system, which benefit communities, the environment, and local economies.

### The Richmond Floodplain and floods

The Richmond River floodplain is the largest coastal floodplain on the NSW coast, covering 1,000 square kilometres with a waterway area of 19 square kilometres. The tidal limit is 110 kilometres, extending to Casino on the Richmond River and Boat Harbour at Lismore on the Wilson River<sup>3</sup>.

Most of our cities and towns are located on the floodplain. This is an historical outcome as most of the travel and trade in the earlier times was by boat. Some of the settlements include Lismore, Casino, Coraki, Woodburn, Broadwater, Wardell and Ballina.

The Rous County Council is a county council constituted under the Local Government Act 1993. County Councils are different to local councils; they are specifically set up or delegated to provide one or more functions of a local council. This means that they have quite specific functions that they undertake for the local councils of the areas within which they operate. These Councils are referred to as 'constituent councils'.

The Rous Council is a flood mitigation authority operating across the local government areas of Ballina, Bryon, Lismore, and Richmond Valley. It is responsible for the construction and replacement of flood mitigation infrastructure including the routine maintenance of various canals and floodgates and related natural resource management activities.

### Floods

Floods are a naturally reoccurring event in the Richmond catchment, with the earliest recorded flood events dating back to 1857. Seven major floods have been recorded since 1857, with the two largest occurring in 1954 and 1974.

---

<sup>2</sup> [https://www.marine.nsw.gov.au/\\_data/assets/pdf\\_file/0007/815596/Marine-Estate-Management-Strategy-2018-2028.pdf](https://www.marine.nsw.gov.au/_data/assets/pdf_file/0007/815596/Marine-Estate-Management-Strategy-2018-2028.pdf)

<sup>3</sup> <https://rous.nsw.gov.au/floodplains-and-floods>



Following the 1954 disaster, state and local governments and the local community resolved to address the flood problems through mitigation. Council conducted infrastructure works from 1960 to the late 1980s to reduce flood impacts and to remove flood water more rapidly. Levees, flood channels and floodgates were installed to not only protect settlements, but also to open areas for agriculture.

There are many homes and businesses on the floodplain that rely on the protection of levees and floodgates. In some areas, local councils and state and federal governments fund a scheme used to buy houses in high-risk areas. This scheme, known as Voluntary House Purchase, began after the disastrous flood of 1954. The scheme enters into an agreement where houses are purchased from people who wish to sell. The house is then removed from the site and the remaining house block is left as open parkland, effectively removing the family from flood risk, while creating an open public space.

The NSW Government's 'Flood Prone Land Policy' requires flood studies and management plans to be developed incorporating sustainable strategies for human occupation and utilisation on the floodplain. In the Richmond catchment, flood risk management studies have been carried out for Ballina, Lismore, Casino, and the mid Richmond. These studies identify flood flows and flood extent and height for 1:20, 1:50, 1:100, 1:500 year and PMF events. These studies also identify works that can be implemented to reduce flood problems. In Lismore, the Lismore Levee was constructed as an action of mitigation provided as a recommendation of the flood study.

Flooding in the Richmond River basin is a recurring natural disaster that poses major risk to both urban and rural communities and property. Major flooding has been experienced in the Richmond Valley, with widespread flooding having occurred in 1954 and 1974. A range of other more localised flood events have occurred since, with different parts of the Richmond having been affected at different times. These floods have greatly impacted on the urban and rural communities of the Richmond River.

Over the last 20 years numerous Flood Studies, Floodplain Risk Management Studies and Plans have been undertaken to help protect emergency service providers, rural communities, and urban centres of the Richmond River catchment. These studies have included the whole of the Richmond River floodplain from Kyogle to Ballina and Lismore on the Wilsons River, with particular focus on the urban centres of Kyogle, Casino, Coraki, Lismore, Woodburn, Broadwater, Cabbage Tree Island, Wardell and Ballina.<sup>4</sup>

## **A disjointed approach to flood risk management**

In 2012, BMT WBM, Brisbane, Queensland released a study titled 'Towards a catchment-based model after two decades of modelling in the Richmond'<sup>5</sup>. The report identified that the Richmond River catchment in northern NSW offered a prime example of the limitations with the conventional flood risk management process. The majority of the catchment covers five local government areas. Over the past two decades, separate flood studies and Flood risk Management Plans (FRMPs) have been prepared for Kyogle, Lismore, Casino, Ballina, and some of the rural villages between. A combination of modelling methods have been applied using three hydrologic programs, five hydraulic programs, totalling 15 separate flood models.

The BMT WBM report identified five key issues. From a modelling perspective, five local government areas using various different modelling methods and software is highly undesirable. For some smaller catchments this approach meets its purpose. However, for larger catchments a range of issues are evident, including:

- inadequate coverage of rural areas;
- poor synchronisation of FRMPs;
- discrepancies at model interfaces;
- inconsistent modelling and mapping approaches;
- and inadequate use of flood information for flood response.

At the time of the BMT WBM report a common issue to most parts of Australia was the inadequate use of flood mapping

---

<sup>4</sup> BMT WBM Richmond River Flood Warning and Evacuation Management Review report April 2016

<sup>5</sup> <https://www.floodplainconference.com/papers2012/Ben%20Caddis%20Full%20Paper.pdf>

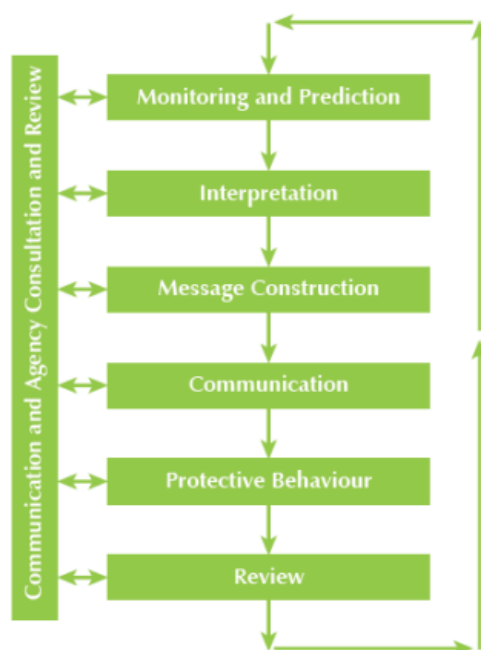


in an operational context. During flood emergencies, response agencies would default to local knowledge of past flood behaviour, rather than make use of the information available from Flood Studies and Flood Risk Management Studies. A factor which could contribute to this issue is the numerous, and sometimes conflicting, studies available for a single catchment. Further, a collection of localised flood models has limited use for flood warning purposes. Response agencies require an overview of the complete hydrologic system, rather than having to waste time making interpretations between separate sources of information and data.

#### 4. Data collection across the Richmond Catchment

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.

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):



**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).

[http://www.bom.gov.au/nsw/NSW\\_SLS\\_Current.pdf](http://www.bom.gov.au/nsw/NSW_SLS_Current.pdf)



- Forecast location is a location for which the Bureau provides a forecast of future water level either as the class of flood that is predicted (minor, moderate or major) or as a level and class – refer to Appendix A for definitions. At these locations observed data, flood classifications and additional qualifying information will be available.
- Information location is a location at which flood classifications are defined and observations of water level data are provided. At these locations forecasts of future water level are not produced. Other key thresholds may be defined and reported.
- Data location is a location for which just the observed water level data is provided. Flood classifications are not available for these locations and forecasts of future water level are not produced.

Within the Richmond Catchment as defined in the Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory the following Forecast, Information and Data locations were identified prior to the workshop.

The Bureau use gauges to provide predictions and warning.

1. Forecast locations – 7 sites
2. Information locations – 1 site
3. Data locations – 28 sites
4. Sites if rainfall gages owned by the BOM – 15 sites
5. List of sites where the Bureau co-locates equipment and the site is owned by another agency – 8 sites (The Channon, Nashua (Wilson's River), Nimbin, Rock Valley, Tuncester, Bentley, Corndale, and Repentance).
6. The Bureau regularly provides flood warning related products (warnings, watches, bulletins (river and rainfall), and river alerts) on a regular basis as detailed in the Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory.

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. This data, when provided to the Bureau, can be used to provide flood warnings as a component of the Total Flood Warning System (as defined in the Australian Emergency Manuals Series, Manual 21 Flood Warning).<sup>6</sup>

---

<sup>6</sup> Page 7, <https://www.ses.nsw.gov.au/media/2655/gauges-and-warnings.pdf>



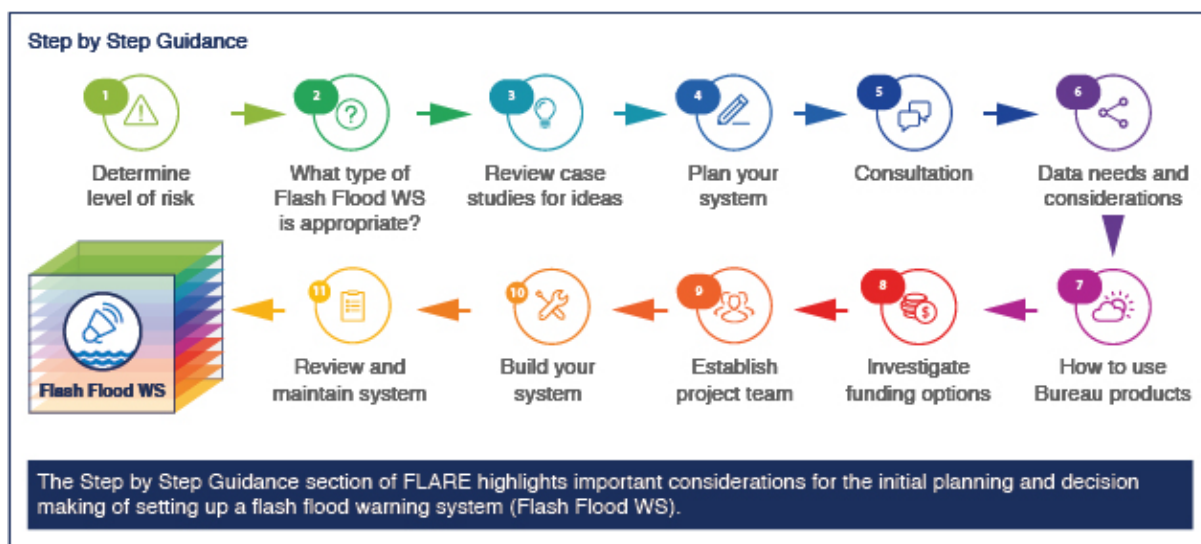
## 5. Key Stakeholders and their Role

### The Bureau of Meteorology (The Bureau)

The Bureau has historical and statutory responsibility for the issuing of warnings of weather conditions likely to give rise to floods. The Bureau provides forecasting and warning services for Riverine Flooding across the State. The Bureau provides generalised, qualitative, or quantitative flood predictions for agreed flood forecast locations. 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.

- [http://www.bom.gov.au/nsw/NSW\\_SLS\\_Current.pdf](http://www.bom.gov.au/nsw/NSW_SLS_Current.pdf)

The Bureau use gauges to provide predictions and warning. The Bureau relies on accurate gauge information and metadata to ensure these services are provided correctly. The Bureau owns and maintain gauges as well as utilise externally owned and maintained gauges to provide the above service. 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) <http://www.bom.gov.au/australia/flood/flashfloodadvisoryresource/> 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.



### NSW State Emergency Service (NSW SES)

As the legislated Combat Agency for floods, NSW SES is responsible for the control of flood operations. The SES Act 1989 states that NSW SES also has the function of establishing flood warning systems. NSW SES work with the Bureau and Councils to develop warning systems and to ensure warning products and messaging are consistent across the state.

The requirements of the Act are met by NSW SES issuing flood warning products and by identifying the need for flood warning classifications and associated warning services. NSW SES utilise gauge information to prepare flood intelligence, to prepare and issue warning products and to respond to flooding.

NSW SES are responsible for maintaining the NSW SES Flood Intelligence System which documents gauge and associated warning information as well as consequences at varying gauge water levels and recommended response actions. Provision of and Requirements for Flood Warning Page 4 February 2018 NSW SES work with the Bureau and Councils to develop warning systems and to ensure warning products and messaging are consistent across the state.



## NSW Local Government (Council)

The Intergovernmental Agreement states that in areas where the Bureau does not provide Flash Flood warnings (for small catchments), that the responsibility for Flash Flood warnings and systems lies with the States and Territories in partnership with local government (where appropriate) within their jurisdictions.

Council is responsible for implementing the NSW Floodplain Management Process. A Floodplain Risk Management Committee is established as part of this process to assist Council in the development and implementation of Floodplain Risk Management Plans. A Plan may recommend the installation of gauges, establishment of a gauge network, or establishment of a warning system. These recommendations may be for riverine or flash flood catchments. For Riverine Flooding, Councils work with the Bureau and NSW SES to establish this addition to the statewide service. For Flash Flooding, Councils lead the development of these systems which they would own and maintain.

In addition to this, Councils may identify the need for a new or revision to existing flood classification level through the Floodplain Management Process.

## NSW Office of Environment and Heritage (OEH)

OEH administer the NSW Floodplain Management Program by providing financial support and technical advice to Councils to investigate the potential for new gauges/networks, to install gauges/networks and to develop new flood warning services through the program.

OEH is also a Gauge Owner, maintaining a gauge network within the coastal zone of catchments east of the Great Dividing Range. Manly Hydraulics Laboratory (MHL), on behalf of OEH, operate, upgrade, and maintain this network as well as provide public access to this data.

## WaterNSW

WaterNSW own a gauge network west of the Great Dividing Range. Water NSW is responsible for the upgrade and maintenance of the existing primary network of flood gauges, and provision of a permanent archive of, and access to, the state's dataset.

## Dam Owners and Operators

Dam Failure Warning Systems and accompanying arrangements have been established for communities below dams identified as the as the highest risk by the Dam Safety Committee. Arrangements for these are specified in an individual dams, Dam Safety Emergency Plan (DSEP).

Dam Owners and Operators are responsible for the ongoing management of dams, as well as maintaining and operating associated Dam Failure Warning Systems.

It is the responsibility of Dam Owners and Operators to:

- state the arrangements governing the operation of these systems;
- develop warnings and notification processes in consultation with NSW SES;
- notify downstream emergency managers and warn communities; as well as
- document these processes and arrangements in the Dams DSEP.



The Dam Failure Hotline is to be used to inform NSW SES to ensure dam failure warnings are disseminated with priority and urgency.



## 6. Flood Infrastructure

### Data Collection – River Gauges

Throughout the Richmond River catchment, there is a broad network of river gauges, owned and operated by a range of agencies for a variety of purposes. Many gauges serve multiple purposes.

The existing river gauges can be broadly categorised as follows:

(1) Telemetered gauges:

(a) Tidal pool gauges – generally owned and operated by:

- NSW Office of Environment and Heritage (OEH) (operated by Manly Hydraulics Laboratory (MHL)); and
- NSW Office of Water (NoW)

(b) Non-tidal gauges – these are the river gauges located upstream of the tidal limits, and are generally owned and operated by:

- NSW Office of Water

(2) Manual gauges:

(a) Tidal pool gauges – these are mostly used by the SES as additional information on local flood conditions. The manual gauge at Lismore (Dawson Street) is also used by the BoM as a secondary gauge for flood prediction.

(b) Non-tidal gauges – similarly, these gauges are mostly used by the SES as additional information on local flood conditions. The manual gauge on the Casino Road Bridge is also used by the BoM as a secondary gauge for flood prediction. Refer to Table 3-4 for a listing of manual staff gauges upstream of the tidal limits.

#### Data collection across the Richmond Catchment

Source: BMT WBM Richmond River Flood Warning & Evacuation Management Review, and the Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory – Version 3.13

Gauge Name	Gauge No	Location	River	Owner	Used by BOM for Flood Warning	Reported on BoM Website
<b>Ballina Breakwall</b>	558097 (203425)	Ballina	Richmond River	OEH	No	Yes
<b>Misingham Bridge</b>	203465	Ballina	North Creek	OEH	No	No
<b>Byrnes Point</b>	558044 (203461)	Ballina	Richmond River	OEH	No	Yes
<b>Wardell</b>	203468	Wardell	Richmond River	OEH	No	No
<b>Woodburn</b>	058061 (203412)	Woodburn	Richmond River	OEH	Yes	Yes
<b>Rocky Mouth Creek</b>	558054 (203432)	Woodburn	Rocky Mouth Creek	OEH	No	Yes
<b>Tucombil Canal Floodgates</b>	558057 (203434)	Woodburn	Evans River	OEH	No	Yes
<b>Tucombil Highway Bridge</b>	558058 (203408)	Woodburn	Evans River	OEH	No	Yes
<b>Iron Gates</b>	203475	Evans Head	Evans River	OEH	No	No
<b>Evans River Fishing Co-op</b>	558048 (203462)	Evans Head	Evans River	OEH	No	Yes
<b>Bungawalbin Junction</b>	58184 (203450)	Near Coraki	Richmond River	BOM	Yes	Yes
<b>Richmond River at Oakland Drive</b>	203470	Near Coraki	Richmond River	NoW	No	No
<b>Coraki</b>	058175 (203403)	Coraki	Richmond River	OEH	Yes	Yes
<b>Bungawalbin Creek at Neiley Lagoon Road</b>	2034133	Bungawalbin	Bungawalbin Creek	OEH	No	No
<b>Tuckurimba (Baxter Lane)</b>	558076	Tuckurimba	Wilson's River	BOM	No	Yes





<b>East Gundurimba</b>	558047 (203427)	Gundurimba	Wilsons River	BOM	No	Yes
<b>Lismore</b>	058176 (203904)	Lismore	Wilsons River	BOM	Yes	Yes
<b>Tuncester</b>	58201 (203904)	Lismore	Leycester Creek	OEH	Yes	Yes
<b>Woodlawn College</b>	558012 (203402)	Lismore	Wilsons River	OEH	Yes	Yes
Telemetered river gauges upstream of the tidal limits						
<b>Bentley</b>	058292 (203009)		Back Creek	NoW	Yes	Yes
<b>Binna Burra</b>	293912	Binna Burra	Byron Creek	NoW	Yes	Yes
<b>Casino</b>	558013 (203004)	Casino	Richmond River	OEH	Yes	Yes
<b>Ewing Bridge (Corndale)</b>	058206 (203909)	Corndale	Coopers Creek	NoW	Yes	Yes
<b>Doubtful</b>	558037 (203034)		Eden Creek	NoW	Yes	Yes
<b>Eltham</b>	058200 (203014)	Eltham	Wilsons River	NoW	Yes	Yes
<b>Fairmeadow</b>	203060		Coopers Creek	NoW	No	No
<b>Goolmangar Creek at Nimbin</b>	058180 (203901)	Nimbin	Goolmangar	LCC	Yes	Yes
<b>Goolmangar Creek</b>	558075	Goolmangar	Goolmangar Creek	LCC		Yes
<b>Houghlahans Creek</b>	203057	Teven	Houghlahans Creek	NoW	No	No
<b>Kyogle</b>	558002 (203900)	Kyogle	Richmond River	NoW	Yes	Yes
<b>Lavelles Road</b>	203056		Richmond River	NoW	No	No
<b>Lismore (Dawson Creek)</b>	558087	Lismore	Browns Creek	LCC		Yes
<b>Marom Creek at Graham Road</b>	203059	Tuckean Swamp	Marom Creek	NoW	No	No
<b>Gauge Name</b>	Gauge No	Location	River	Owner	Used by BOM for Flood Warning	Reported on BoM Website
<b>McNamara Bridge Weir</b>	203061		Goolmangar Creek	NoW	No	No
<b>Nashua</b>	058162 (203902)	Nashua	Wilsons River	LCC	Yes	Yes
<b>Rappville</b>	558015 (203030)	Rappville	Myrtle Creek	NoW	Yes	Yes
<b>Repentance</b>	558000		Coopers Creek	Now	Yes	Yes
<b>Rock Valley</b>	058199 (203010)		Leychester	Now	Yes	Yes
<b>Teven</b>	558070 (203039)	Teven	Maquires Creek	NoW	No	Yes
<b>The Channon</b>	058147 (203039)	The Channon	Terania Creek	NoW	Yes	Yes
<b>Toonumbar Dam d/s</b>	203023	Toonumbar Dam	Ironpot Creek	NoW	Yes	No
<b>Toonumbar Dam WL</b>	558039 (203042)	Toonumbar Dam	Ironpot Creek	NoW	Yes	No
<b>Wiangaree</b>	558001 (203005)	Wiangaree	Richmond River	NoW	Yes	Yes
<b>Yorklea</b>	558038 (203041)	Yorklea	Deep Creek (Shannon Brook)	NoW	Yes	Yes



## Manual Gauges within tidal limits

Gauge Name	BOM Gauge Number	River	SES Unit	Used by BOM for Flood Warning
<b>Bagotville Barrage</b>		Tuckean Broadwater	Broadwater	No
<b>Ballina RSL</b>		Richmond River	Ballina	No
<b>Broadwater</b>		Richmond River	Woodburn	No
<b>Bungawalbin Junction</b>		Richmond River	Coraki & Woodburn	No
<b>Codrington – Bailey Lane</b>		Richmond River		No
<b>Coraki Boat Ramp</b>		Richmond River	Coraki	No
<b>Emigrant Creek Boat Ramp</b>		Emigrant Creek	Ballina	No
<b>Lismore (Dawson Street)</b>	558087	Browns Creek	Lismore	Yes
<b>Swan Bay</b>		Richmond River	Woodburn	No
Gauge Name	BOM Gauge Number	River	SES Unit	Used by BOM for Flood Warning
<b>Tintenbar Road Bridge</b>		Maquires Creek	Ballina	No
<b>Wardell</b>		Richmond River	Ballina	No
<b>Woodburn – SES Headquarters</b>		Richmond River	Woodburn	No
Manual Gauges upstream of tidal limits				
<b>Boggy Creek</b>		Boggy Creek		No
<b>Bungawalbin Creek (Sam Robinsons Farm off Whiporie Road)</b>		Bungawalbin Creek		No
<b>Casino Irving Bridge</b>	58179 (203907)	Richmond River	Casino	Yes
<b>Eltham Road - Teven Golf Course</b>		Maquires Creek	Ballina	No
<b>Leevile – Blumers Moonem</b>				No
<b>Piora – Pylons of Piora Bridge at Hogarths Range</b>				No
<b>Rappville Railway Bridge</b>				No
<b>Wyan – Merv Smalls Farm</b>				No
<b>Wyan – Noel Kinsleys Farm</b>				No



## 7. Geoscience Australia – Exposure Reports (Local Government Area)

Building Exposure, V11 September 2020		Dwelling estimates where residents:			
Residential	Event	Demographic*	Event	NSW(Av)‡	Nat (Av)
Population count	44,321	Are all aged 65 or over	18.5%	17.3%	16.9%
Dwelling count*	19,635	Includes persons aged 14 years and under	21.6%	25.3%	25.4%
Building count	17,231	Includes an Indigenous person	6.0%	3.5%	3%
Pre 1980 construction count	2,837	Are a single parent family	7.8%	5.3%	5.5%
Pre 1990 probable asbestos containing products**	11,034	Are in need of assistance for self-care activities	11.3%	10.4%	10%
Reconstruction value	\$11,445,980,000	Include persons not proficient in English	0.0%	1.3%	1%
Contents value	\$1,339,420,000	Do not have access to a motor vehicle	6.6%	9.7%	7.5%
Commercial		No one has completed Year 12 or higher	18.6%	15.4%	15.5%
Building count	667	Moved to the region in the last 1 year	8.7%	11.3%	12.2%
Reconstruction value	\$8,507,170,000	Moved to the region in the last 5 years	23.6%	30.5%	32.3%
Industrial		Top 5 employing industry*:	Health Care Social Assistance, Retail Trade, Education Training, Accommodation Food Services, Construction		
Building count	378				
Reconstruction value	\$1,097,830,000				
2016 SEIFA IRSAD*		Economic*	Event	NSW(Av)‡	Nat (Av)
Dwellings in area with a SEIFA decile 10 score (most advantaged)	-	Are low income (\$1-\$499/week)	32.0%	23.8%	23.5%
Dwellings in area with a SEIFA decile 9 score	234	Are medium income (\$500-\$1,499/week)	57.2%	51.6%	53%
Dwellings in area with a SEIFA decile 8 score	934	Are high income (\$1,500+/week)	10.1%	23.3%	22.1%
Dwellings in area with a SEIFA decile 7 score	785	Are in public housing	4.1%	5%	4.2%
Dwellings in area with a SEIFA decile 6 score	2,272	Are all unemployed	1.5%	0.9%	1.1%

Building Exposure, V11 September 2020		Dwelling estimates where residents:			
Residential	Event	Demographic*	Event	NSW(Av)‡	Nat (Av)
Population count	47,217	Are all aged 65 or over	22.5%	17.3%	16.9%
Dwelling count*	21,531	Includes persons aged 14 years and under	18.9%	25.3%	25.4%
Building count	16,081	Includes an Indigenous person	3.6%	3.5%	3%
Pre 1980 construction count	3,203	Are a single parent family	5.5%	5.3%	5.5%
Pre 1990 probable asbestos containing products**	8,030	Are in need of assistance for self-care activities	9.0%	10.4%	10%
Reconstruction value	\$8,987,190,000	Include persons not proficient in English	0.0%	1.3%	1%
Contents value	\$1,259,950,000	Do not have access to a motor vehicle	5.6%	9.7%	7.5%
Commercial		No one has completed Year 12 or higher	17.2%	15.4%	15.5%
Building count	465	Moved to the region in the last 1 year	11.3%	11.3%	12.2%
Reconstruction value	\$2,838,120,000	Moved to the region in the last 5 years	29.7%	30.5%	32.3%
Industrial		Top 5 employing industry*:	Health Care Social Assistance, Retail Trade, Education Training, Construction, Accommodation Food Services		
Building count	358				
Reconstruction value	\$589,370,000				
2016 SEIFA IRSAD*		Economic*	Event	NSW(Av)‡	Nat (Av)
Dwellings in area with a SEIFA decile 10 score (most advantaged)	-	Are low income (\$1-\$499/week)	25.5%	23.8%	23.5%
Dwellings in area with a SEIFA decile 9 score	1,271	Are medium income (\$500-\$1,499/week)	60.2%	51.6%	53%
Dwellings in area with a SEIFA decile 8 score	2,270	Are high income (\$1,500+/week)	13.8%	23.3%	22.1%
Dwellings in area with a SEIFA decile 7 score	2,892	Are in public housing	4.1%	5%	4.2%
Dwellings in area with a SEIFA decile 6 score	3,253	Are all unemployed	0.5%	0.9%	1.1%
Dwellings in area with a SEIFA decile 5 score	2,477	* Demographic information is based on 2016 Census. Residential demographic and economic information is not provided for dwelling counts less than 20 or when the population count is zero **Buildings may contain asbestos cement materials, especially in the eaves, internal and external wall cladding, ceilings (particularly in wet areas such as bathrooms and laundries), corrugated products (roofing and cladding) and fences # State averages and state proportions are not displayed when the area of interest crosses state boundaries			
Dwellings in area with a SEIFA decile 4 score	2,134				
Dwellings in area with a SEIFA decile 3 score	2,361				
Dwellings in area with a SEIFA decile 2 score	2,861				
Dwellings in area with a SEIFA decile 1 score (most disadvantaged)	1,912				
Dwellings in area without a SEIFA score	-				

Ballina Local Government Area

Building Exposure, V11 September 2020		Dwelling estimates where residents:			
Residential	Event	Demographic*	Event	NSW(Av)‡	Nat (Av)
Population count	22,263	Are all aged 65 or over	26.1%	17.3%	16.9%
Dwelling count*	10,265	Includes persons aged 14 years and under	21.2%	25.3%	25.4%
Building count	8,752	Includes an Indigenous person	7.4%	3.5%	3%
Pre 1980 construction count	1,098	Are a single parent family	7.2%	5.3%	5.5%
Pre 1990 probable asbestos containing products**	5,321	Are in need of assistance for self-care activities	14.1%	10.4%	10%
Reconstruction value	\$4,398,230,000	Include persons not proficient in English	0.0%	1.3%	1%
Contents value	\$681,480,000	Do not have access to a motor vehicle	7.8%	9.7%	7.5%
Commercial		No one has completed Year 12 or higher	31.9%	15.4%	15.5%
Building count	181	Moved to the region in the last 1 year	8.0%	11.3%	12.2%
Reconstruction value	\$1,208,030,000	Moved to the region in the last 5 years	20.7%	30.5%	32.3%
Industrial		Top 5 employing industry*:	Manufacturing, Health Care Social Assistance, Retail Trade, Education Training, Accommodation Food Services		
Building count	67				
Reconstruction value	\$275,280,000				
2016 SEIFA IRSAD*		Economic*	Event	NSW(Av)‡	Nat (Av)
Dwellings in area with a SEIFA decile 10 score (most advantaged)	-	Are low income (\$1-\$499/week)	38.3%	23.8%	23.5%
Dwellings in area with a SEIFA decile 9 score	-	Are medium income (\$500-\$1,499/week)	54.3%	51.6%	53%
Dwellings in area with a SEIFA decile 8 score	-	Are high income (\$1,500+/week)	6.4%	23.3%	22.1%
Dwellings in area with a SEIFA decile 7 score	-	Are in public housing	4.8%	5%	4.2%
Dwellings in area with a SEIFA decile 6 score	145	Are all unemployed	1.2%	0.9%	1.1%

Building Exposure, V11 September 2020		Dwelling estimates where residents:			
Residential	Event	Demographic*	Event	NSW(Av)‡	Nat (Av)
Population count	30,220	Are all aged 65 or over	14.5%	17.3%	16.9%
Dwelling count*	15,720	Includes persons aged 14 years and under	19.1%	25.3%	25.4%
Building count	12,611	Includes an Indigenous person	2.0%	3.5%	3%
Pre 1980 construction count	2,212	Are a single parent family	7.2%	5.3%	5.5%
Pre 1990 probable asbestos containing products**	6,228	Are in need of assistance for self-care activities	8.0%	10.4%	10%
Reconstruction value	\$6,708,830,000	Include persons not proficient in English	0%	1.3%	1%
Contents value	\$987,360,000	Do not have access to a motor vehicle	3.5%	9.7%	7.5%
Commercial		No one has completed Year 12 or higher	11.4%	15.4%	15.5%
Building count	424	Moved to the region in the last 1 year	9.4%	11.3%	12.2%
Reconstruction value	\$3,307,300,000	Moved to the region in the last 5 years	27.1%	30.5%	32.3%
Industrial		Top 5 employing industry*:	Health Care Social Assistance, Accommodation Food Services, Retail Trade, Education Training, Construction		
Building count	252				
Reconstruction value	\$529,530,000				
2016 SEIFA IRSAD*		Economic*	Event	NSW(Av)‡	Nat (Av)
Dwellings in area with a SEIFA decile 10 score (most advantaged)	-	Are low income (\$1-\$499/week)	27.4%	23.8%	23.5%
Dwellings in area with a SEIFA decile 9 score	326	Are medium income (\$500-\$1,499/week)	57.8%	51.6%	53%
Dwellings in area with a SEIFA decile 8 score	2,019	Are high income (\$1,500+/week)	14.1%	23.3%	22.1%
Dwellings in area with a SEIFA decile 7 score	3,300	Are in public housing	2.4%	5%	4.2%
Dwellings in area with a SEIFA decile 6 score	1,750	Are all unemployed	1.1%	0.9%	1.1%
Dwellings in area with a SEIFA decile 5 score	2,556	* Demographic information is based on 2016 Census. Residential demographic and economic information is not provided for dwelling counts less than 20 or when the population count is zero **Buildings may contain asbestos cement materials, especially in the eaves, internal and external wall cladding, ceilings (particularly in wet areas such as bathrooms and laundries), corrugated products (roofing and cladding) and fences # State averages and state proportions are not displayed when the area of interest crosses state boundaries			
Dwellings in area with a SEIFA decile 4 score	2,643				
Dwellings in area with a SEIFA decile 3 score	2,630				
Dwellings in area with a SEIFA decile 2 score	487				
Dwellings in area with a SEIFA decile 1 score (most disadvantaged)	-				
Dwellings in area without a SEIFA score	9				

Byron Local Government Area

Building Exposure, V11 September 2020		Dwelling estimates where residents:			
Residential	Event	Demographic*	Event	NSW(Av)‡	Nat (Av)
Population count	8,176	Are all aged 65 or over	23.2%	17.3%	16.9%
Dwelling count*	4,107	Includes persons aged 14 years and under	17.1%	25.3%	25.4%
Building count	3,925	Includes an Indigenous person	5.0%	3.5%	3%
Pre 1980 construction count	295	Are a single parent family	5.9%	5.3%	5.5%
Pre 1990 probable asbestos containing products**	1,875	Are in need of assistance for self-care activities	13.7%	10.4%	10%
Reconstruction value	\$2,006,960,000	Include persons not proficient in English	0%	1.3%	1%
Contents value	\$303,870,000	Do not have access to a motor vehicle	5.2%	9.7%	7.5%
Commercial		No one has completed Year 12 or higher	28.8%	15.4%	15.5%
Building count	53	Moved to the region in the last 1 year	6.8%	11.3%	12.2%
Reconstruction value	\$147,000,000	Moved to the region in the last 5 years	18.5%	30.5%	32.3%
Industrial		Top 5 employing industry*:	Agriculture Forestry Fishing, Health Care Social Assistance, Retail Trade, Education Training, Construction		
Building count	4				
Reconstruction value	\$30,220,000				
2016 SEIFA IRSAD*		Economic*	Event	NSW(Av)‡	Nat (Av)
Dwellings in area with a SEIFA decile 10 score (most advantaged)	-	Are low income (\$1-\$499/week)	44.0%	23.8%	23.5%
Dwellings in area with a SEIFA decile 9 score	-	Are medium income (\$500-\$1,499/week)	48.5%	51.6%	53%
Dwellings in area with a SEIFA decile 8 score	-	Are high income (\$1,500+/week)	6.0%	23.3%	22.1%
Dwellings in area with a SEIFA decile 7 score	-	Are in public housing	2.0%	5%	4.2%
Dwellings in area with a SEIFA decile 6 score	-	Are all unemployed	1.9%	0.9%	1.1%
Dwellings in area with a SEIFA decile 5 score	202	* Demographic information is based on 2016 Census. Residential demographic and economic information is not provided for dwelling counts less than 20 or when the population count is zero **Buildings may contain asbestos cement materials, especially in the eaves, internal and external wall cladding, ceilings (particularly in wet areas such as bathrooms and laundries), corrugated products (roofing and cladding) and fences # State averages and state proportions are not displayed when the area of interest crosses state boundaries			
Dwellings in area with a SEIFA decile 4 score	407				
Dwellings in area with a SEIFA decile 3 score	1,159				
Dwellings in area with a SEIFA decile 2 score	776				
Dwellings in area with a SEIFA decile 1 score (most disadvantaged)	1,549				
Dwellings in area without a SEIFA score	14				

Kyogle Local Government Area



Exposure Report key analysis (Data correct as at: Sep 2020)							
Local Government	Population	Dwelling count	Aged 65 or over	Low income (\$1-\$499/welk)	In need of assistance for self-care	Moved to area in last 5 years	Dwellings in area with a SEIFA decile 1 score (most disadvantaged)
Lismore	44,321	19,635	18.5% - 2.4% above national average	32.0% - 10% above national average	11.3% - 1.3% above national average	23% - 9.5% below national average <sup>3</sup>	4,291
Richmond	22,263	10,265	26.1% - 10.5% above national average	38.3% - 10.2% above national average	14.1% - 4.1% above national average	20.7% - 12.3% below national average <sup>3</sup>	5,231
Ballina	47,217	21,531	22.5% - 6.5% above national average	25.5% - 2.2% above national average	9.0% - 1% below national average	29.7% - 2.3% below national average <sup>3</sup>	1,912
Byron	30,220	15,720	14.5% - 2.4% below national average	24.7% - 4.2% above national average	8.0% - 2% below national average	27.1% - 5.2% below national average <sup>3</sup>	Nil
Kyogle	8,176	4,107	23.2% - 6.4% above national average	44.0% - 21.5% above national average	13.7% - 3.7% above national average	18.5% - 14% below national average <sup>3</sup>	1,549

## 8. The Richmond River Catchment Resilience Activity

### 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 Richmond Catchment Resilience Strategy was to better understand the community complexities and develop a community risk profile based on the exposure from flood that leads to vulnerabilities and community risk. By understanding how, when and where this region is impacted by flood 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 it works to make risk-informed investment and operational decisions in line with future Local Council objectives.

Managing flood risk is a cooperative and coordinated effort between all sectors of the community including individuals, businesses, non-government organisations and governments.

### Method:

Disaster Relief Australia (DRA) in collaboration with the Minderoo Foundation's Resilient Communities Initiative conducted a locally led, scenario-based modelling exercise (*Australia Defence Force wargame approach*) in the Richmond Catchment, Northern Rivers NSW.

The Richmond River Catchment 'Operational Big Map' was conducted over two days (9 - 10 September 2022).

Day one – Local Government representatives, operational staff, key partners and stakeholders.

Day two – The Richmond River Catchment Community, NGOs, and partners.

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 don't 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.

-  
-



## The Intelligence Picture

On the 25<sup>th</sup> of May 2022, the Bureau released the Special Climate Statement 76 - Extreme rainfall and flooding in south-eastern Queensland and eastern New South Wales.<sup>7</sup> Extreme multi-day rainfall and significant flooding affected south-eastern Queensland and eastern New South Wales from 22 February to 9 March 2022. The heavy rainfall began in south-east Queensland and north-east New South Wales during the last week of February and continued further south into eastern New South Wales in March.

Multi-day rainfall records were broken across north-east New South Wales, with multiple sites recording over 1 metre of rainfall. For the last week of February, rainfalls across parts of the region were at least 2.5 times the February average (based on the 1961–1990 period), with some parts more than 5 times the average.

For north-east New South Wales and large areas of south-eastern Queensland, this was the wettest week since at least 1900. The intense and sustained rainfall across the region led to flash flooding and riverine flooding extending from Maryborough in Queensland to Grafton in New South Wales. In parts of north-east New South Wales, peak flood levels broke previous observed records (reliable since at least 1974 and for some locations dating back more than 100 years) by considerable margins. Devastating flooding occurred through Lismore (Wilson's River) and other nearby towns, including Coraki and Woodburn (Richmond River) and Murwillumbah and Tumbulgum (Tweed River).

The 2022 rainfall and flooding were the result of a blocking high pressure system over New Zealand, that assisted the formation of a series of slow-moving low-pressure systems within a trough that fed a large volume of warm moist air from the Coral and Tasman seas into eastern Australia. The subsequent development of a series of deep low-pressure systems delivered intense rain to east and south-east New South Wales. Following two years of La Niña conditions, the rain fell on catchments that were already wet so water storages and river levels were high and catchments quickly became saturated.

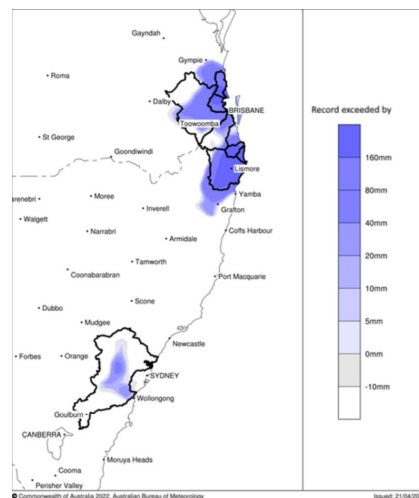


Image 1: Highest 7-day rainfall totals

The rainfall that extended and intensified into north-east New South Wales on 27 and 28 February. For the 3-day period ending 9am 1 March, 5 flood warning sites exceeded 1,000 mm of rainfall. For the 7-day period ending 1 March, the Bureau's Upper North Coast rainfall district, which covers the Northern Rivers region in north-east New South Wales, had its wettest week since at least 1900, with an area-averaged rainfall total of 642.8 mm, exceeding the previous record set in March 1974 of 480.3 mm. This region also broke its previous area-averaged rainfall records for the single daily rainfall total (since 1900), and for multi-day totals of 2, 3, 5, 6 and 7 days. Image 1, highlights the areas where the 7-day rainfall totals exceeded previous 7-day records. Large areas of south-eastern Queensland and north-east New South Wales received in excess of 80 mm more rain in a 7-day period than previously recorded in any 7-day period since at least 1900.

<sup>7</sup> <http://www.bom.gov.au/climate/current/statements/scs76.pdf?20220525>



## Major local and widespread flooding – Northern Rivers, NSW

Record breaking floods in late February and early March (based on the available history of river level records) occurred in northern New South Wales and inundated major towns, including Lismore (Wilson's River), Coraki and Woodburn (Richmond River), and Murwillumbah and Tumbulgum (Tweed River). Lismore, located at the junction of Leicester Creek and Wilson's River, suffered devastating flooding on 28 February.

The Wilson's River at Lismore peaked at a record high level at 14.4 metres between 1pm and 3pm on 28 February, overtopping the riverbank levee (10.6 metres) with floodwaters inundating the city. This exceeded the previous record flood level (12.27 metres in February 1954) by over 2 metres.

Heavy rainfall also caused record major flooding along the Richmond and Tweed rivers. Levels of the Richmond River at Woodburn (Image 2) peaked at 7.17 metres on 1 March, well above the major flood level of 4.2 metres and exceeding the February 1954 peak (5.42 metres) by around 1.8 metres. The Richmond River at Coraki peaked at 7.65 metres on Tuesday 1 March, higher than the March 1974 peak (7.01 metres).

Along the Tweed River at Murwillumbah, the river peaked at 6.51 metres on the afternoon of 28 February, with major flooding, exceeding the March 2017 flood (6.20 metres). At Tumbulgum on the Tweed River, the river peaked at 4.77 metres on the evening of 28 February, with major flooding, exceeding the March 2017 flood (3.91 metres).

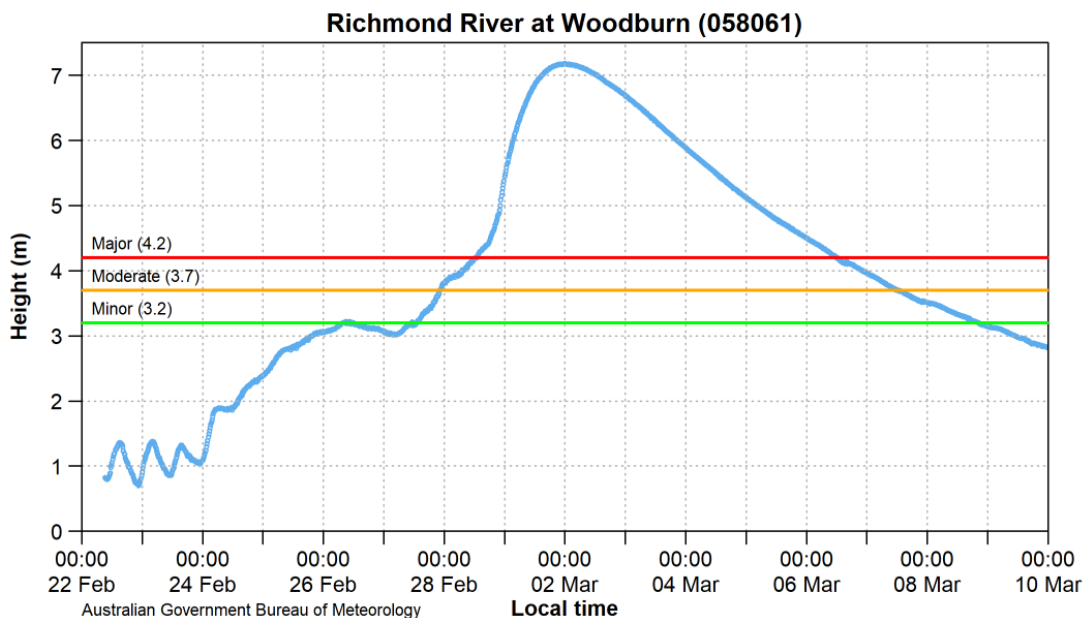


Image 2: Richmond River at Woodburn gauge (058061) (bottom). The oscillations in the water level indicate the rise and fall of the tide. Major, moderate and minor flood levels shown as defined at <http://www.bom.gov.au/water/floods/floodWarningServices.shtml>.

### Key intelligence:

Extreme multi-day rainfall and significant flooding affected New South Wales from 22 February to 9 March 2022. The rainfall was the result of a series of low-pressure systems combining with a blocking high pressure system over New Zealand and a coastal trough which fed a large volume of moist tropical air into eastern Australia.

Across south-eastern Queensland and north-east New South Wales, rainfall in the last week of February was between 2.5 to more than 5 times the monthly average (based on the 1961–1990 period).

More than 50 sites in south-eastern Queensland and north-east New South Wales recorded more than 1 metre (1,000 mm) of rain in the week ending 1 March.

The intense and sustained rainfall, coupled with saturated soils in catchments, caused major flooding across many catchments in south-eastern Queensland and eastern New South Wales.



Rivers in north-east New South Wales reached record levels, causing devastating flooding through Lismore (Wilson's River) and other nearby towns, including Coraki and Woodburn (Richmond River) and Murwillumbah and Tumbulgum (Tweed River).

The Hawkesbury-Nepean catchment recorded its wettest 9- and 14-day periods on record (since 1900) to 9 March, with major flooding recorded at locations along the Nepean and Hawkesbury Rivers. Major flooding was also recorded in the New South Wales Hunter Valley.

### 9. Response to major flooding within the Northern Rivers and New South Wales

In the weeks leading up to the two-day workshop in Lismore, the Legislative Council of New South Wales (NSW) provided a response to the major flooding across the State. This response came from the 2022 Flood Enquiry, 29 July 2022.

The inquiry was set up to consider the NSW Government's preparedness, coordination, and response to the flooding events. Whilst the report outlines many of the failures of the NSW Government, it also seeks to ensure that the Government is better prepared and coordinated when the next natural disaster of this nature inevitably occurs.

The Inquiry's initial timeframe was to provide a report to the NSW Premier on causation and land use planning by 30 June, and on all other matters by 30 September 2022. However, early consultations made it clear that flood-affected communities across NSW need certainty of direction and support. It also became apparent that causation, planning and emergency management considerations were all integrally linked. For these reasons, the Inquiry sought approval to deliver a single and complete report by the end of July. This accelerated the Inquiry's final timeline but, importantly, did not inhibit deep consultation and analysis.

In total, about 150 consultation meetings were held with individuals, communities and community representatives, government stakeholders, researchers, emergency services agencies, experts and others. All participants were invited to speak at these meetings, and their contributions were of great value to the Inquiry.

The Inquiry also drew on a wide range of source material to understand the climate factors which led to the 2022 floods, and how these floods were prepared for and responded to. This material included research literature and journal articles, operational guidelines, NSW Government policies and procedures, media reports and publications from experts in the field.

Submissions to the Inquiry opened on 4 April. Submissions were initially set to close on 20 May, but were extended to 24 June, helping to ensure that flood-affected residents had maximum opportunity to contribute to the Inquiry. In total, 1,498 written submissions were received by 26 July 2022 from about 125 postcodes across NSW, with over half of these coming from the Northern Rivers region – 32% of submissions were from postcode 2480 (Lismore area), followed by 9% from 2472 (Broadwater, Woodburn), 6% from 2487 (Kingscliff, Chinderah and surrounds), 6% from 2482 (Mullumbimby) and 4% from 2477 (Alstonville).

Key themes raised in submissions are illustrated in image 3. Most submissions relate to 3 main topics, namely: Topic A: homes and family (698 submissions), Topic B: water engineering (414 submissions) and Topic C: emergency services (191 submissions). Other main topic areas were Topic D: planning in light of climate change (78 submissions), Topic E: recovery (54 submissions) and Topic F: environment (15 submissions).

The flood events in February, March and July 2022 occurred within a year of a prior declared flood event (March 2021), and within 2 years of a major storm event (February-March 2020) and the worst ever forest fires. The 2019–20 Black Summer fires were preceded by a crippling drought that affecting the whole of NSW. These successive disasters occurred at the same time that communities across Australia were grappling with the devastating impacts of the COVID-19 pandemic.

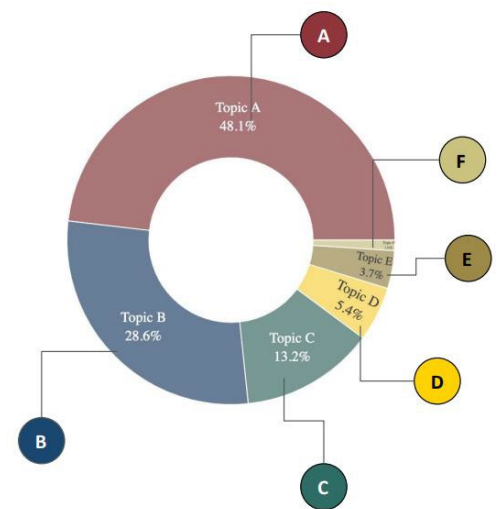


Image 3: Topic Modelling. Source: League of Scholars (2022)



Cumulatively, these events have disrupted almost every aspect of our society and the economy. The recent floods affected many communities across NSW still dealing with and recovering from the impacts of these previous natural and health disasters. Many submissions to the Inquiry described the compounding effects of these successive disasters, with little time for recovery between each.

## **The Whole of Catchment Approach to Flood Mitigation**

In March 2022, the NSW Government commissioned an independent expert inquiry into the preparation for, causes of, response to and recovery from the 2022 catastrophic flood event across the state of NSW. The Full Report has now been published.

### **2022 Flood Inquiry – Volume One: Summary Report**

[https://www.nsw.gov.au/sites/default/files/noindex/2022-08/VOLUME\\_ONE\\_Summary.pdf](https://www.nsw.gov.au/sites/default/files/noindex/2022-08/VOLUME_ONE_Summary.pdf)

### **2022 Flood Inquiry – Volume Two: Full Report**

[https://www.nsw.gov.au/sites/default/files/noindex/2022-08/VOLUME\\_TWO\\_Full%20report.pdf](https://www.nsw.gov.au/sites/default/files/noindex/2022-08/VOLUME_TWO_Full%20report.pdf)

### **2022 Flood Inquiry – Volume Three: Case Studies**

[https://www.nsw.gov.au/sites/default/files/noindex/2022-08/VOLUME\\_THREE\\_Appendices\\_1.pdf](https://www.nsw.gov.au/sites/default/files/noindex/2022-08/VOLUME_THREE_Appendices_1.pdf)

### **Legislative Council – Response to major flooding across New South Wales in 2022**

<https://www.parliament.nsw.gov.au/lcdocs/inquiries/2866/Report%20No%201%20-%20Response%20to%20major%20flooding%20across%20New%20South%20Wales%20in%202022.pdf>

Based on the 323 page, 2022 Flood Enquiry, Volume Two: Full Report (detailed above), a decision was made when delivering the ‘Big Map’ exercise to not replicate what the inquiry had already produced and delivered. Given the breadth of the Inquiry’s Terms of Reference and the fact that floods are an incredibly complex issue across NSW and Australia, the Inquiry covered a lot of important matters. But it could not cover all of them – many additional issues required further consideration and consultation with stakeholders.

The Inquiry has made 28 recommendations across a broad range of areas, including emergency management arrangements, land management and planning, equipment and technology, capacity and capability building and research.

The NSW Government:

- Supports 6 recommendations
- Supports in Principle 22 recommendations, with further work required on implementation

On page 221 (2022 Flood Inquiry – Volume Two: Full Report), only three paragraphs have been dedicated to a discussion around a whole of catchment approach. For this purpose, DRA made a deliberate choice when delivering the ‘Big Map’ exercise to openly discuss how the catchment works whilst paying complete attention to not being dragged into issues that require far more detail and are noted within recommendations of the Flood Inquiry.

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. An important component of preparing for, and building resilience against, flood and other disaster is personal preparedness. Failure to prepare at a personal level makes preparations at the state and wider community level much harder and more expensive.

The severity and scale of the floods was not lost on us as a charitable organisation and on many of our military veterans. The damage and impact caused by the major flooding, flash flooding and storm damage significantly impacted the communities in which we served across the Richmond Catchment. The impact and damage throughout these communities rivalled what we have observed on operational battlefields.

-  
-





## Outcomes of the Workshops (Walking the map)

During day one of the exercise, it became apparent that many of the key representatives from the Local Government Areas (LGAs), (Localised Emergency Management Officer (LEMO), Mayor's, General Managers (GMs), and Emergency Responders could not attend. For this reason, it was difficult to have a discussion with regards to the operational effectiveness of the entire catchment when in flood. Based on the attendance (Day one only) the following could not be discussed:

- The identify and the number of flood models used across the Catchment,
- Understanding the strengths and weaknesses that align to the national standard for flood warning infrastructure,
- Flood mapping as opposed to operational plans,
- Assets and flood infrastructure: purpose, locations, ownership, and maintenance,
- The network efficiency (prior, during and after) did it do what is was supposed too?
- Discuss the various levels of understanding of how the network operates for flood impacts and flood classifications.
- Data collection,
- Data mapping and data sharing across the various partners, stakeholders, the LGAs and the community,
- Data management (software, formats, flood programs and flood software), and
- Data use: flood warning, messaging, and communication.

A discussion around the development of a Flood Modelling Master Plan for the Richmond Catchment:

In 2010, Lismore City Council changed its flood warning stations to be relative to the Australian height datum, whereas the rest of the Richmond Valley utilised the Richmond Valley datum. A concerted effort from all Councils in the area and other Government agencies was required to bring about a single datum for the Richmond Valley to improve flood warning and flood response.

Day two of the workshop was far more community focused. Within the region, DRA has completed over 500 work orders to help devastated homeowners get back some semblance of normality and begin the road back to recovery. This is only a small proportion of the amount of work required in the region and we have been humbled to participate in a small proportion of this community's long road back to recovery. Members of the community were invited to attend and participate on the following:

- Utilise the map to identify their home and or property and slowly discuss what occurred during the flood event.
- At a very basic level discuss the current flood gauge network and the Richmond Catchment geographically.

Floods are a natural part of the Australian landscape. Floods vary greatly in size, extent, duration and frequency. No flood is the same, and as such floods can have different impacts. The Richmond Catchment has seen its fair share of flood events over the years.

Learn from others as the community openly shares stories through local knowledge and experience.

## The Use of local knowledge

Whilst discussing the flood gauge network across the catchment the topic turned to timings of water flow between gauges or known landmarks. During a riverine flood event, predictions are typically for expected stream levels at specific times at key locations on a river in this case the Richmond River. Predictions can be of:

- flood stages (the levels reached at specified times as the flood rises towards the peak)
- flood classification levels (when the river is expected to reach, or exceed the minor, moderate or major flood level)
- the peak flood levels
- particular significant levels that reach a threshold (e.g. the lowest point on the crest of a levee) that will be reached or exceeded as the river rises. These can be tipping points for changes in the impacts on the community and for community response to an event.

Knowing river heights or expected water levels at specific times at key locations on a river enhances situation awareness and more importantly allows emergency responders to understand the threat and warn the community as required.



During a flood event, warning lead time is the time between the issuing of a warning containing a prediction and the time when the predicted height is reached or when the stream peaks below that height. The longer the lead time, the more time there is to undertake protective behavior and action (Community awareness). The value of flood prediction is determined by both the accuracy of the prediction itself and the amount of warning lead time provided. The potential warning lead time depends on the hydrology of the catchment draining to the forecast location and the technical components of the flood prediction system. Where a location can be flooded by runoff from small catchments which respond very quickly to rainfall (flash flooding) the potential warning lead time is very small (from less than an hour up to several hours). In these situations, forecast rainfall is often utilised to increase the available lead time, but this can be at the expense of forecast accuracy.

During our discussions on the map (day one) an elderly gentleman stepped forward and provided a significant conversation piece that redirected the discussion immediately and inadvertently added great value to the overall flood awareness within the Richmond Catchment. The elderly gentleman's name has been withheld for privacy purposes however the information he provided adds significant local knowledge and for emergency management purposes serves as value data. That information has been detailed below:

- The Wilson River – Leycester Creek Catchment
- Elapsed time between flood peaks between gauges
- (Complete extract used as provided by Ed Bennett)

**The following details are the result of an analysis of forty-five floods between 1954 and 2017 for which accurate records are available. Gauges were installed at some locations earlier than at others so there is much more information on locations such as Lismore and Nimbin than for Goolmangar and Corndale.**

Location	Shortest time	Median time	Longest time between peaks
Nimbin to Lismore	8h 30min	21h	25h
Goolmangar to Lismore	6h 30min	11h	16h
Bentley to Lismore	8h 30min	14h	22h 45min
Rock Valley to Lismore	8h 30min	14h	21h 30min
The Channon to Lismore	5h	18h 30min	25h
Tuncester - Lismore	1h 30min	4h	13h 45min
Repentance to Lismore	9 h 30min	23h	31h 30min
Corndale to Lismore	6h	17h	23h 45min
Nashua to Lismore	5 h 15min	18h	27h 30min
Eltham to Lismore	1h 30min / 4h 30min	13h	29h 45min
Nimbin to Goolmangar	1h 45min	11h 30min	20h 30min
Repentance to Corndale	1h	4h 30min	13h 30min

**Image 4: The Wilson River – Leycester Creek Catchment elapsed time between flood peaks between gauges**

In all of the examples above there is considerable variation between the times indicated. This makes it very difficult to determine a really useful figure for the purposes of flood prediction. In the case of the shortest time for Eltham to Lismore, the 1h 30min time is believed to be due to a short period of very heavy rain in the Nashua-Eltham area late in the flood event and it is suggested that it is something of a 'one-off' and the 4h 30min figure is more representative. This further supports the usefulness of quality data for flood prediction purposes. The true value of this data however is educating the community and allowing them to access this information when required to make sound decisions.

Another pair of figures at the bottom of the table are also quite interesting because both Nimbin and Goolmangar are on Goolmangar Creek and Repentance and Corndale are on Coopers Creek. Between Nimbin and Goolmangar there are only a few minor creeks each with quite small catchments so not a great volume of water would influence stream levels and flow times between Nimbin and Goolmangar yet there is considerable time variation. Between Repentance and Corndale there are several minor creeks which could generate considerably far more flow into Coopers Creek just upstream from Corndale and thus affect stream levels and flow times between Repentance and Corndale to a greater degree than between Nimbin and Goolmangar. This only adds to the problem of flood predictions.

-  
-



In the case of flow times from upstream locations to Lismore the case is very complex. There are four major creeks in the Leycester catchment (Back, Goolmangar, Leycester, and Terania) and two major streams in the Wilson catchment (Coopers Creek and Wilson River). Essentially there are six separate floods that eventually come together at Lismore. Each of the six creeks cannot be expected to behave in the same way for every flood. It must be expected that from flood to flood the six flood peaks or crests will not reach Lismore at the same time or in the same order.

Within this particular region in the northern parts of the Richmond catchment the problem of using predetermined flood times for prediction purposes is problematic. It is suggested that the most useful approach would be to be aware of how quickly flood peaks / crests can travel from location to location. In going forward it may be useful to seek a link between: stream level and flow time, e.g are flow times shorter during higher floods and intensity / amount of rainfall and flow times.

During (day two) of the workshop another elderly gentleman stepped forward and provided a significant amount of work and analysis in note form. Between 1954 and 2022 the elderly gentleman who again cannot be named for privacy reasons analysed the Wilson – Leycester Catchment Flood Peak Heights (Lismore Major Floods). This information from his body of work has been detailed below:

Wilson – Leycester Catchment Flood Peak Heights (Lismore Major Floods) 1954-2022															
Gauge Location	Feb 1954	July 1962	Nay 1963	Feb 1974	Mar 1975	Feb 1976	Mar 1978	Mar 1987	May 1987	Apr 1989	Oct 1992	June 2005	Mar 2017	Feb 2022	Mar 2022
Lismore	12.17	11.36	11.06	12.17	10.53	10.14	10.08	10.43	10.78	11.28	10.10	10.26	11.59	14.37	11.40
Nimbin	8.99	6.70	6.96	7.40	4.40	3.50	5.60	5.60	6.80	7.35	4.72	5.46	8.54	9.34	7.29
The Channon	10.95	10.98	9.65	9.91	7.20	6.00	8.30	7.50	9.00	11.00	7.13	6.69	12.14	(13.25) oh	(10.75)
Rock Valley				10.91	8.41		8.60	9.15	10.04		7.20	6.31	11.84	13.14	9.29
Goolmangar				(12.50) oh	11.43		11.00				10.33	(10.50)	12.47	13.66	11.08
Bentley	12.19	11.43	11.58	10.67	10.10	5.65		10.60		11.80	8.50	7.20	11.22	12.19	10.12
Tunchester								12.61	12.98	14.00		11.44	13.68	(16.00) oh	(12.50)
Repentance Creek		5.79	4.88	5.49	4.00	5.10	5.15	5.10		4.75	5.33	4.74	5.61	9.55	5.06
Corndale				10.97	9.10	11.11	9.95	10.20	10.52	10.85		10.47	10.42	13.10	(10.00)
Nashua	9.63	10.36	8.48	9.12	7.40	11.00	8.40		9.00	7.30	8.75	9.60	7.79	9.83	8.61
Eltham		10.67	9.75	9.97	9.50	11.21	9.60	8.60	9.80		9.91	9.95	(8.50)	(10.50)	(9.25)
Woodlawn						12.17			11.94			11.76	(12.25)	15.01	11.86

Note: Blank spaces indicate lack of accurate data, no gauge in earlier years, or gauge overtopped / gauge failure

Image 5: The Wilson River – Leycester Catchment Flood Peak Heights

Based on the analysis of peak flood heights at known locations during a major flood event the elderly gentleman was also able to provide predictive analysis in the form of predictive flood heights. With this knowledge at hand and his awareness of the entire river catchment the predicted flood heights when compared to what actually occurred was very close. At some key locations his predicted flood heights based on peak heights, flow time and amount of rainfall were validated later by the Bureau of Metrology. Of particular note is the predictive flood height at the Lismore Gauge on February 2022.

-  
-



The predictive flood height was assessed to be 14.63m, the Wilsons River at Lismore peaked at a record high level at 14.4 metres between 1pm and 3pm on 28 February, overtopping the riverbank levee (10.6 metres) with floodwaters inundating the city. This exceeded the previous record flood level (12.27 metres in February 1954) by over 2 metres.

FLOOD	R.V	BENTLEY	NIMBIN	T.CH	REP CRK	NASHUA	TOTAL	DRY	WET	LISMORE	REMARKS	Variance
2/1954	-	12.19	8.99	10.95	-	9.63	41.76	-	11.93	12.17		24
7/1962	11.43	6.70	10.98	10.98	5.79	10.36	45.26	12.23	12.93	11.36		
5/1963	-	11.58	6.96	9.65	4.88	8.48	41.55	11.22	11.87	11.06		16
2/1974	10.91	-	7.40	9.91	5.49	9.12	42.83	11.57	12.23	12.17	RV ALT	6
2/1974	-	10.67	7.40	9.91	5.49	9.12	42.59	11.51	12.16	12.17	RV ALT	-1
3/1975	8.41	-	4.40	7.20	4	7.40	31.41	8.49	8.97	10.53		
3/1975	-	10.10	4.40	7.20	4	7.40	33.10	8.95	9.46	10.53		
2/1976	-	5.65	5.60	6	5.10	11	33.46	9.04	9.56	10.14	Nashua storm	
3/1978	8.60	-	5.6	8.3	5.15	8.4	36.05	9.74	10.3	10.08	RV ALT	22
3/1978	-	no bentley reading										
3/1987	9.15	-	5.6	7.5	5.1	8.5	35.85	9.69	10.24	10.43	RV ALT	-19
5/1987	10.04	-	6.8	9	6.2	9	41.04	11.09	11.72	10.78	RV ALT	31
5/1987	-	9.5	6.8	9	6.2	9	40.05	10.82	11.44	10.78		4
4/1989	n/a	11.80	7.35	11	4.75	7.3	42.2	11.41	12.05	11.28	No RV Gauge	13
10/92	7.2	-	4.72	7.13	5.33	8.75	33.13	8.95	9.46	10.10	RV ALT	26
10/92	-	8.5	4.72	7.13	5.33	8.75	34.43	9.3	9.84			
6/05	6.31	-	5.46	6.69	4.74	9.6	32.8	8.86	9.37	10.26	RV ALT	64
6/5	-	7.2	5.46	6.69	4.74	9.6	33.69	9.1	9.62			
3/17	-	11.22	12.14	5.61	7.79	45.3	12.24	12.94	11.59			
2/22	13.14	-	9.34	13.25	9.55	9.83	55.11	14.89	15.74	14.37	RV Alt	
2/22	-	12.19	9.34	13.25	9.55	9.83	54.16	14.63	15.47	14.37		26
3/22	9.29	-	7.29	10.75	5.06	8.61	41.00	11.08	11.71	11.40	RV Alt	-10
3/22	-	10.12	7.29	10.75	5.06	8.61	41.83	11.30	11.95	11.40		
		Predicted height		Actual height recorded								

Image 6: The Wilson River – Leicester Catchment. Predictive vs Actual heights recorded

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

Once the discussion around the flood gauge network finished, the discussion then turned to critical infrastructure. Participants from the workshops were asked to identify what they believed critical infrastructure was within the Richmond Catchment. 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 a disaster event (the relief and recovery):

### Schools within the region

Schools are seen as a critical enabler immediately post a disaster event. In the weeks post a disaster event, communities that self-serve and immediately start cleaning up and getting on with their life always appear stronger and more resilient. During this clean up phase allowing children to attend school removes the burden of children being around parents as they struggle to clean and deal with the impacts.

### Supermarkets / food items

Access to food and essential items is critical 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. During this discussion, it was clear that the Lismore CBD is heavily impacted and access to these types of stores is difficult.

### Doctors

Immediate access to medical is essential to the wellbeing of any community post a disaster event.



## Hospital

Immediate access to medical is essential to the wellbeing of any community post 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 even 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 affect, 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 to deal with these complaints from the vital needs of cleaning up. 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.
- Domestic Waste. The types of domestic hazardous waste that are typically found following a natural disaster include:
  - Asbestos from the demolition of houses.
  - Chemical containers e.g. pesticide containers, paint tins.
  - Other materials that look out of the ordinary compared to other materials being disposed of.

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.

## 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's) and indirect (business interruption, temporary unemployment, rising of insurance premium) consequences. The damages may cause major accidents within industrial plants. These include release of hazardous material, soil or water pollutions by hazardous substances for the environment, fires, explosions, dispersion of toxic clouds.

It is therefore necessary in the preparation preparedness phase of disaster management that industrial plant operators and owners improve their understanding of potential impact of flooding on their facility and analyse major accidents or release of hazardous materials that may be caused by such a natural event in order to prevent them.

## 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.

### Drinking water

Access to fresh running water is essential and a key requirement for a community dealing with flood.

### Essential Services

Essential services are relied on by each and 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 (eg when to evacuate).

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 efforts<sup>8</sup>.

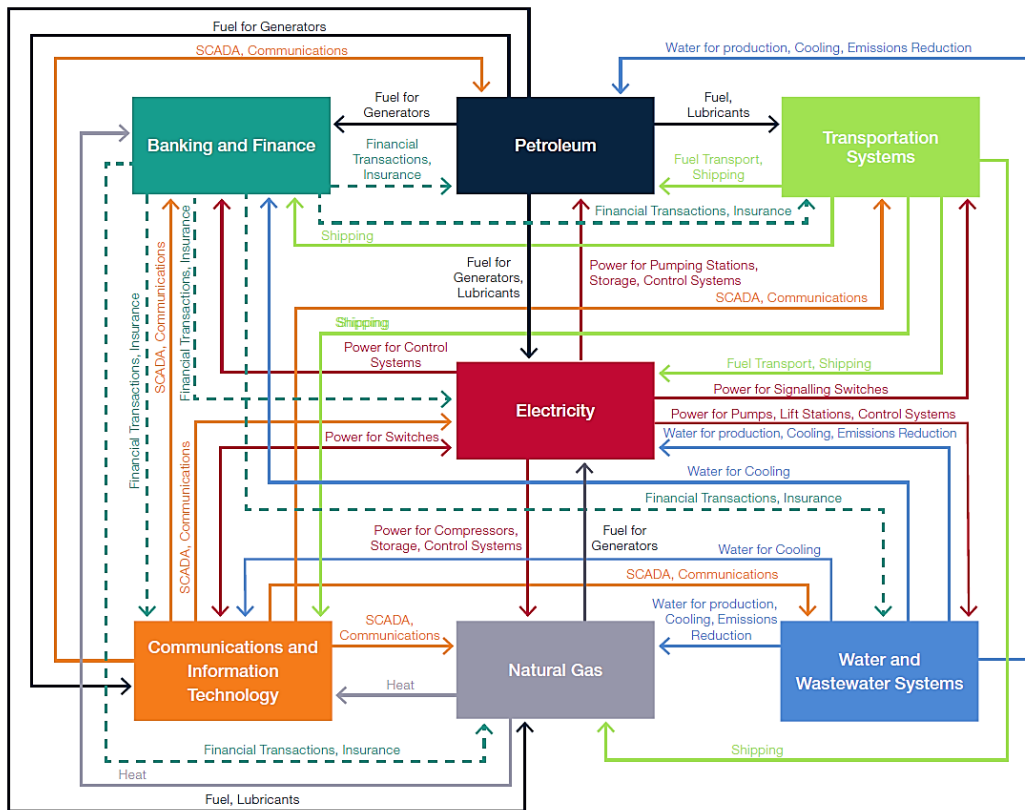


Image 7: Example of interdependencies post a disaster event.

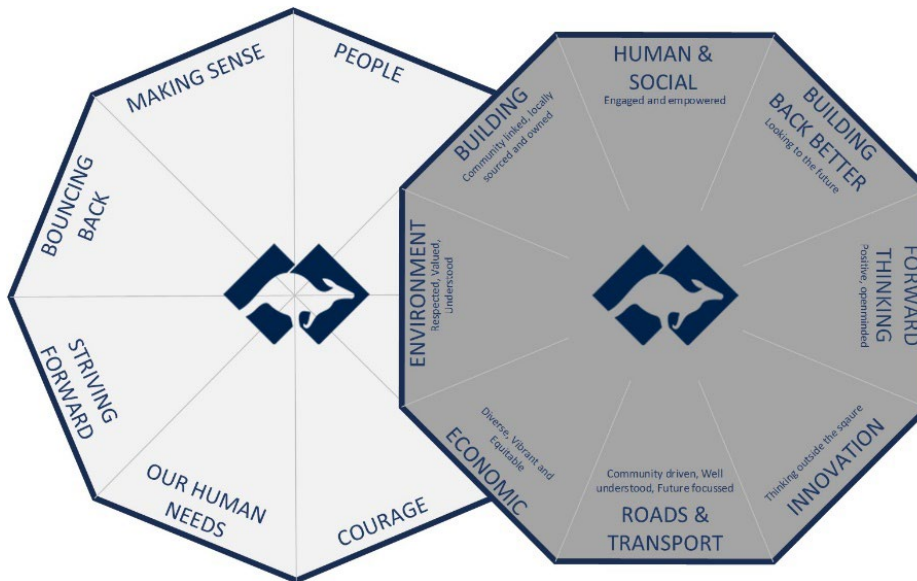
Source: <https://naturaldisaster.royalcommission.gov.au/publications/html-report/chapter-09>

<sup>8</sup> <https://naturaldisaster.royalcommission.gov.au/publications/html-report/chapter-09>



## Community Assessment and Prioritisation Tool

As part of the discussion, DRA included the Community Assessment & Prioritisation activity. This activity is designed to shape a holistic conversation and assessment about Richmond Catchments perceived strengths and weaknesses. The exercise captures the participants' assessment (red, yellow and green) for each of the Principles and Environments detailed below.



Principles and Environments in more details.

### People

- 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.
- Diverse community projects.
- What are the needs of the community?
- How are we strengthening this community?
- Where do you see the future and what have we done about it?
- Accountable for future actions.
- Lingering cultural grievances.

### Making Sense

- Do you understand your risk?
- How often do you look forward in terms of future events?
- Promote community level knowledge and skills, build understanding, and strengthen collective impact for risk reduction and resilience.
- Evidence based practice.
- 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.



### **Bouncing Back**

- 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.
- Are there are range of diverse groups and how do the communicate?
- Are we adaptable as a community?

### **Striving Forward**

- 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 also depends on having high levels of all types of capital—natural, human, built, financial, and social.
- Are there sectors and silos across the community and can these be closed?
- What vulnerabilities may exist in one sector and during a disaster event manifest into another sector / silo?
- Diverse levels of expertise if integrated rather than acting silos.

### **Our Human Needs**

- 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.

### **Courage**

- Do we hold ourselves and others accountable for decisions, actions, and outcomes?
- We know that we need to face problems head on. Resilience building makes us grapple with complex problems that don't have easy or obvious answers.
- We know it's hard enough to work on these issues as individuals and households; it's harder still to work on them as a community, with people who may see things differently.

## **11. The DRA Environments**

### **Human & Social – Engaged & empowered**

- Strong social connections and high levels of trust exist within and across diverse groups and generations, and residents feel a secure sense of belonging and inclusion in their community.
- Residents have high levels of trust in institutions and in public leadership, for example, demonstrated by participation in high levels of compliance with public health and community safety measures.
- Inclusive local government and community leaders recognise the importance of grassroots knowledge and value evidence-based decision-making. Community leaders are visible and represented at both the State and Federal government levels.

### **Building - Community linked, locally sourced and owned**

- As a community we understand what has been impacted and or damaged (Minor, Moderate, Major) and this is communicated via our Local Governments.
- We build from within first and fully utilise or own community tradespeople and before bringing in outside influence.
- What building capabilities exists within the community?
- Members of all cultural groups actively collaborate and listen to one another.
- Indigenous community members and leaders oversee the application of traditional knowledge and representation of their culture throughout the community.





### **Economic – Diverse, Vibrant and Equitable**

- Diverse livelihood and employment opportunities are available and provide liveable wages.
- Accessible social safety nets are in place and support community members from a variety of social, cultural, and economic backgrounds — especially those who experience disadvantage.
- Communities experience reliably high labour force participation rates regardless of gender, race, sexuality, age, and culture.
- Households have control of expenses, the ability to make financial choices, appropriate levels of savings and insurance, and are on track to meet their financial goals.

### **Environment – Respected, Valued, Understood**

- Natural environments, such as forests and wetlands, are prioritised to mitigate environmental hazards, such as fire and flood.
- The flora and fauna is valued and invested in before, during, and after disaster events through diverse perspectives, including the use of traditional and informal knowledge systems.
- Community members apply and measure locally adapted land management practises to expand knowledge and inform future practice.

### **Transport and Roads – Community driven, Well understood, Future focussed**

- Integrated land-use and infrastructure planning is in place — minimising negative impacts to the natural environment and maximising the benefits to the community.
- Do we understand what local roads, bridges and or access routes have been impacted or damaged?
- What is the result of these impacts (can't access property, roads damaged, bridges damaged etc)?
- Building back better. Do we understand what this means?

### **Innovation – Thinking outside the square**

- When innovators talk about thinking outside the box or the square, we mean coming up with creative ways to solve problems - new ways to look at things.
- Do we embrace constraints?
- Constraints should never be seen as just a negative. According to recent research, innovative communities will usually succeed because of constraints, not despite of them. With no or very limited constraints, it's easy for complacency to kick in, and for innovators to simply go for the most obvious idea.
- Are we as a community thinking bigger?

### **Forward Thinking – Positive & open minded**

- Are we a forward-thinking community?
- Forward thinking people only use the past as a reference point from where they've been.
- As a community we keep rationality and creativity balanced.
- We are focused on higher aspirations and have no room for bigotry and narrow-mindedness in our lives. We respect different opinions and levels of society even if they aren't ours. We actively listen to others and share ideas; we may find common ground that benefits us and them.
- Courage isn't the absence of fear, but it's the determination to overcome it. For this community, fear is the main obstacle standing between us and achieving our goals. Positive thinking people also have fears and uncertainties, this community refuses to be defined or controlled.

### **Building Back Better - Looking to the future**

We formalise processes and systems to enable effective assessment of post-disaster damages and needs in order to more accurately quantify and characterise the recovery needs and to formulate broad recovery strategies across all of 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 the Northern Rivers and the perceived strengths and weaknesses. This analysis is somewhat flawed however based on the fact that not all of the communities that reside within the Richmond Catchment could attend.

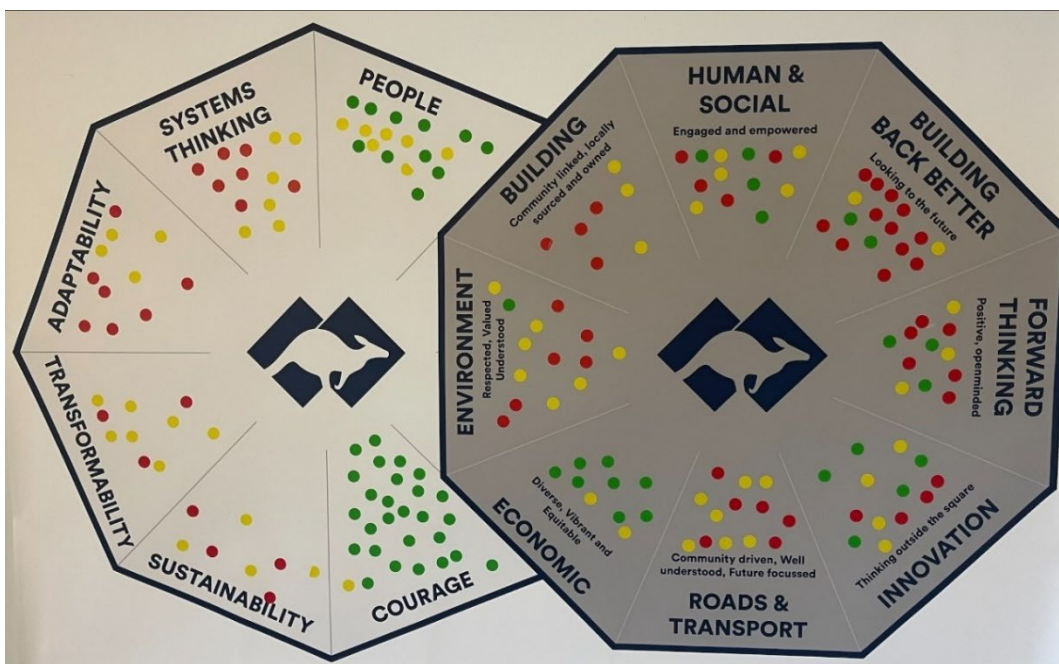


Prior to leading this exercise however, DRA staff were well informed by information pertained in the 2022 Flood Inquiry, Volume Two. In the months leading up to the exercise approximately 150 consultation meetings were held with individuals, communities and community representatives, government stakeholders, researchers, emergency services agencies, experts and others. All participants were invited to speak at these meetings, and their contributions were of great value to the Inquiry. DRA did not want to replicate this process nor was it our place. Given the breadth of the Inquiry's Terms of Reference and the fact that floods are an incredibly complex issue across NSW and Australia, the Inquiry covered a lot of important matters. But it could not cover all of them –many additional issues required further consideration and consultation with partners and stakeholders.

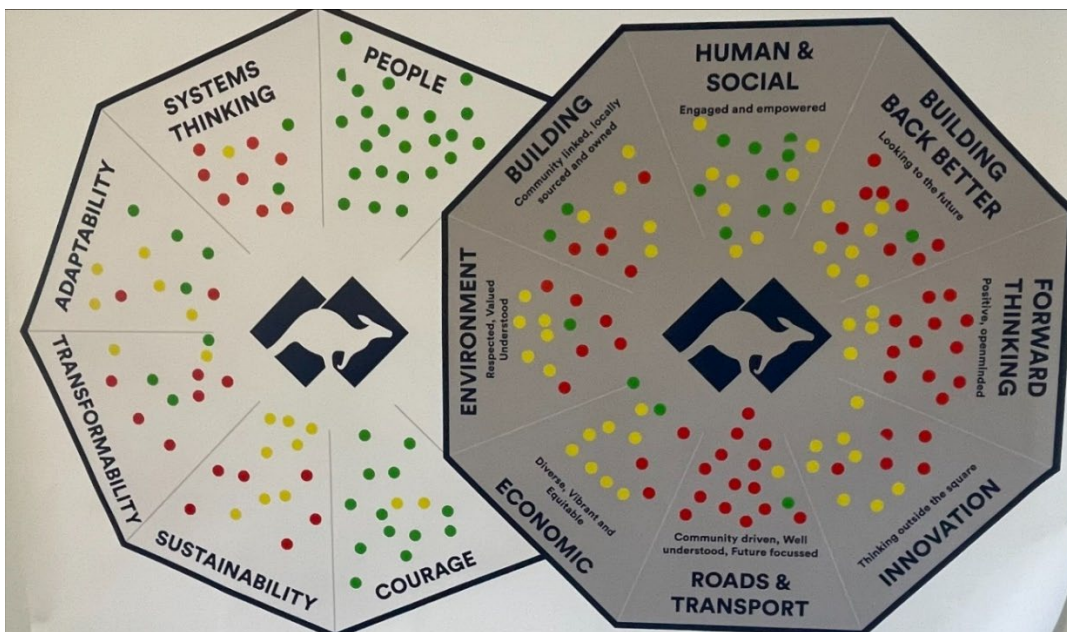
At the two workshops, each participant received 12 sticky dots (4 each of red, yellow and green) and was asked to place a dot on the Community Assessment & Prioritisation Worksheet. Participants placed all 12 dots on any area of the Framework (multiple dots on one area is acceptable) that, in their judgement, most closely correspond to:

- Red** – Area of weakness
- Yellow** – Can Improve
- Green** – Area of strength

Richmond Catchment Workshop (Day 1)



Richmond Catchment Workshop (Day 2)



Once the activity was completed, the two worksheets were compared and discussed at length. The DRA staff leading the activity then used this as tool to focus on:

- What were the areas of alignment, analyse where participants generally agreed on areas of strengths or weakness?
- Were there areas of divergence, where there any sharp disagreements, and
- What were the opportunities for further study or priority next steps at a community level?

The community led discussion / activity highlighted several key discussions and, in some areas, some real insights. It is also important to mention that this community was only represented by a small proportion of the community from the Lismore and surrounding areas.

The following detail was captured from both groups:

- **People** – More than six months after the major floods impacted numerous communities within the Richmond Catchment, there is still no clarity for the regions residents and businesses who urgently need to make investment decisions. Should they move to higher ground, make temporary fixes, or renovate for the long haul? However as indicated in the charts above, 'people' are seen as an area of strength. The community spirit is essentially all that's left. For the communities within the Northern Rivers Region recovery will be a long and drawn-out process. This process will be full of broke promises, heartache and limited support. The community however and the people within it will unite and support each other when required.
- **Systems Thinking (Making Sense)** – This was the regions 25<sup>th</sup> major flood event in just over 100 years. On Sunday 27<sup>th</sup> February, communities across the region seemed hell-bent on relocating personal items to higher ground. In the back of their minds this was a very different weather event. While most homes were high-set, they're high uninsured, and neighbours spent a sleepless weekend moving upstairs each other's downstairs goods – lawnmowers, washing machines, cupboards, tools – and stacking their upstairs possessions – hard drives, heaters, clothes, books – atop tables, beds and fridges. These communities understood their risk and the threat what they weren't prepared for was the sheer scale and intensity. As a community this will be a major impact in years to come. When drafting this report, the Northern Rivers region was again facing another 'east coast low' and the future aspects of major flooding in Lismore. Making sense of this at the community level will require significant engagement from local, state, and federal organisations. All three tiers will need to be united in their messaging and approach.
- **Inclusive Engagement (Bouncing Back)** – This was a key discussion point. Those present at the exercise believed that not all parts of the community are being engaged. This included the elderly, those at risk to flooding within the known flood prone locations, those with disabilities and most importantly the indigenous communities.
- **Integrated Action (Striving Forward)** - There are some sectors and silos across this community, and these be closed. The diverse levels of expertise living within the community do exist however the discussion revolved around how these could be integrated rather than acting silos. At both workshops community members stood forward and provided significant information and data that could assist emergency managers significantly. These community members are for some reason not being heard and the analysis / local knowledge is basically being ignored.
- **Accountable (Our Human Needs)** – Both groups identified that more accountability needs to be voiced and acknowledge. Whilst DRA made all efforts within the workshop not to turn the discussion about blame there was some discussion. The complex nature of homes being built within a known floodplain is a key discussion point across Australia. Lismore and the surrounding communities are not on their own in this instance. On the 29<sup>th</sup> October 2022, the Prime Minister announced on Friday morning that \$520 million would be made available to buy back land affected by the Richmond River floods — with the NSW Government kicking in another \$280 million for the 2000 flood-affected residents. The \$800 million package will be available for people who choose to demolish, raise or retrofit their homes — with the aim of making them more flood resilient. But the ultimate aim is to have the flood-ravaged community, which was again under threat only two weeks ago, re-located to a non-flood plain location.
- **Courage** – Courage was seen as an area of strength in both workshops. A majority of the people at both workshops are also seeking actions and outcomes going forward. Seeking clarification and information with regards to future recovery funding, flood funding, recovery grants etc. Individually this community has the courage to work on issues as required, however it will need all the courage it can get to work in these issues as a community, with a vast number of people who see things differently.
- **Community Led Resilience Initiatives**



During the workshop, a number of community led resilience initiatives were identified and openly discussed. Post the workshop a number of projects have also been identified and with the owner's permission some details have been provided below:

## The Terania-Keerrong Flood Safety Project

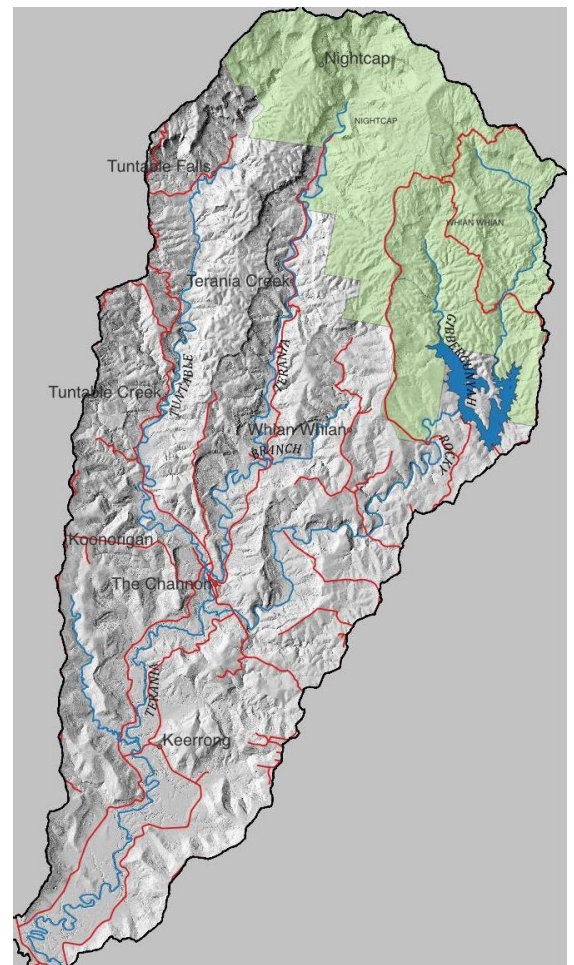
The idea of The Peoples Catchment arose because we thought upstream citizens could provide valuable information. While we envisaged a system that could work for the catchment that floods Lismore, we found that we needed to start local: the Terania-Keerrong flood safety project. As we develop this, we're learning how citizens can provide useful rain data and creek information, and how we might benchmark this so that it's not just 'numbers' but helpful to those downstream. This will inform development of citizen flood data projects.

This year we experienced systemic failure of the creek & rain gauge system. The many causes include insufficient spare parts, poor maintenance, and lack of quality control. During the February flood the Terania rain gauge was not working and missed nearly a metre of rain on Feb 27-28. Several creek and rain gauges were not working for the March flood. Extreme rain caused dangerous flooding and landscape collapse in the Terania catchment. Tuntable, Terania and Rocky creeks join at The Channon and then hurtle down Keerrong valley as Terania creek. Some Keerrong residents had narrow escapes and spent the night in perilous conditions.

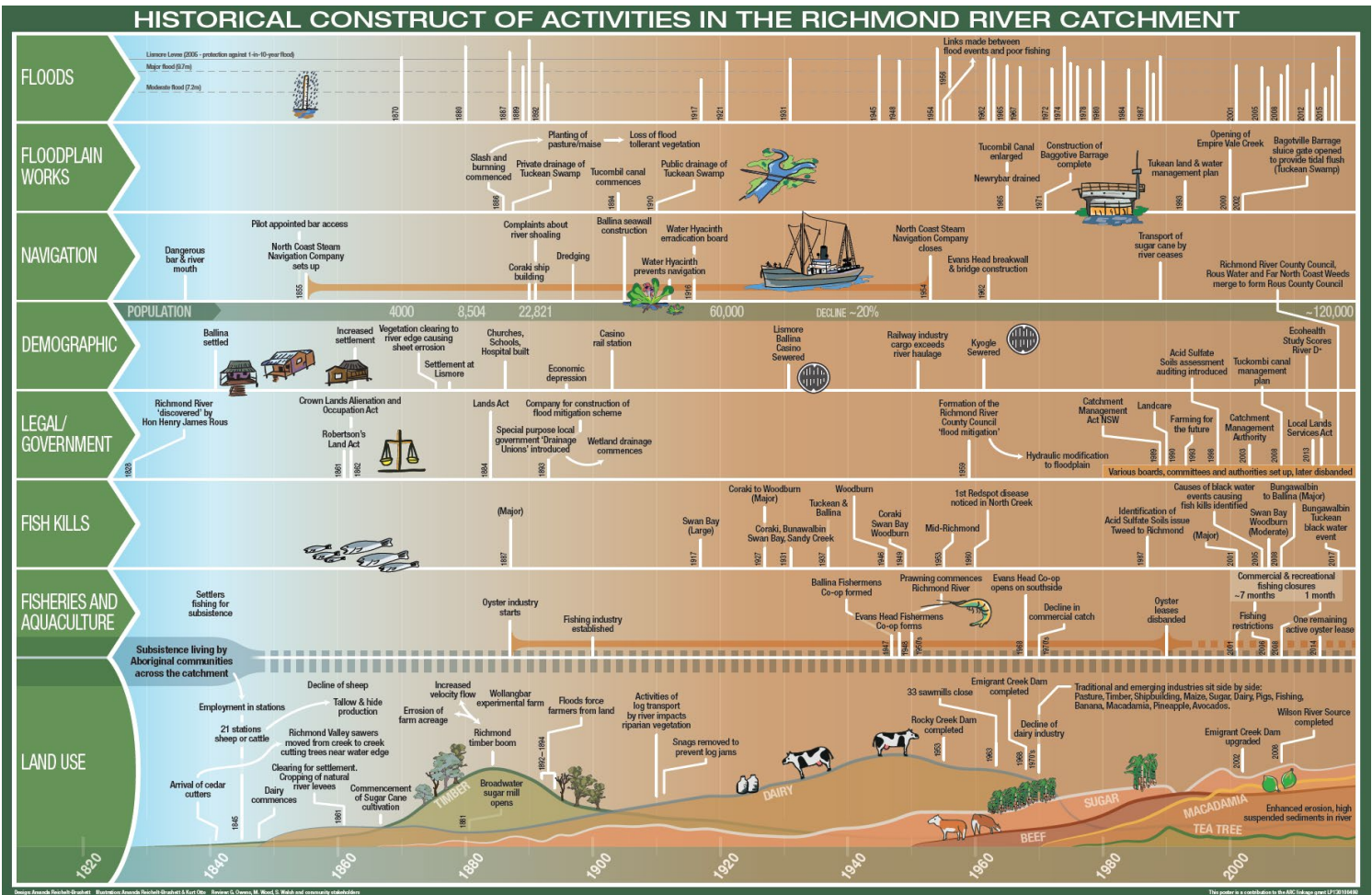
Even if official gauges are working, there is scant information available to help residents with decision-making. The gauge at The Channon is too close to impact and there are no creek measures on Tuntable or upper Terania Creeks. Rous County Council issues alerts for Rocky Creek Dam but these are problematic and fail to convey real-time information on Rocky Creek. These warnings do not take into account floodwaters from Terania and Tuntable creeks.

## Progress thus far

- Rain sentinels committed to take frequent observations during rain events.
- Developing a system for collating rain data and conveying this to the SES and those downstream
- A decision to benchmark creek levels for 'normal wet season variation', the 2017 and February 2022 floods. The Northern Rivers Community Foundation has granted funding for us to gather community knowledge, including photos where they exist.
- We've started exploring locations on Tuntable & Terania creeks for citizen creek monitoring.
- We've asked Rous County Council to show real-time data on BOM for Rocky Creek and rain - to help the situational awareness of those downstream.
- An Emergency CB Radio network with 70 members.
- Trialling electronic rain gauges to determine those best for a robust, fail-safe citizen data system.
- A partnership with ANU Institute of Climate, Energy and Disaster Solutions.



# Historical Construct of Activities in the Richmond River Catchment



## Establishing a Community Core

At the end of the workshop the idea of developing a localised community - led Richmond Community Core was discussed. Community members run a Core without official assistance - it's 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.

The primary role of the Community Core however is to act as the link between the associated Local Government and the community.

Post a disaster event the community will naturally come together to support one another after 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.



During this workshop 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, and
- 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's unique to this community and if its impacted how will this impact the community over the next 3, 6 months if lost or damaged?
- Understand the State and Federal Recovery and Funding Arrangements.

[https://recovery.gov.au/?gclid=EAlalQobChMIINHI69b9wIVtppmAh2AQA2wEAAYASAAEqJtpvD\\_BwE&gclidsrc=aw.ds#/404](https://recovery.gov.au/?gclid=EAlalQobChMIINHI69b9wIVtppmAh2AQA2wEAAYASAAEqJtpvD_BwE&gclidsrc=aw.ds#/404)

**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 and 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 exist 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 (can't access property, roads damaged, bridges damaged etc)?

### **Group Activities**

For the purpose of the Richmond Resilience Workshop no group activities were conducted.

### **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.



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



	<p><b>People</b> - 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><b>What does success look like</b></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><b>Our commitments to the community</b></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><b>Making Sense</b> – 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><b>What does success look like</b></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><b>Our commitments to the community</b></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><b>Bouncing Back</b> - 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><b>What does success look like</b></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><b>Our commitments to the community</b></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>
	<p><b>Striving Forward</b> – 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.</p>





<p><b>What does success look like</b></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><b>Our commitments to the community</b></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><b>Our Human Needs</b> - 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><b>What does success look like</b></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><b>Our commitments to the community</b></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><b>Courage</b> – Everyone within a community needs courage, we need courage to confront challenging issues and take responsibility for our collective future.</p>
<p><b>What does success look like</b></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 don't have easy or obvious answers          We know it's hard enough to work on these issues as individuals and households; it's harder still to work on them as a community, with people who may see things differently.</p>
<p><b>Our commitments to the community</b></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>



## 12. Our recommendations

Only a small proportion of the Richmond region community attended the DRA Workshop however it was clear that from those that did attend, a vast amount of information and local knowledge does exist, it's just not being heard. The severity and scale of the floods was not lost on us as a charitable organisation and on many of our military veterans. The damage and impact caused by major flooding, flash flooding and storm damage significantly impacted many communities across the entire Richmond Catchment. The impact and damage throughout these communities rivalled what we have observed on operational battlefields.

In our experience, based on our previous flood resilience projects across Australia, a common issue is the inadequate use of flood mapping in an operational context. During flood emergencies, response agencies often default to local knowledge of past flood behaviour, rather than make use of the information available from Flood Studies and or Flood Risk Management. A factor which could contribute to this issue is the numerous, and sometimes conflicting, studies available for a single catchment. Further, a collection of localised flood models has limited use for flood warning purposes. Response agencies require an overview of the complete hydrologic system, rather than having to waste time making interpretations between separate sources of information. The DRA Richmond River Catchment 'Big Map' exercise did exactly that.

In going forward the Australian Government will prove \$150 million in 2022–23 for priority flood resilience projects in the Northern Rivers region of New South Wales. The Northern Rivers Resilience Initiative will provide science to inform the investment, through a process to understand the drivers behind the unprecedented flood event in February-March 2022 and develop community-supported solutions for resilience investment. The National Emergency Management Agency (NEMA) has engaged Australia's national science agency CSIRO to support the Northern Rivers Resilience Initiative, which will consider climate, catchment and hydrological systems, and the broader influences of land-use practice and infrastructure.

In parallel to the CSIRO program the Northern Rivers Reconstruction Corporation is expected to outline the region's rebuild in the months ahead, more than eight months after the flood. There will be a lot of money on the table, in the order of billions of dollars, and various developers and architect firms will be ready to move.

The NSW Government expects buyback transactions in the most dangerous suburbs and towns to be completed by the end of this year. Securing land for substitute homes will take longer. At the margins, there will be subsidies for further house-raising and rebuilding with flood-safe materials.

Within DRA, we intimately understand that a community that is heard and valued is a community that is more likely to take ownership of their own relief and recovery post a disaster event. Increasing our knowledge and awareness of community vulnerabilities, strengthening our capability and capacity to provide relief and recovery when required and tightening our community bonds are all key milestones for DRA.

### **The following recommendations have been identified:**

A catchment based approach to flood modelling, mapping and floodplain management should be considered by all Councils where a river system is shared by more than one local government. Together with the benefits presented here, the collaborative approach will ultimately result in significant cost savings to State and Local Government.

Basis to improve synchronisation of FRMPs – improvements to the synchronisation of FRMPs is limited by the need and available budget of the individual Councils within the catchment. However, with a single flood model, a collaborative approach to floodplain management between neighbouring Councils is more feasible.

Consistent modelling and mapping approaches – all areas of the floodplain are modelled in a consistent manner, using one software and one style of mapping. However, there remain discrepancies between flood hazard definition between neighboring Councils, which can only be resolved through a collaborative approach to floodplain management

During the 'Big Map' activity vulnerable assets such as infrastructure and or essential services were discussed. In going forward the Community has very little influence on how these assets are managed in an emergency and as such, in future workshops within the Richmond Catchment a focus on empowering the community to understand their individual vulnerabilities in the context of the identified risk would be far more relevant. This is the part of emergency preparedness and planning they do have control over.



A focus on individual preparedness planning in the context of the identified vulnerabilities would have been a useful discussion. The vulnerabilities discussed predominantly focused on essential services and built assets. These are not the only factors community need to take into consideration when thinking about preparedness and resilience.

People/communities can no longer be seen as recipients; rather, they have become critical stakeholders who have a major role to play in the management of community flood management programmes.

Community involvement is more effective when people are fully conscious, empowered and aware of the hazard. It is important, therefore, that this community be provided with an opportunity to play a more active role and the levels of government or public officials facilitate and provide catalytic support for community-based flood-management programmes going forward. DRA actively puts our hand in the air to help facilitate these engagements as required.

Enhance the communities understanding of how the entire Richmond Catchment works during a flood event, it can't just be all about Lismore:

South of Lismore, the Wilsons River switches and slithers its way through the paddocks and sugarcane plantations of an enormous coastal floodplain – at 100,000 hectares, the largest in New South Wales – to join the Richmond River at Coraki. Coraki is a town of halves; half on a small hill and half on the flats. DRA spent 13 weeks within Coraki providing significant flood recovery operations. We know this community very well. After floodwaters peaked in Lismore around 3pm on February 28, then in Wyrallah late in the afternoon, the rivers completely swamped lower Coraki that night, displacing some 600 people.

The next morning, the river swallowed Woodburn. Almost everyone in town – another 600 people – had to be evacuated by boat to the primary school. Next in line, four sweeping bends downriver, was Broadwater, where the sludge likewise surged through almost every home and business, as well as the sugar mill, knocking it out of order for six months.

An hour later, the river engulfed Cabbage Tree Island, a mangrove-edged delta strip home to an Aboriginal community of about 170 people. They evacuated in time but the damage to their 25 high-set homes, plus a low-set school, was such they're unlikely to be able to return for years.

The last river village to go under was Wardell. To track February's floodwater across the plain by car, along more or less the same route from Wyrallah to the river mouth at Ballina, a distance of some 65 kilometres, is to imagine driving entirely underwater, every kilometre of the way. Every paddock became a brown bog. Fences were washed away, stock is still conspicuously missing. Some of the most distressing images of the flood were those of whole dairy herds swept away. Where fences held firm, cows tangled and drowned. Some washed up near Byron Bay, 20 kilometres north of Ballina. In Coraki, which was marooned for close to a week, residents cleaning up had to deal with the stench of bloated beasts wedged in trees above them.

On the 9<sup>th</sup> of August 2022, the NSW Legislative Council provided a response to the major flooding across NSW. In response the NSW Legislative Council made 21 findings and 37 recommendations. The committee received almost 90 submissions and almost 120 responses to its online questionnaire. It held six public hearings. This included ones in Ballina; Lismore; Murwillumbah; Windsor; and two at Parliament House.

Recommendation 6: The NSW State Emergency Service, in partnership with the Bureau of Meteorology, investigate ways in which local communities and local media with local knowledge can play a stronger role in flood predictions and warnings.

During the 'big map' workshop several community members readily stepped forward and provided significant information and data relevant to flooding.

Recommendation 7: The NSW Government advocate through the National Cabinet for the Bureau of Meteorology to review its rain data infrastructure and flood modelling tools, to ensure forecasting locations, rain and flood gauges and other infrastructure are appropriately placed, maintained, and updated.



To address this recommendation the Northern Rivers Region should look to mirror the Queensland Strategic Flood Warning Infrastructure Plan as best practice. <https://www.qra.qld.gov.au/resilience/flood-resilience/queensland-strategic-flood-warning-infrastructure-plan>. Currently the Queensland's Flood Warning Gauge Network:

- supports the Bureau of Meteorology's Total Flood Warning System,
- meets the national standard for flood warning infrastructure
- provides real-time situational awareness and suitable data for flood forecasting models and timely early warnings
- is reliable, accurate and fit for purpose
- is continuously improved through ongoing review, endorsed governance structures and investment in upgrades, and
- is managed collaboratively for shared benefits and cost effectiveness

In another approach the Northern Rivers Region should again look north to Queensland and develop a NSW Flood Risk Management Framework. <https://www.qra.qld.gov.au/QFRMF> The purpose of the future NSW Flood Risk Management Framework (the Framework) would be to:

- set the direction for flood risk management in NSW
- provide clarity around expectations
- outline the roles and responsibilities of all stakeholders involved, and
- guide and support decision-making by councils.

Across NSW and more importantly the Northern Rivers Region, a flood risk management process and outcomes could easily be tailored to apply to the local, regional and state level. This would involve steps to:

- collect the necessary data
- define the flood hazard
- assess the risk, and consider options to manage the risk to acceptable levels
- develop an implementation plan to manage the risk.
- This staged approach leads to flood risk management outcomes across a range of disciplines, including land use planning, emergency management, community engagement, structural mitigation and infrastructure, land management, built form, and insurance.

Recommendation 17: The NSW Government ensure that community groups, both existing and emerging, including First Nations groups, are well integrated into disaster recovery, by incorporating them into state recovery plans and engaging with them in between and in the lead up to natural disasters.

In the frame of a future integrated flood management approach, the sharing and exchange of data, information, knowledge and experience among experts and the general public, policymakers and managers, researchers and voluntary organisations, upstream and downstream users, becomes transparent in nature and is readily accessed by all within the community.

The impact of floods within the Richmond Catchment is based, among other things, on the historical experience and the traditional backgrounds and features of the community. Communities are usually composed of many societal actors firmly bonded to each other and which pursue interests more or less differentiated. We can find cohesive communities, but also cohesive groups inside non-cohesive communities (even with levels of high conflict internally). In the absence of organised community participation (even at the level of specific groups), most of the activities are carried out at individual or household level, driven by individual necessity.

A number of factors determine the actual participation of people and their need to be considered before initiating any community activities (first of all, we need to understand who comprise the community and what their participation is). Strategies for involving communities in flood management activities going forward will depend on the natural characteristics of the floods, the socioeconomic conditions and institutional set-up. It is useful to understand these factors because they clarify the relationships between flood and communities. The Shire of Collie utilise the Community Assessment and Prioritisation Activity in more detail with the various community groups across the area to better understand and align to as required.

The Installation of flood boards on the various creek and river crossing across the Richmond Catchment.



In a consistent approach all councils within the Richmond Catchment look to install locally within the region relevant flood totem icons that display:

- Flood classifications of minor / moderate
- Major flood levels (if available)
- Peak levels of historic flood (noting the date of the flood)
- Levels of local landmarks (such as the town bridges or the local post office steps).
- Where a flood height relates to a particular level on the gauge, this value should also be clearly highlighted on the totem.

### 13. Your Feedback and what we learned

How did you hear about Disaster Relief Australia: Project Resilience Initiative?
Through the Red Cross Emergency Services
From an email sent to myself
Direct Invitation from DRA
Through my role with Richmond Valley Council
Through Australian Red Cross Emergency Service
Facebook
By email
"Did the event provide you with a better understanding of the community's vulnerabilities? If YES or NO, please explain why."
"Yes the visual had an impact"
"Yes, increased understanding of waterways, critical to evacuation of areas, etc. "
"To some extent, yes. In the context of vulnerable assets such as significant infrastructure, essential services, etc. Community, however, have little influence on how these assets are managed in an emergency and as such, I felt a focus on empowering them to understand their individual vulnerabilities in the context of the identified risk is more relevant. This is the part of emergency preparedness and planning they do have control over. "
"Yes. With the big map and information provided by the presenter it was easy to underst"
"Yes. It was an excellent way to learn together about the catchment, how floods develop, how monitoring is meant to work (types of gauges).
"Yes, particularly in regard to flood mitigation on an LGA basis rather than a catchment basis and just how unprepared we were/are for disasters."
"Did we identify sufficient actions to be taken, with identified vulnerabilities? If YES or NO, please explain why."
"Around Casino area the waters had subsided at the time the images were taken so there wasn't an accurate picture "
Yes
"Yes probably, though I was looking for an environmental focus"
"The exercise report has not been disseminated at this time so I can only comment on the day itself. Not really, given many of the assets discussed don't belong to the community members, they are either Council, State & Federal Government and Business assets. A focus on individual preparedness planning in the context of the identified vulnerabilities would have been a useful discussion. The vulnerabilities discussed predominantly focused on essential services and built assets. These are not the only factors community need to take into consideration when thinking about preparedness and resilience."
"Yes, advice on suitable actions to be taken was explained well."
"I went to both days. Given that catchment monitoring is so inadequate, with multiple organisations involved, I was disappointed in who was there that first day. We needed all LGAs (LEMO, mayor, GM) as well as key orgs BOM, SES etc. If it is possible, it would be good to do it again but only if the LGAs and key orgs made a commitment to being there. I'm not feeling that optimistic that institutions and responsible agencies will grasp the opportunity to adopt a wholistic and comprehensive approach. LCC won't even apply a chainsaw to trees overhanging rain gauges, or train their staff in standards for gauge maintenance.
"Vulnerability certainly. Actions I'm not so sure. This exercise/ gathering of Community was brilliant. That Map is truly an eye opener. Thanks"
"Yes, particularly by following approaches in Queensland."



"Do you believe, you had the opportunity to contribute towards improving the community's resilience? If YES or NO, please explain why."
"Yes by listening to the local knowledge"
Yes
"yes, local info plotted on map"
"I'm unable respond to this question as the final report for the big map event has not been circulated to the participants. I am not sure how well the talking points outlined in the event invitation have contributed to improving overall community resilience given their operational focus."
"Yes it was very interactive."
"Yes, It was an opportunity to connect with others keen to improve catchment management, particularly for the project we're developing for citizen catchment info. "
"not as much as we need to"
"Only as an individual."
"What was your favourite part of the event and why?"
"Listening to the lived experience"
"Large map exercise, learning how other areas measure rain and community participation monitoring water levels"
The map
"I liked the visual component of the exercise. It is often difficult to for community to understand river catchments and the flow on effects severe weather events can have downriver, particularly in larger catchments."
"The Big Map itself. Loved it. Adam's facilitation and information."
"that map & meeting with people that people who may be able to improve response ,& recovery into the future"
"Seeing the catchment map and understanding how water moves in flood events."
"Are there any areas of improvement?"
"Job well done "
"Could you please advise when and how the report that the team was compiling will be made available?"
"The exercise would have been better served if it was facilitated not led. I often heard the lead make comments about the lack of resources and systems in NSW with comparisons to Queensland. This was neither appropriate nor helpful. At one point looting following an evacuation was raised by the lead. Introducing reasons not to evacuate when ordered hampers emergency service efforts and leads to poor decision making by community, particularly given reports of looting are generally uncommon here. DRA should think about how they can improve accessibility for elderly and disabled participants. Many of the activities involved standing for long periods and squatting/bending to the floor. These activities may be excluded. participants, some of which may have lived in the area for some time and have excellent knowledge of relevant issues. Refrain from using defence force jargon, while community appreciate DRA's mission and veteran led volunteer base, during these exercises, you are communicating with people who come from diverse backgrounds. Having not seen the final report from the 2-day event, it is difficult to understand what relevance the second activity, Day 1 has and if the objectives of the exercise were met. I feel this time would have been better spent in a discussion about how the identified vulnerabilities could inform individual preparedness plans. The big map concept is good. DRA should work closely with local stakeholders prior to shape the scope of the event to align with current emergency management arrangements and desired outcomes of the exercise for both DRA and the targeted community. A big map exercise should focus on facts, current circumstances and vulnerabilities and building capability within the confines of these factors. Discussing innovative ideas that would require multi-level Government funding, action or commitment or changes to policy are not helpful in this context."
Always
"No, I thought the day was informative, interesting and useful. I have a much greater understanding of flood-resilient approaches."





DISASTER  
RELIEF  
AUSTRALIA