

Bega Valley

Local Flood Plan



BEGA VALLEY SHIRE

FLOOD EMERGENCY SUB PLAN

A Sub Plan of the Local Emergency Management Plan (EMPLAN)

Volume 1 of the Bega Valley Shire Local Flood Plan

Endorsed by the Emergency Management Committee

March 2021

AUTHORISATION

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

Recommended



NSW SES Local Commander

Date: 18 MAR 21

Approved



Chair, Local Emergency Management Committee

Date: 11/03/2021

VERSION HISTORY

Version Number	Description	Date
	Bega Valley Shire Flood Emergency Sub Plan	July 2013
	Bega Valley Shire Local Flood Plan	May 2007

The above table lists all previously endorsed versions of this plan.

AMENDMENT LIST

Suggestions for amendments to this plan should be forwarded to:

Community Planning & Readiness
NSW State Emergency Service
PO Box 6126, Wollongong NSW 2500
nswses.communityplanning@ses.nsw.gov.au

Amendments in the list below have been entered in this plan.

Amendment Number	Description	Updated by	Date

Document Issue:

Available for general use and distribution on the following websites - www.emergency.nsw.gov.au
or www.ses.nsw.gov.au

This plan is Attribution (CC BY) under the Creative Commons licensing system, unless otherwise indicated. Copyright resides with the State of New South Wales, NSW State Emergency Service unless otherwise indicated.

CONTENTS

1	OUTLINE AND SCOPE	5
1.1	Purpose	5
1.2	Authority	5
1.3	Activation	5
1.4	Scope	5
1.5	Goals	6
1.6	Key Principles	6
1.7	Roles and Responsibilities	6
1.8	Plan Maintenance and Review	6
1.9	Supplementary Documents	7
2	OVERVIEW OF NSW FLOOD HAZARD AND RISK	7
2.1	The Flood Threat	7
3	PREVENTION/ MITIGATION	7
3.1	Introduction	7
3.2	Land Use Planning	8
3.3	Floodplain Risk Management	8
4	PREPARATION	8
4.1	Introduction	8
4.2	Flood Emergency Planning	8
4.3	Flood Intelligence Systems	9
4.4	Development of Warning Systems	9
4.5	Operational Readiness	10
4.6	Community Resilience to Flooding	10
5	RESPONSE	11
5.1	Introduction	11
5.2	Incident Management Arrangements	11
5.3	Use of Information and Collection of Intelligence	12
5.4	Provision of Information and Warnings to the Community	13
5.5	Protection of Property	14
5.6	Road and Traffic Control	14
5.7	Protection of Essential Services	15
5.8	Evacuation	15
5.9	Evacuee Management And Welfare	17

5.10	Flood Rescue	18
5.11	Resupply	19
5.12	All Clear and Return	19
5.13	End of Response Operations	20
5.14	Post Impact Actions	20
6	RECOVERY OPERATIONS	21
6.1	Introduction	21
6.2	NSW SES Recovery Role	21
7	ABBREVIATIONS	22
8	GLOSSARY	23
9	APPENDIX A – MAP OF BEGA VALLEY SHIRE COUNCIL AREA	24
10	APPENDIX B – ROLES AND RESPONSIBILITIES	25
11	APPENDIX C – COMMUNITY SPECIFIC ROLES AND RESPONSIBILITIES (EXAMPLES ONLY)	37

1 OUTLINE AND SCOPE

1.1 PURPOSE

1.1.1 The purpose of this plan is to set out the multi-agency arrangements for the emergency management of flooding in the Bega Valley Shire Local Government Area.

1.2 AUTHORITY

1.2.1 This Plan is written and issued under the authority of the *State Emergency and Rescue Management Act 1989* (NSW) ('SERM Act'), the *State Emergency Service Act 1989* (NSW) ('SES Act') and the NSW State Emergency Management Plan (EMPLAN).

1.2.2 This plan is a sub plan to the Bega Valley Shire Local Emergency Management Plan (EMPLAN) and is endorsed by the Emergency Management Committee (LEMC).

1.3 ACTIVATION

1.3.1 This plan does not require activation. The arrangements set out in this plan are always active.

1.3.2 The Bega Valley Shire Emergency Management Plan (EMPLAN) is active at all times in anticipation of the need to coordinate support and resources requested by combat agencies, including the NSW State Emergency Service (NSW SES).

1.4 SCOPE

1.4.1 The area covered by this plan is the Bega Valley Shire LGA. The Bega Valley Shire Council area and its principal towns, villages, rivers and creeks are shown in Appendix A.

1.4.2 The council area is in the NSW SES South Eastern Zone and for emergency management purposes is part of the Illawarra South Coast Emergency Management Region.

1.4.3 The plan sets out the Bega Valley Shire Council level emergency management arrangements for prevention, preparation, response and initial recovery for flooding in the Bega Valley Shire LGA. Hazard and Risk information can be found in Volume 2 of this document, and NSW SES Response Arrangements can be found in Volume 3.

1.4.4 In this plan a flood is defined as a relatively high water level which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves (including tsunamis) overtopping coastline defences.

1.4.5 The arrangements for dealing with episodes of coastal erosion by severe weather, are described in the NSW State Storm Plan.

- 1.4.6 The arrangements for the emergency management of tsunami are dealt with in the NSW State Tsunami Emergency Sub Plan.
- 1.4.7 This plan outlines the local level arrangements for the management of downstream consequences of dam failure, however it does not cover the management of flooding of an underground mine by inrush or other cause, which should be covered by the Mine Sub Plan for the respective mine.

1.5 GOALS

- 1.5.1 The primary goals for flood emergency management in NSW are:
- a. Protection and preservation of life;
 - b. Establishment and operation of flood warning systems;
 - c. Issuing of community information and community warnings;
 - d. Coordination of evacuation and welfare of affected communities;
 - e. Protection of critical infrastructure and community assets essential to community survival during and emergency incident;
 - f. Protection of residential property;
 - g. Protection of assets and infrastructure that support individual and community financial sustainability and aid assisting a community to recover from an incident; and
 - h. Protection of the environment and conservation values considering the cultural, biodiversity and social values of the environment.

1.6 KEY PRINCIPLES

- 1.6.1 The protection and preservation of human life (including the lives of responders and the community) is the highest priority.
- 1.6.2 Evacuation is the primary response strategy for people impacted by flooding.

1.7 ROLES AND RESPONSIBILITIES

- 1.7.1 General responsibilities of emergency service organisations and functional areas are set out in the State EMPLAN.
- 1.7.2 Specific roles and responsibilities for agencies, functional areas and organisations in relation to flooding within Bega Valley Shire LGA are detailed within this Plan, Appendix B and Appendix C.
- 1.7.3 Any agency with agreed responsibilities in this Plan that are temporarily, or no longer able to fulfil their responsibilities must as soon as possible notify the:
- a. NSW SES Incident Controller (for local level responsibilities during response operations);
 - b. NSW SES Zone Commander (for regional level responsibilities outside of response operations); and
 - c. NSW SES Local Commander (for local level responsibilities outside of response operations).

1.8 PLAN MAINTENANCE AND REVIEW

1.8.1 The NSW SES will maintain the currency of this plan by:

- a. Ensuring that all supporting emergency services and functional areas, organisations and officers mentioned in it are aware of their roles and responsibilities;
- b. Conducting exercises to test arrangements;
- c. Reviewing the contents of the plan:
 - When there are changes which alter agreed plan arrangements;
 - When changes to land use strategic plans and policies increase the population at risk;
 - After a flood including from after action reviews, reports or inquiries; and
 - As determined by the NSW SES Commissioner.
- d. The plan is to be reviewed no less frequently than every five years.

1.9 SUPPLEMENTARY DOCUMENTS

1.9.1 Supplementary material published in previous versions of the Local Flood Plan is now maintained on the NSW SES website at: [NSW SES Flood Storm and Tsunami Plans](#) including:

- a. Flood Plan Glossary;
- b. Dam Failure Notification Flowchart;
- c. NSW SES Resupply Flowchart.

2 OVERVIEW OF NSW FLOOD HAZARD AND RISK

2.1 THE FLOOD THREAT

2.1.1 The NSW SES maintains information on the nature of flooding and effects of flooding on the community in the Bega Valley Shire LGA. This is outlined in Volume 2 – Hazard and Risk in Bega Valley Shire LGA.

2.1.2 Declared dams in or upstream of the Bega Valley Shire LGA.

Dam Name	Owner
Brogo	WaterNSW
Cochrane	Delta Electricity & Brown Mountain Power Station
Ben Boyd	Bega Valley Shire Council
Yellow Pinch	Bega Valley Shire Council

3 PREVENTION/ MITIGATION

3.1 INTRODUCTION

3.1.1 The Floodplain Development Manual outlines the NSW Government's Flood Prone Lands Policy which details the framework for managing flood prone land in New South Wales. Incorporation of floodplain risk management into land use planning is one of the key means to limit the exposure to flood risks to our communities and help build long term resilience to future flood events.

3.2 LAND USE PLANNING

3.2.1 **Strategy:** Work with landuse planning and consent authorities to advocate that the risks arising from floods are considered so as to prevent the creation of intolerable impacts of these hazards on the community.

Actions:

- a. NSW SES will provide strategic input about land use planning matters which have or will create significant flood risk;
- b. NSW SES will provide responses to land use planning proposal referrals that have or will create significant flood risk;

3.3 FLOODPLAIN RISK MANAGEMENT

3.3.1 **Strategy:** NSW SES advocates for the recognition of emergency management considerations through participation in the floodplain risk management program.

Actions:

- a. NSW SES will provide coordinated and consistent emergency management advice to councils and other agencies in relation to the management of land that is subject to flooding or coastal inundation; and
- b. NSW SES will provide advice, support and technical resources for NSW SES representatives to contribute effectively to local Floodplain Management Committees.

4 PREPARATION

4.1 INTRODUCTION

4.1.1 Preparation includes arrangements or plans to deal with an emergency or the effects of an emergency.

4.2 FLOOD EMERGENCY PLANNING

4.2.1 **Strategy:** NSW SES develop, review and maintain flood sub-plans

Actions:

- a. Develop and review this NSW SES Local Flood Plan as required. Local Flood Plans outline the specific arrangements for management of flood events within

- a Local Government Area (LGA), and may include cross boundary arrangements; and
 - b. Review plans as per Section 1.8.
- 4.2.2 Local EMPLAN Consequence Management Guides for flood are not required for communities covered by NSW SES Local Flood Plans.

4.3 FLOOD INTELLIGENCE SYSTEMS

- 4.3.1 **Strategy:** NSW SES develop and maintain a flood intelligence system to identify flood behaviour, its impact on the community and required response actions.

Actions:

- a. Gather and assess flood information for the full range of flood types and severities;
- b. Collect, collate and assess information on the characteristics of communities at risk and the potential effects of flooding on communities at risk; and
- c. Share flood intelligence information with supporting agencies.

4.4 DEVELOPMENT OF WARNING SYSTEMS

- 4.4.1 **Strategy:** Develop, maintain and prepare systems for the provision of flood warnings and associated warning services.

Actions:

- a. All levels of government work in partnership to develop and maintain flood warning infrastructure;
- b. NSW SES maintains a list of the requirements for flood warnings for flood gauges in NSW (including flood classifications, warning times required and key statistics) and can be found in the supplementary document to the State Flood Plan (see Section 1.8). Gauges of relevance to the Bega Valley Shire LGA are also listed in Volume 3 of this plan;
- c. The NSW SES will recommend new warning services and changes to warning alert levels for gauges to the NSW Flood Warning Consultative Committee.
- d. The State Government, in partnership with Local Government, is responsible for developing and maintaining flash flood warning systems for local catchments where required;
- e. Dam Owners will provide Dam Failure Warning Systems (where required) and consult NSW SES on alert levels and messaging. Alert level definitions are listed in Dam Safety Emergency Plans;
- f. NSW SES will maintain a dedicated dam failure hotline and procedures to ensure priority dissemination of dam failure warnings;
- g. NSW SES will develop and maintain warning and flood information products by:
 - Utilising flood intelligence data;
 - Developing pre-written warning and flood information products;
 - Continuously reviewing warning and flood information products; and

- Consulting with affected communities, key stakeholders, Dam Safety NSW and the NSW Flood Warning Consultative Committee; and Operational Readiness

4.4.2 **Strategy:** Ensure NSW SES, supporting agencies, functional areas and the community are prepared and familiar with the strategies and arrangements within the Flood Sub-Plan and supporting documents.

Actions:

- NSW SES will consult stakeholders through the development of plans;
- NSW SES will inform stakeholders of content changes after revisions;
- NSW SES will ensure NSW SES facilities and resources are maintained and operationally ready;
- NSW SES will train personnel for their expected flood operation roles; and
- NSW SES will regularly brief and exercise the arrangements contained in the Flood Sub-Plan with stakeholders.

4.5 COMMUNITY RESILIENCE TO FLOODING

4.5.1 **Strategy:** NSW SES provides and maintains a flexible volunteer workforce to support community resilience.

Actions:

- Ensure ongoing recruitment and training of a diverse range of volunteers.
- Ensure pre-planning to facilitate the management of spontaneous volunteers and community members during a flood.

4.5.2 **Strategy:** NSW SES works with individuals, communities, businesses and government agencies to build flood resilience.

Actions:

- Work with communities to understand and manage the risks associated with floods, including providing business continuity guidance (NSW SES Business Floodsafe), family preparedness (NSW SES Home Floodsafe) and other engagement strategies.
- NSW SES will collate, assess and disseminate flood information to the community.
- Collaborate with individuals, businesses, government agencies and communities when developing flood intelligence, preparedness and response information.
- Plan for floods collaboratively with communities through community and stakeholder participation and engagement.

5 RESPONSE

5.1 INTRODUCTION

5.1.1 Flood response operations will begin:

- a. On receipt of a Bureau of Meteorology (BoM) Severe Weather Warning or Thunderstorm Warning that includes heavy rain or storm surge; or
- b. On the receipt of a BoM Flood Watch or Flood Warning; or
- c. On receipt warnings for flash flood; or
- d. On receipt of a dam failure alert; or
- e. When other evidence leads to an expectation of flooding.

5.2 INCIDENT MANAGEMENT ARRANGEMENTS

5.2.1 **Strategy:** Maintain effective control of flood operations across New South Wales.

Actions:

- a. The NSW SES uses the Australasian Inter-service Incident Management System (AIIMS) to manage the flood response;
- b. Control of flood response will be at the lowest effective level and may be scaled to suit the incident;
- c. The NSW SES State Controller will appoint Incident Controllers and establish Incident Control Centres (see NSW SES facilities on Map 1);
- d. The Incident Controller, in consultation with participating supporting emergency services and Functional Areas will determine appropriate breakdown of an incident area into Divisions and/or Sectors in accordance with the principles of AIIMS as well as the predefined Divisions and Sectors outlined within Volume 3 of this Plan.

5.2.2 **Strategy:** Maintain Incident Control Centre(s).

Actions:

- a. NSW SES will operate Incident Control Centre(s) as required;
- b. The NSW SES Incident Control Centre(s) will:
 - Control resources from NSW SES and coordinate resources of supporting emergency services and functional areas;
 - Manage Request for Assistance (RFA) tasking and ensure they are actioned in a timely manner;
 - Undertake response planning and determine future resourcing requirements; and
 - Coordinate information flow, including warnings, public information and social media.

5.2.3 **Strategy:** Provide effective liaison between the NSW SES and supporting agencies or functional areas in accordance with Local EMPLAN.

Actions:

- a. Supporting emergency services and Functional Areas should provide Liaison Officers to NSW SES Incident Control Centres and/or Emergency Operation Centres as required; and
- b. NSW SES will provide Liaison Officer(s) to Emergency Operations Centres as required.

5.2.4 **Strategy:** Coordinate resources and logistics support to ensure operational effectiveness.

Actions:

- a. The NSW SES Incident Controller will notify agencies of potential access issues between locations, for the consideration of pre-deployment of resources;
- b. The NSW SES may request resources and logistics support directly from a supporting emergency service or Functional Area.
- c. Wherever possible, supporting organisations are to provide their own logistic support in consultation with NSW SES where appropriate.
- d. The NSW SES Incident Controller will control air support operations and may utilise supporting agencies in the management of aircraft.

5.3 USE OF INFORMATION AND COLLECTION OF INTELLIGENCE

5.3.1 **Strategy:** Ensure flood information is effectively communicated and collected during a flood.

Actions:

- a. Information relating to the consequences of flooding, response strategies, situational awareness and operational updates will be distributed by NSW SES to supporting emergency services and Functional Areas listed under this Plan;
- b. All supporting emergency services and Functional Areas will accurately record and report information relevant to their activities and any real time flood information (including road closure information) to the NSW SES Incident Controller. This may be in the form of a combined EOC report, or direct from agencies where an EOC has not been established;
- c. The NSW SES may establish and operate a Joint Intelligence Unit to coordinate the collection, collation, interpretation, mapping, actioning and dissemination of information; and
- d. Reconnaissance, mapping, damage assessments, intelligence validation and post flood evaluation will be coordinated by NSW SES. This may occur post impact, and continue into the recovery phase.

5.3.2 **Strategy:** Ensure flood intelligence is incorporated into operational decision-making.

5.3.3 **Action:** The NSW SES will use flood intelligence and official forecasts and warnings, to undertake an assessment of the predicted impact of a flood and to inform operational decision-making.

5.4 PROVISION OF INFORMATION AND WARNINGS TO THE COMMUNITY

5.4.1 **Strategy:** Timely and effective warnings are distributed to the community.

Actions:

- a. The BoM issues public weather and flood warning products before and during a flood. These may including:
 - Severe Thunderstorm Warnings with reference to heavy rainfall
 - Regional Severe Thunderstorm Warnings with reference to heavy rainfall
 - Detailed Severe Thunderstorm Warnings (for Sydney / Newcastle / Wollongong) with reference to heavy rainfall,
 - Severe Weather Warnings with reference to heavy rainfall and/or storm surge,
 - Flood Watches, and
 - Flood Warnings.
- b. Dam Owners will utilise Dam Failure Warning Systems to provide warnings and information to NSW SES and communities (where appropriate).
- c. NSW SES Incident Controllers will issue the following NSW SES flood information products incorporating warnings from the above, expected consequences and safety messages:
 - Livestock and Equipment (pump) Warnings
 - Local Flood Advices
 - Flood Bulletins
 - NSW SES Evacuation Warning
 - NSW SES Evacuation Order
 - NSW SES All Clear
- d. NSW SES will contact the Bureau of Meteorology to discuss the development of flood warnings as required.
- e. NSW SES will provide alerts and deliver flood information to affected communities using a combination of some of the following methods:
 - Mobile and fixed public address systems;
 - Two-way radio;
 - Emergency Alert (SMS and voice message alerting system);
 - Telephony (including Auto dial systems);
 - Facsimile
 - Standard Emergency Warning Signal;

- Doorknocking;
 - Mobile and fixed sirens;
 - Variable message signs;
 - Community notices in identified hubs;
 - Distribution through established community liaison networks, partnerships and relationships; and
 - NSW SES social media and website.
- f. NSW SES may request supporting agencies redistribute NSW SES alerts and information, including through the provision of doorknocking teams;
- g. Road closure information will be provided to the community through the following agencies/methods:
- Local Government Council websites; and
 - Road and Maritime Services 'Live Traffic' website: www.livetraffic.com or 'Transport InfoLine': 131 500.
- h. The Public Information and Inquiry Centre will be established by the NSW Police Force where required to provide information regarding evacuees and emergency information.
- i. The Disaster Welfare Assistance Line will be established by Disaster Welfare Services where required to provide information on welfare services and assistance.

5.5 PROTECTION OF PROPERTY

5.5.1 **Strategy:** Coordinate the protection of property from destruction or damage arising from floods.

Action: NSW SES, supporting agencies, and community volunteers will assist the community (where resources are available and where feasible) in:

- a. The protection of properties through flood protection systems (e.g. sandbagging) to minimise entry of water into buildings; and
- b. The lifting or moving of household furniture and commercial stock/equipment.

5.6 ROAD AND TRAFFIC CONTROL

5.6.1 **Strategy:** Coordinate the closing and re-opening of flood affected roads.

Actions:

- a. Bega Valley Shire Council will coordinate the closure and reopening of council managed roads;
- b. The Transport Management Centre (TMC) in coordination with RMS will coordinate the closure and reopening of the state road network;
- c. The NSW Police Force may close and re-open roads but will normally only do so (if the Bega Valley Shire Council or the RMS have not already acted) and if public safety requires such action;

- d. NSW SES will assist with erecting road closure signs and barriers when time and resources permit.

5.6.2 **Strategy:** Coordinate traffic control measures in flood affected areas.

- a. The NSW SES Incident Controller may direct the imposition of traffic control measures into flood affected areas in accordance with the provisions of the *State Emergency Service Act, 1989* and the *State Emergency Rescue Management Act, 1989*.
- b. The NSW SES Incident Controller may request the Local Emergency Operations Controller provide personnel to assist with traffic coordination.

5.7 PROTECTION OF ESSENTIAL SERVICES

5.7.1 Arrangements for the protection of local assets are outlined in Volume 3 of this NSW SES local Flood Plan. In addition, Local and Region EMPLAN's contain infrastructure inventories.

5.7.2 **Strategy:** Minimise disruption to the community by ensuring protection of infrastructure and supply of essential energy and utility services.

Actions:

- a. Transport Services Functional Area will keep the NSW SES informed of the status of transport infrastructure;
- b. The Energy and Utility Services Functional Area is to coordinate the assessment and restoration of essential energy and utility services (not including telecommunications);
- c. The Telecommunications Services Functional Area is to coordinate the assessment and restoration of telecommunications and the Government Radio Network;
- d. The Engineering Services Functional Area is to coordinate the assessment and restoration of critical public buildings for example hospitals; and
- e. Functional Areas will keep the NSW SES informed of the status of utilities and infrastructure.

5.8 EVACUATION

5.8.1 Evacuation is the NSW SES's primary response strategy for managing the population at risk of flooding.

5.8.2 Community specific evacuation arrangements are located in Volume 3 of this Plan.

5.8.3 **Strategy:** Conduct planning to ensure all evacuation constraints are considered.

Actions:

- a. Evacuations will take place when there is a risk to public safety. Circumstances may include:
 - Evacuation of people when their homes or businesses are likely to flood;

- Evacuation of people who are unsuited to living in isolated circumstances, due to flood water closing access; and
 - Evacuation of people where essential energy and/or utility services are likely to fail or where buildings have been or may be made uninhabitable; and
- b. The NSW SES will consider the following in evacuation decisions:
- Duration of evacuation;
 - Characteristics of the community;
 - Numbers requiring evacuation;
 - Availability of evacuation routes and transport;
 - Time available for evacuation;
 - Evacuee management requirements; and
 - Resources and delivery of evacuation information.
- c. NSW SES Incident Controllers, and flood planners will carefully consider the risks involved in conducting evacuations;
- d. All evacuation decisions will be made as per the NSW SES Communication and Dissemination of Evacuation Decisions Standard Operating Procedure and Evacuation operations are to be consistent with the NSW Evacuation Management Guidelines;
- e. Potential evacuation centres are located in Volume 3 / Local EMPLAN; and
- f. The NSW Police Force will coordinate the provision of overall security for evacuated areas.

5.8.4 **Strategy:** Evacuate people pre-emptively from dangerous or potentially dangerous places created by the flood hazard to safe locations away from the hazard.

- a. NSW SES will control and coordinate the evacuation of affected communities;
- b. The NSW SES Incident Controller will warn communities to prepare for a possible evacuation, where circumstances allow such lead time;
- c. The NSW SES Incident Controller will order any necessary evacuations and provide information to the community about when and how to evacuate;
- d. Support to evacuation operations may be requested from other emergency services and supporting agencies using arrangements in local EMPLAN and supporting plans;
- e. Health Services Functional Area will coordinate the evacuation of hospitals, health centres and aged care facilities (including nursing homes) in consultation with the NSW SES and Welfare Services.
- f. School administration offices (Department of Education, Catholic Education Office and Private Schools) will coordinate the evacuation of schools in consultation with the NSW SES and Welfare Services, if not already closed.

- g. Caravan Park proprietors will inform the NSW SES Incident Controller when caravan park evacuations have been completed.
- h. People who are reluctant or refuse to comply with any Evacuation Order will be referred to the NSW Police Force.

5.9 EVACUEE MANAGEMENT AND WELFARE

5.9.1 Research and experience in flood operations shows that most evacuees go to family, friends and commercial accommodation outside the impact area.

5.9.2 **Strategy:** Maintain the welfare of communities and individuals affected by the impact of a flood.

Actions:

- a. NSW SES will provide initial welfare for evacuees where required but will hand the responsibility over to the Welfare Services Functional Area as soon as possible. In these cases the NSW SES will brief the Welfare Services Functional Area at the earliest opportunity regarding the assistance required;
- b. Welfare Services Functional Area will manage evacuation centres for affected residents and travellers in accordance with the Welfare Services Functional Area Supporting Plan;
- c. The Department of Education will manage the safety of students directly affected by flooding, will work with the NSW SES in the temporary closure of schools and will work with NSW SES and Welfare Services in the management of school evacuees.
- d. Disaster Victim Registration will be controlled and coordinated by the NSWPF, with the assistance of NSW SES and Welfare Services Functional Area;
- e. NSW SES will provide details of all residents assisted in evacuations to the Welfare Services Functional Area as early as possible;
- f. Where the expected remaining number of evacuees and the duration of evacuation is assessed to be beyond the capability and capacity of the established evacuation centre arrangements the SEOCAN may establish Major Evacuation Centres or Mass Care facilities; and
- g. The decision to establish Major Evacuation Centres or Mass Care Facilities will be made by the NSW SES and SEOCAN in consultation with members of the State Emergency Management Committee.

5.9.3 **Strategy:** Coordinate available and accessible health services for flood affected communities.

Action: The provision of environmental health advice, assessment of public health risks and coordination of immediate mental health support will be provided by Health Services Functional Area.

5.9.4 **Strategy:** Coordinate maintenance of food supplies for flood affected communities.

Actions: All matters relating to the primary production, manufacturing, processing and handling of all food from primary industries to retail, inclusive of all restaurants, food services and catering businesses should be referred to the

NSW Food Authority through the Agriculture and Animal Services Functional Area.

5.9.5 **Strategy:** Maintain the welfare of animals impacted by a flood.

Actions:

- a. Agriculture and Animal Services Functional Area will coordinate the welfare of livestock, pets, companion animals and wildlife including support to primary producers, animal holding establishments and community members; and
- b. Agriculture and Animal Services Functional Area role will assist with evacuation, emergency care of animals and assessment, humane destruction and disposal of affected animals, and supply of emergency fodder, water and aerial support where necessary.

5.10 FLOOD RESCUE

5.10.1 **Strategy:** Control and coordinate flood rescue of people and domestic animals.

Actions:

- a. NSW SES will perform flood rescue, where training and equipment is suitable and where a risk assessment has indicated that the risk to rescuers is acceptable;
- b. Flood rescue operations will be conducted in accordance with the State Rescue Board Land Rescue Policy and the NSW State Rescue Board Flood Rescue Policy which sets out the framework, governance, responsibilities and requirements for the management and conduct of flood rescue in NSW;
- c. NSW SES may request other supporting emergency services to undertake flood rescues on behalf of the NSW SES. Agencies must be authorised/accredited to undertake flood rescue operations in accordance with State Rescue Board requirements, as prescribed by NSW SES. Supporting emergency services must supply information regarding rescues performed to the NSW SES. Notification arrangements with NSW Police Force are outlined in the NSW State Rescue Board Flood Rescue Policy; and
- d. Rescue agencies will conduct rescue of domestic small and large animals as per the State Rescue Board Land Rescue Policy (and may include Large Animal Rescue of family horses and cows at a residence or property). The rescue of livestock (which includes commercial animals found on farming and breeding enterprises) will be coordinated through Animal and Agriculture Services Functional Area.

5.11 RESUPPLY

5.11.1 **Strategy:** Coordinate resupply to towns and villages isolated by flooding to minimise disruption to the community.

Actions:

- a. NSW SES will advise communities and businesses if flood predictions indicate that areas are likely to become isolated, and indicative timeframes where possible.

- b. Retailers should be advised to ensure sufficient stock is available for the duration of the flood.
- c. When isolation occurs, NSW SES will establish loading points where retailers can instruct suppliers to deliver goods.
- d. NSW SES will endeavour to deliver mail to isolated communities, but may not be able to do so according to normal Australia Post timetables.
- e. NSW SES will assist hospitals with resupply of linen and other consumables where able.
- f. NSW SES may request resupply assistance from supporting agencies.

5.11.2 **Strategy:** Coordinate resupply to rural properties isolated by flooding.

Actions:

- a. When requested, NSW SES will establish a resupply schedule and coordinate the resupply for isolated rural properties;
- b. NSW SES will provide local suppliers with designated loading points. Resupply items are to be packaged by the supplier; and
- c. Isolated households unable to afford resupply items will be referred to Welfare Services Functional Area for assistance.

5.12 ALL CLEAR AND RETURN

5.12.1 **Strategy:** Coordinate the safe return of communities to flood affected areas when the immediate danger to life and property has passed.

Actions:

- a. NSW SES Incident Controller will determine when it is safe to progressively return in consultation with the relevant Emergency Operations Controller and supporting agencies, considering the impact on the following:
 - Access and egress;
 - Communications;
 - Power supply;
 - Gas supply;
 - Infrastructure damage;
 - Hazardous materials; and
 - Public health risks.
- b. NSW SES Incident Controller will specify the level of access to affected communities as the following:
 - Not suitable for access;
 - Limited access by emergency services and response agencies;
 - Limited access by residents and/or business operators; or
 - Full access.

- c. NSW SES Incident Controller will issue an 'All Clear' message when the immediate danger to life and property has passed for areas assessed as safe; and
- d. The NSW SES will facilitate the return of evacuees to their homes.

5.13 END OF RESPONSE OPERATIONS

5.13.1 **Strategy:** Conclude response operations.

Actions:

- a. Response operations will conclude when:
 - The physical impact of the flood has ceased;
 - All requests for assistance related to the flood have been completed;
 - The need for warning and evacuation no longer exist;
 - There is no further prospect of rescuing people;
 - Resupply is no longer required (resupply operations may occur concurrently with the recovery phase);
 - Response to fire and hazardous material incidents have concluded (not including subsequent clean-up of contaminated sites); and
 - All affected areas have had an 'All Clear' issued.

5.14 POST IMPACT ACTIONS

5.14.1 **Strategy:** Learnings from the event are used to inform recovery and future events.

Actions:

- a. NSW SES will continue to engage with communities after significant floods through convening one or more community forums, workshops or other opportunities to provide communities a chance to provide feedback, address any concerns and provide input into the recovery process. These will typically include other agencies such as the Bureau of Meteorology, Welfare Services and Bega Valley Shire Council representatives;
- b. NSW SES will ensure that damage assessment information is provided to the relevant Emergency Operations Controller to inform the recovery impact assessment;
- c. NSW SES will conduct After Action Reviews, wherever possible, within three weeks of the end of response operations, which will involve all stakeholders. Findings will be shared and incorporated into improved disaster resilience planning;
- d. NSW SES will undertake/coordinate a comprehensive review of intelligence and plans following significant flood events.

5.14.2 **Strategy:** Participate in post flood data collection analysis.

Actions: NSW SES will work with the NSW Department of Planning, Industry and Environment (DPIE) and Bega Valley Shire Council on post flood data collection analysis including review of flood intelligence where necessary.

6 RECOVERY OPERATIONS

6.1 INTRODUCTION

6.1.1 Recovery is the process of returning an affected community to its proper level of functioning after an emergency. It will generally commence simultaneously with the Response phase.

6.1.2 Recovery operations will be initiated and conducted as outlined in the State EMPLAN and as further detailed in the NSW Recovery Supporting Plan.

6.2 NSW SES RECOVERY ROLE

6.2.1 **Strategy:** NSW SES will support recovery operations and established Recovery Committees.

Actions:

- a. NSW SES will provide representation to Recovery Committees as required and may have an ongoing role in the Recovery phase through its community engagement personnel;
- b. NSW SES roles on Recovery committees may include providing information about any continuing response, guidance on mitigation strategies and general advice and assistance to the committee as a subject matter specialist;
- c. NSW SES will provide information to Office of Emergency Management to support applications to Treasury for Natural Disaster Relief and Recovery Arrangements;
- d. The NSW SES, in conjunction with a Recovery Committee, will provide a service to support the information needs of a community immediately following a flood; and
- e. NSW SES will assist with clean-up operations after floods, where possible.

7 ABBREVIATIONS

AIIMS	Australasian Inter-service Incident Management System
BoM	Australian Government Bureau of Meteorology
DPIE	NSW Department of Planning, Industry and Environment
DSEP	Dam Safety Emergency Plan
EMPLAN	Emergency Management Plan
EOC	Emergency Operations Centre
EOCON	Emergency Operations Controller
FRNSW	Fire and Rescue NSW
LEMC	Local Emergency Management Committee
LEOCON	Local Emergency Operations Controller
MHL	Manly Hydraulics Laboratory
NSW RFS	New South Wales Rural Fire Service
NSW SES	New South Wales State Emergency Service
OEM	Office of Emergency Management
PMF	Probable Maximum Flood
RMS	Roads and Maritime Services (Transport for NSW)
SDOC	State Duty Operations Controller
SEOCON	State Emergency Operations Controller
SERCON	State Emergency Recovery Controller
SOC	State Operations Centre
TMC	Transport Management Centre

8 GLOSSARY

For a full list of definitions refer to the Supporting Document - State Flood Plan Glossary [NSW State Flood Plan](#)

Community Resilience. Communities and individuals harnessing local resources and expertise to help themselves in an emergency, in a way that complements the response of the emergency services. Resilient communities are better able to withstand a crisis event and have an enhanced ability to recover from residual impacts.

Dam Failure. The uncontrolled release of a water storage. The failure may consist of the collapse of the dam or some part of it, or excessive seepage or discharges. The most likely causes of dam failure are:

- **Flood Induced Dam Failure** - dam failure caused by flood, either due to overtopping erosion or by subsequent structural failure.
- **Sunny Day Dam Failure** - dam Failure as a result of factors other than flood i.e. other than flood flow into the reservoir. Causes of "Sunny Day" dam failure can include internal erosion, landslide, piping, earthquake, structural weaknesses or sabotage.

Damage Assessment. Collection and collation of specific impact information to inform the impact assessment. The information assists with the transition to recovery.

Declared Dam. A declared dam is a dam or proposed dam that is declared by order under section 4 of the 2019 regulation:

- a dam having a dam wall that is more than 15 metres high.
- an existing or proposed dam that Dams Safety NSW is reasonably satisfied would result in a major or catastrophic level of severity of damage or loss were there to be a failure of the dam.
- dams that were 'prescribed' under the old Dams Safety Act (1978) became declared dams upon commencement of the new Act.

Once a dam is declared, the dam owner must comply with all the relevant requirements of the legislation.

Evacuation. A risk management strategy that may be used to mitigate the effects of an emergency on a community. It involves the movement of people to a safer location and their return. For an evacuation to be effective, it must be appropriately planned and implemented.

Evacuation Order. Notification to the community, authorised by the NSW SES, when the intent of an Incident Controller is to instruct a community to immediately evacuate in response to an imminent threat.

Evacuation Warning. Notification to the community, authorised by the NSW SES, when the intent of an Incident Controller is to warn a community of the need to prepare for a possible evacuation.

Flash Flooding. Flooding which is sudden and often unexpected because it is caused by sudden local or nearby heavy rainfall and typically occurs in small catchments. Technically, flash flooding means any flooding of short duration with a relatively high peak discharge in which the time interval between the observable causative event and the Flood is less than six hours.

Flood. Relatively high water level which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with drainage before entering a

watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves (including tsunami) overtopping coastline defences.

Flood Intelligence. The product of a process of collecting, evaluating and analysing flood information relating to an event and presenting and communicating it in such a way as to inform decision making and to devise treatment options across prevention, preparedness, response and recovery. NSW SES maintain a Flood Intelligence system to store Flood Intelligence.

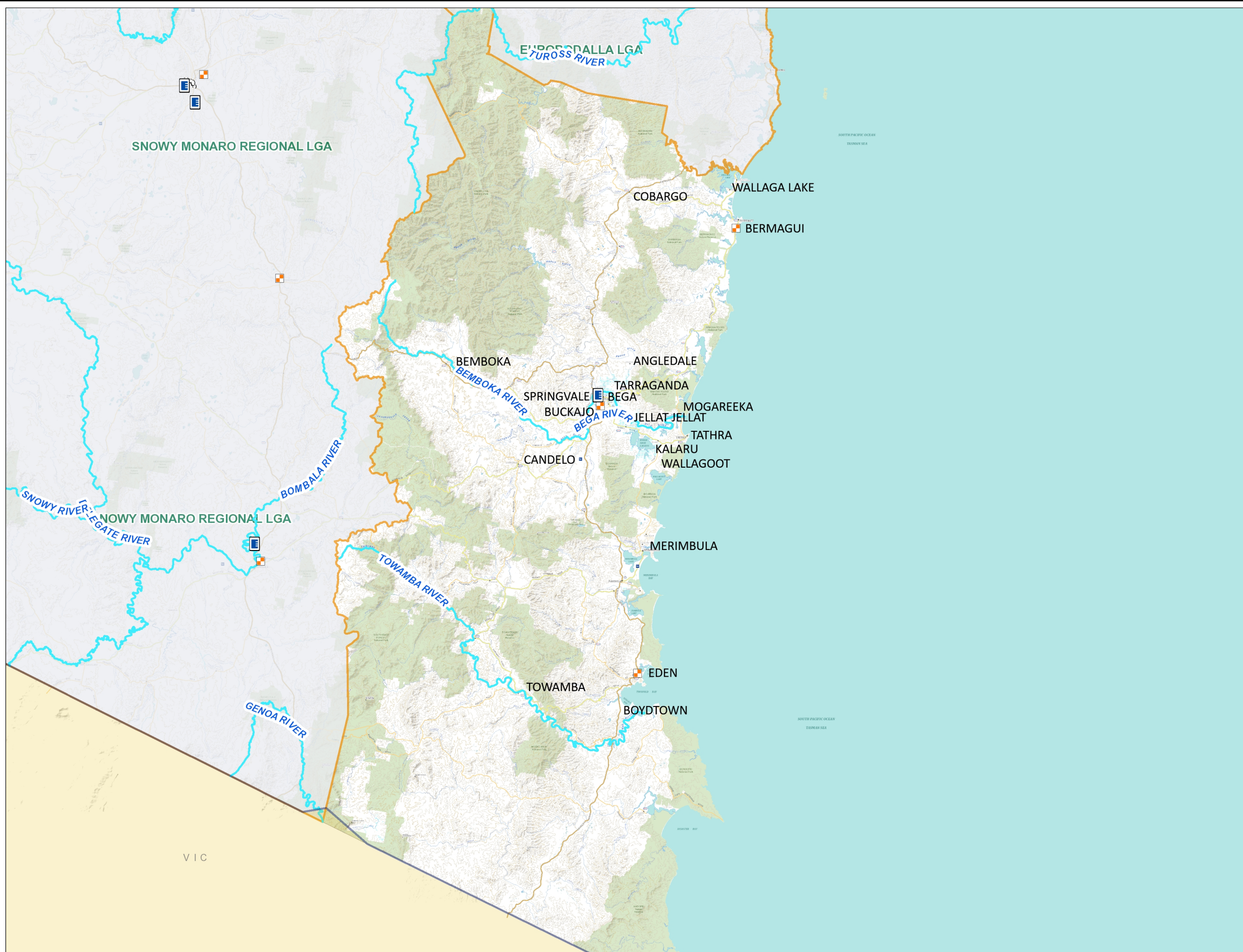
Incident Controller. The individual responsible for the overall management of an emergency or critical incident.

NSW SES State Controller. The NSW SES Commissioner, in connection with the exercise of his or her functions under the SES Act, may use the title NSW SES State Controller and the NSW SES Deputy Commissioner may use the title NSW SES Deputy State Controller.

NSW SES State Duty Operations Controller (SDOC). The delegated authority appointed by the NSW SES State Controller, responsible for providing advice and support to an Incident Controller and/or Operations Controller when required. State Duty Operations Controller is in command of emergency response operations.

Riverine Flooding. Any flooding where the rain-to-flood delay time is relatively high and typically more than six hours, but excludes Flooding caused by: elevated sea levels, storm surge, flash floods, failure of any man-made infrastructure, for example failure of dams or levees, or urban overland flow.

Spontaneous Volunteers. Emergent volunteers during times of crisis who volunteer their time to help their local communities but do not wish to have an ongoing commitment to an organisation.



Legend

-  NSW SES Headquarters
-  Gauges BOM Forecast Locations
-  Major Rivers
-  Levees
-  Prescribed Dams
-  Regional Towns NSW
-  Local Government Areas
-  States Australia

DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.



THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.

Printed: 15/04/2020

10 Appendix B – Roles and Responsibilities

AGENCY	RESPONSIBILITIES
NSW State Emergency Service	The NSW SES is the designated Combat Agency for floods, storms and tsunami and controls response operations. NSW SES roles and responsibilities in relation to floods are detailed within the New South Wales State Flood Plan .

AGENCY	RESPONSIBILITIES
Agriculture and Animal Services Functional Area	<p>The roles and responsibilities for Agriculture and Animal Services are outlined in the Agriculture and Animal Services Supporting Plan</p> <p>Roles and responsibilities in addition to the Supporting Plan are:</p> <ul style="list-style-type: none"> • Disseminate briefing information to participating agriculture and animal services and related stakeholders; • When activated the Agriculture and Animal Services will coordinate the provision of required services which may include: <ul style="list-style-type: none"> – Coordinate response for animal welfare including pets, livestock and wildlife; – Supply and delivery of emergency fodder; – Emergency water replacement in certain circumstances; and – Financial, welfare and damage assessment assistance to flood affected primary producers. • Support recovery arrangements including: <ul style="list-style-type: none"> – Administer transport subsidies to primary producers.
Australian Government Bureau of Meteorology	The roles and responsibilities of the Australian Government Bureau of Meteorology are outlined in the NSW State Flood Plan.
Council - Bega Valley Shire	<p>Preparedness</p> <ul style="list-style-type: none"> • Establish and maintain floodplain and coastal risk management committees and ensure that key agencies are represented; • Develop and implement floodplain risk management plans in accordance with the NSW Government’s Flood Prone Land Policy and the Floodplain Development Manual; • Provide levee studies, flood studies and floodplain management studies to the NSW SES; • Maintain Dam Safety Emergency Plans for the Bega Valley Shire Council owned dams and provide copies to the NSW SES. • Provide information on the consequences of dam failure to the NSW SES for incorporation into planning and flood intelligence.

AGENCY	RESPONSIBILITIES
	<ul style="list-style-type: none"> • Coordinate the development of warning services for catchments prone to flash flooding (small catchments), where appropriate; • Maintain council-owned flood warning networks and flood mitigation works; • Participate in NSW SES-led flood emergency planning meetings, to assist in the preparation of Flood Sub-Plans; • Maintain a plant and equipment resource list for the council area. • Contribute to community engagement activities. <p>Response</p> <ul style="list-style-type: none"> • Subject to the availability of council resources, assist the NSW SES with flood operations including: <ul style="list-style-type: none"> – Traffic management on council managed roads; – Provision of assistance to the NSW SES (plant, equipment and personnel where able and requested); – Property protection tasks including sandbagging; – Assist with the removal of caravans from caravan parks – Warning and/or evacuation of residents and other people in flood liable areas; – Provision of back-up radio communications – Resupply of isolated properties; and – Technical advice on the impacts of flooding. – Close and reopen council roads (and other roads nominated by agreement with RMS) and advise the NSW SES, the NSW Police Force and people who contact the council for road information; – Assist the NSW SES to provide filled sandbags and filling facilities to residents and business in areas which flooding is expected. • Assist with making facilities available for the domestic pets and companion animals of evacuees during evacuations. • Operate the flash flood warning systems; • Operate flood mitigation works including critical structures such as detention basins and levees and advise the NSW SES regarding their operation; • Manage and protect council-owned infrastructure facilities during floods; • Provide advice to the NSW SES and the Health Services Functional Area during floods about key council managed infrastructure such as sewerage treatment and water supply; • Advise the Environmental Protection Agency of any sewerage overflow caused by flooding;

AGENCY	RESPONSIBILITIES
	<ul style="list-style-type: none"> • Work with the NSW SES and DPIE to collect flood related data during and after flood events. <p>Recovery</p> <ul style="list-style-type: none"> • Provide for the management of health hazards associated with flooding including removing debris and waste; • Ensure premises are fit and safe for reoccupation and assess any need for demolition; • Provide services, assistance and advice to State Government in accordance with the State Recovery Plan.
Caravan Park Proprietor(s)	<ul style="list-style-type: none"> • Prepare a flood emergency plan for the Caravan Park; • Ensure that owners and occupiers of movable dwellings are aware that the caravan park is flood liable by providing a written notice to occupiers taking up residence and displaying this notice and emergency management arrangement within the park; • Ensure that owners and occupiers of movable dwellings are aware that if they are expecting to be absent for extended periods, they should: <ul style="list-style-type: none"> – Provide the manager of the caravan park with a contact address and telephone number in case of an emergency; and – Leave any movable dwelling in a condition allowing it to be relocated in an emergency (i.e.: should ensure that the wheels, axles and draw bar of the caravans are not removed, and are maintained in proper working order); • Ensure that occupiers are informed of Flood Information. At this time, occupiers should be advised to: <ul style="list-style-type: none"> – Ensure that they have spare batteries for their radios; – Listen to a local radio station for updated flood information; and – Prepare for evacuation and movable dwelling relocation; • Ensure that owners and occupiers of caravans are aware of what they must do to facilitate evacuation and movable dwelling relocation when flooding occurs; • Coordinate the evacuation of people and the relocation of movable dwellings when floods are rising and their return when flood waters have subsided. Movable dwellings will be relocated back to the caravan park(s) by owners or by vehicles and drivers arranged by the park managers; • Secure any movable dwellings that are not able to be relocated to prevent floatation; and

AGENCY	RESPONSIBILITIES
	<ul style="list-style-type: none"> • Inform the NSW SES of the progress of evacuation and/or movable dwellings relocation operations and of any need for assistance in the conduct of these tasks.
Childcare Centres and Preschools	<ul style="list-style-type: none"> • When notified of possible flooding or isolation, child care centres and preschools should; <ul style="list-style-type: none"> – Liaise with the NSW SES and arrange for the early release of children whose travel arrangements are likely to be disrupted by flooding and/or road closures; and – Assist with coordinating the evacuation of preschools and child care centres.
Dams Safety NSW	The roles and responsibilities of the Dams Safety NSW (formerly NSW Dam Safety Committee) are outlined in the NSW State Flood Plan.
Department of Defence	Arrangements for Defence Assistance to the Civil Community are detailed within the State EMPLAN (section 448).
Department of Industry	The roles and responsibilities for the Department of Industry (Crown Lands and Water Division) are outlined in the State Flood Plan.
Energy and Utilities Services Functional Area	<p>The roles and responsibilities for Energy and Utilities Services are outlined in the Energy and Utility Services Supporting Plan (EUSPLAN).</p> <p>Roles and responsibilities in addition to the Supporting Plan are:</p> <ul style="list-style-type: none"> • Assist NSW SES with identification of infrastructure at risk of flood damage where resources are available. • Facilitate local utility service distribution providers (electricity, gas, water, waste water) to: <ul style="list-style-type: none"> – Provide advice to the NSW SES of any need to disconnect power/gas/water/waste water supplies or of any timetable for reconnection – Advise the NSW SES of any hazards from utility services during flooding and coastal erosion/inundation – Advise the public with regard to electrical hazards during flooding and coastal erosion/inundation, and to the availability or otherwise of the electricity supply – Clear or make safe any hazard caused by power lines or electricity distribution equipment – Reconnect customers’ electrical/ gas/ water/waste water installations, when certified safe to do so and as conditions allow – Assist the NSW SES to identify infrastructure at risk of flooding for incorporation into planning and intelligence.
Engineering Services Functional Area	The roles and responsibilities for Engineering Services are outlined in the Engineering Services Supporting Plan .

AGENCY	RESPONSIBILITIES
Environmental Services Functional Area	The roles and responsibilities for Environmental Services are outlined in the Environmental Services (ENVIROPLAN) Supporting Plan .
Floodplain Management Australia	The roles and responsibilities of Floodplain Management Australia are outlined in the NSW State Flood Plan.
Fire and Rescue NSW (as per NSW State Flood Plan)	<p>Preparedness</p> <ul style="list-style-type: none"> • Identify and notify the NSW SES of any locations at risk of fire (within Fire Districts (13) or hazardous materials that pose a significant threat to surrounding populations due to the impact of a flood for incorporation into NSW SES flood intelligence and planning; and <p>Response</p> <ul style="list-style-type: none"> • Meet the agreed arrangements described in the NSW SES and Fire and Rescue NSW Mutual Aid Agreement; • Provide Incident Management personnel and Liaison Officers to the NSW SES where required; • When requested by NSW SES, provide support to the NSW SES in response to flood emergencies across the State; • Assist the NSW SES with the warning and/or evacuation of at risk communities; • Assist the NSW SES with the monitoring/reconnaissance of flood prone areas; • Provision of Land Based and In Water Flood Rescue Operators as required; • Provision of appropriately trained personnel to perform Down the Wire (DTW) functions as required; • Conduct Hazmat operations including asbestos risks, arising from flood emergencies in coordination with the SES Incident Controller. • Decontamination of Flood Rescue Operators as required; • Assist the NSW SES with the resupply of isolated communities and/or properties; • Assist the NSW SES with property protection tasks including sandbagging; • Provide resources for pumping flood water out of buildings and from low-lying areas; • Assist with clean-up operations, including the hosing out of flood affected properties;

AGENCY	RESPONSIBILITIES
	<ul style="list-style-type: none"> • Provide trained staff to support a joint intelligence unit, if established by NSW SES, including Remotely Piloted Aircraft System (RPAS) pilots to assist with field observations; • Assist the NSW SES to undertake damage assessment including structural collapse risks; • Coordinate the pre-deployment of fire resources to communities within NSW Fire Districts if access is expected to be lost, in consultation with the NSW SES; and • Coordinate the deployment of the FRNSW Hightrans Pump to locations in consultation with NSW SES. <p>Recovery</p> <ul style="list-style-type: none"> • Participate in After Action Reviews as required.
Forestry Corporation of NSW	<p>Response</p> <ul style="list-style-type: none"> • Close and reopen Forestry Corporation of NSW roads when affected by flood waters and advise the NSW SES of its status; • Manage traffic on Forestry Corporation of NSW roads; • Facilitate the safe reliable access of emergency resources on Forestry Corporation managed roads; • Assist the NSW SES with identification of road infrastructure at risk of flooding; • Assist the NSW SES with the communication of warnings and information provision to the public through variable message signs and other appropriate means; and • Close and relocate people from camping grounds at risk of flooding in State Forest managed areas.
Health Services Functional Area	<p>The roles and responsibilities for Health Services Functional Area are outlined in the Health Services (HEALTHPLAN) Supporting Plan.</p> <p>Roles and responsibilities in addition to the Supporting Plan are:</p> <ul style="list-style-type: none"> • Ensure that appropriate business continuity plans are developed for essential health infrastructure and are activated during floods.
Local Emergency Operations Controller (LEOCON)	<ul style="list-style-type: none"> • Monitor flood operations. • If requested, coordinate support for the NSW SES Incident Controller.
Local Emergency Management Officer (LEMO)	<ul style="list-style-type: none"> • If requested by the NSW SES Incident Controller, advise appropriate agencies and officers of the start of response operations.
Manly Hydraulics Laboratory (MHL)	<p>The roles and responsibilities of Manly Hydraulic Laboratory are outlined in the NSW State Flood Plan.</p>

AGENCY	RESPONSIBILITIES
Marine Rescue NSW (as per NSW State Flood Plan)	<p>Response</p> <ul style="list-style-type: none"> • When requested by NSW SES, assist in flood operations when training and equipment are available and suitable including assistance with: <ul style="list-style-type: none"> – Warning and/or evacuation of at risk communities; – Providing communications personnel; – Property protection tasks including sandbagging; and – Flood rescue operations.
NSW Ambulance	<p>The roles and responsibilities for NSW Ambulance are outlined in the Health Services (HEALTHPLAN) Supporting Plan.</p>
NSW Department of Education	<p>Preparedness</p> <ul style="list-style-type: none"> • Liaise with the NSW SES and arrange for the early release of students whose travel arrangements are likely to be disrupted by flooding and/or road closures (or where required, for students to be moved to a suitable location until normal school closing time); • Ensure that evacuation plans for flood liable schools have arrangements for flooding; and • Assist NSW SES with community engagement and capacity building programs. <p>Response</p> <ul style="list-style-type: none"> • Assist with the coordination of the evacuation of schools and the immediate welfare of students until returned to the appropriate carer; • Pass information to school bus drivers/companies and/or school principals on expected or actual impacts of flooding; and • Provide space in schools for evacuation centres where necessary.
NSW Department of Industry, Planning and Environment (as per NSW State Flood Plan)	<p>Prevention</p> <ul style="list-style-type: none"> • Oversee the delivery of the NSW Flood Prone Land Policy including financial support through the Floodplain Management Program. Provide technical advice to councils and state agencies including assistance with the identification of risks, the preparation and implementation of Floodplain Risk Management Plans and associated mitigation and management actions, and understanding flood mitigation schemes including levees. • Work with the NSW SES on the Flood Data Access Program to improve the provision of flood information through the NSW Flood Data Portal; • Assist the Department of Industry-Water in the preparation of rural floodplain management plans under the <i>Water Management Act 2000</i> (NSW); and <p>Preparedness</p>

AGENCY	RESPONSIBILITIES
	<ul style="list-style-type: none"> • Assist the NSW SES in the exercising of Flood Sub Plans; • Management of the state government’s water level gauges for the flood warning network in tidal areas in NSW (Manly Hydraulic Laboratory operates this system as a service provider on behalf of DPIE.); • Advise NSW SES about conditions which may lead to coastal inundation or retarded river drainage near the coast. <p>Response</p> <ul style="list-style-type: none"> • Provide related advice on flood risks to the NSW SES on request; and • Work with the relevant local council and NSW SES to collect flood related data during and after flood events. <p>Recovery</p> <p>Support recovery committees as required.</p>
NSW Food Authority	The roles and responsibilities for NSW Food Authority are outlined in the Food Industry Emergency Sub Plan .
NSW National Parks and Wildlife Services (as per NSW State Flood Plan)	<p>Preparedness</p> <ul style="list-style-type: none"> • Assist the NSW SES with identification of road infrastructure in National Parks at risk of flooding; <p>Response</p> <ul style="list-style-type: none"> • Close and reopen National Parks and Wildlife Service roads when affected by flood waters and advise the NSW SES of its status; • Facilitate the safe reliable access by emergency resources on National Parks and Wildlife Service managed roads; • Assist the NSW SES with the communication of warnings and information provision to the public through variable message signs and other appropriate means; and <p>Close and direct people to leave camping grounds at risk of flooding in National Parks and Wildlife Service managed areas.</p>
NSW Police Force (as per NSW State Flood Plan)	<p>Preparedness</p> <ul style="list-style-type: none"> • Participate in NSW SES briefings, training and exercises as required. <p>Response</p> <ul style="list-style-type: none"> • Provide a Liaison Officer to the NSW SES Operation Centre if required; • When requested by NSW SES, in flood operations when training and equipment are available and suitable; <ul style="list-style-type: none"> – Assist with warning and/or evacuation of at risk communities; – Assist with monitoring / reconnaissance of flood prone areas;

AGENCY	RESPONSIBILITIES
	<ul style="list-style-type: none"> – Assist with flood rescue operations; • Conduct road and traffic control operations in conjunction with council and/or RMS; • Coordinate searches for missing people within flood affected areas; • Coordinate security of supply lines, evacuated and damaged areas. • Manage Disaster Victim Registration; and • Operate the Public Information and Inquiry Centre, if requested or otherwise needed during flood events. <p>Recovery</p> <ul style="list-style-type: none"> • Participate in After Action Reviews as required.
NSW Rural Fire Service (as per NSW State Flood Plan)	<p>Preparedness</p> <ul style="list-style-type: none"> • Participate in NSW SES briefings, training and exercises as required; and • Meet the agreed arrangements described in the NSW SES/NSW RFS Memorandum of Understanding. <p>Response</p> <ul style="list-style-type: none"> • Provide a Liaison Officer to the NSW SES Operation Centre or Emergency Operations Centre as required; • Provide Incident Management Personnel when requested; • Provide trained staff to support a joint intelligence unit, if established by NSW SES; • Provide aviation support, management and advice as requested through the State Air Desk; • Provide speciality aircraft and appropriately trained personnel to perform Down the Wire (DTW) functions as required; • Assist with Damage Assessments; and • Provide Strike Teams during flood operations when requested by NSW SES. This may include assistance with: <ul style="list-style-type: none"> – Warning and/or evacuation of at risk communities; – Monitoring / reconnaissance of flood prone areas. – Property protection tasks including sandbagging; – Pumping flood water out of buildings and from low-lying areas; – Back-up radio communications; – Clean-up operations, including the hosing out of flood affected properties;

AGENCY	RESPONSIBILITIES
	<ul style="list-style-type: none"> – Deploying resources to communities within Rural Fire Districts where access is expected to be lost in consultation with the NSW SES; – The resupply of isolated communities and/or properties; and – Decontamination of NSW SES Flood Rescue Operators as required. <p>Recovery</p> <ul style="list-style-type: none"> • Participate in After Action Reviews as required.
<p>NSW Volunteer Rescue Association (as per NSW State Flood Plan)</p>	<p>Response</p> <ul style="list-style-type: none"> • Where requested by the NSW SES, assist in flood operations when training and equipment are available and suitable, including assistance with: <ul style="list-style-type: none"> – The warning and/or evacuation of at risk communities; – Flood rescue operations; – Monitoring / reconnaissance of flood prone areas; – Resupply of isolated communities and/or properties; and – Property protection tasks including sandbagging.
<p>Office of Emergency Management</p>	<p>The roles and responsibilities of the Office of Emergency Management are outlined in the NSW State Flood Plan.</p>
<p>Owners of Declared Dams within or upstream of the LGA (as per NSW State Flood Plan)</p>	<p>Preparedness</p> <ul style="list-style-type: none"> • Assist the NSW SES with community engagement programs; • Provide NSW SES with information necessary for response planning and warning distribution; • Assist the NSW SES identify correlations between water level and/or discharges at the dam for use in flood response operations (warning and evacuation); and • Consult with the NSW SES State Headquarters in the development of Dam Safety Emergency Plans, including the development of dam failure alerts, in accordance with the Dam Safety Committee Guidelines. <p>Response</p> <ul style="list-style-type: none"> • Where water level monitoring or other instrumentation allows, provide NSW SES with flood advices as per pre-agreed thresholds for use in downstream flood response operations (warnings); • Notify NSW SES of potential or actual dam failures in accordance with the Dam Safety Emergency Plan and Dam Safety NSW Guidelines; • Close at risk camping grounds / recreational areas within their managed areas;

AGENCY	RESPONSIBILITIES
	<ul style="list-style-type: none"> • In the case of declared dams whose risks are intolerable, assist the NSW SES in planning to warn and evacuate people at risk of dam failure and maintain and operate any special Dam Failure Warning Systems and/or automatic telemetered monitoring devices to assist with early detection of incidents which are installed until such time that the risks have been lowered to an acceptable level; and <p>Owners of gated dams:</p> <ul style="list-style-type: none"> • Provide all available information to the BoM and the NSW SES on storage levels and actual and prospective water releases and their likely impacts on downstream river levels; • Advise the downstream community of prospective and actual water releases, except in those circumstances where the BoM would issue flood warnings; and • Where possible actively work with NSW SES and the BoM to reduce the impacts of flooding on communities through management of water releases within identified safe parameters and within statutory licencing provisions under the <i>Water Management Act 2000</i> and <i>Water NSW Act 2014</i>.
Public Information Services Functional Area	<p>The roles and responsibilities for Public Information Services are outlined in the Public Information Services Supporting Plan.</p> <p>Roles and responsibilities in addition to the Supporting Plan are:</p> <ul style="list-style-type: none"> • On receipt of advice from NSW SES of any weather event likely to result in significant multi agency operational activity, the PIFAC determines if a daily multi-agency teleconference is required to ensure that the information needs of each agency are being met and to address any issues. These teleconferences continue through the response phase into the recovery phase.
Roads and Maritime Services (Transport for NSW)	<ul style="list-style-type: none"> • TMC in conjunction with RMS coordinates information on road conditions for emergency services access. • TMC in conjunction with RMS coordinates the management of the road network across all modes of transport. • Transport for NSW, TMC and RMS in conjunction will assist the NSW SES with the evacuation of at-risk communities by maintaining access and egress routes; • TMC will assist the NSW SES with the communication of flood warnings and information provision to the public through variable message signs (VMS) according to the VMS protocols and procedures; • Assist the NSW SES with identification of road infrastructure at risk of flooding.

AGENCY	RESPONSIBILITIES
SEOCN/SEOC	The roles and responsibilities of the SEOCN/SEOC are outlined in the NSW State Flood Plan.
Surf Life Saving NSW (as per NSW State Flood Plan)	<p>Preparedness</p> <ul style="list-style-type: none"> • Contribute to NSW SES reviews into plans, policies and procedures as required; and • Participate in NSW SES briefings, training and exercises as required. <p>Response</p> <ul style="list-style-type: none"> • Assist the NSW SES with the warning and/or evacuation of at risk communities; • Provide accommodation in Surf Life Saving facilities for evacuation centres where required; and • Assist the NSW SES with flood rescue operations, where training and equipment are suitable.
Telecommunications Services Functional Area	The roles and responsibilities for Telecommunications Services are outlined in the Telecommunications Services (TELCOPLAN) Supporting Plan .
Transport Services Functional Area	<p>The roles and responsibilities for Transport Services are outlined in the Transport Services Supporting Plan.</p> <p>Roles and responsibilities in addition to the Supporting Plan are:</p> <ul style="list-style-type: none"> • Participate in risk management studies; • Assist the NSW SES to identify transport infrastructure at risk of flood damage for incorporation into planning and intelligence; and • Coordinate the provision of traffic and transport operations as consistent with the roles of Transport organisations.
WaterNSW	The roles and responsibilities for WaterNSW are outlined in the NSW State Flood Plan.
Welfare Services Functional Area	The roles and responsibilities for Welfare Services are outlined in the Welfare Services Functional Area Supporting Plan.

11 Appendix C – Community Specific Roles and Responsibilities

<p>Community Members</p>	<p>Preparedness</p> <ul style="list-style-type: none"> • Understand the potential risk and impact of flooding; • Prepare homes and property to reduce the impact of flooding; • Understand warnings and other triggers for action and the safest actions to take in a flood; • Households, institutions and businesses develop plans to manage flood risks, sharing and practicing this with family, friends, employees and neighbours; • Have an emergency kit; and • Be involved in local emergency planning processes.
<p>Bega Local Aboriginal Land Council – 187 Carp Street Bega NSW 2550</p>	<ul style="list-style-type: none"> • Act as the point of contact between the NSW SES and the Bega community. • Inform the NSW SES Bega Local Commander about flood conditions and response needs. • Disseminate flood information, including flood and evacuation warnings, to the Bega community.

HAZARD AND RISK IN BEGA VALLEY SHIRE

Volume 2 of the Bega Valley Shire Local Flood Emergency Sub Plan

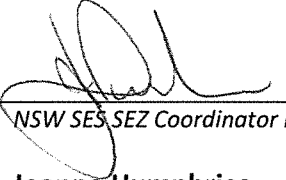
Last Update: November 2021



AUTHORISATION

The Hazard and Risk in Bega Valley Shire LGA has been prepared by the NSW State Emergency Service (NSW SES) as part of a comprehensive planning process. The information contained herein has been compiled from the latest available technical studies.

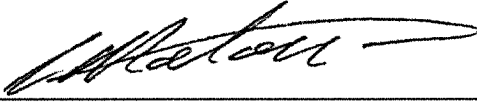
Approved

Signature: 
NSW SES SEZ Coordinator Planning

Print name: **Joanne Humphries**

Date: 15 December 2021

Approved

Signature: 
NSW SES SEZ Zone Commander

Print name: **Colin Malone**

Date: 15 December 2021

Date Tabled at LEMC: 16 February 2022

CONTENTS

AUTHORISATION

HAZARD AND RISK IN	1
BEGA VALLEY SHIRE	1
AUTHORISATION	1
CONTENTS.....	2
LIST OF TABLES.....	4
VERSION LIST.....	5
AMENDMENT LIST	5
1.1 Overview of Bega Valley Shire	6
1.2 Landforms and River Systems.....	7
THE BEGA RIVER BASIN	7
THE TOWAMBA RIVER BASIN.....	9
TUROSS RIVER BASIN	11
1.3 Storage Dams.....	12
1.4 Weather Systems and Flooding	15
1.5 Characteristics of Flooding	16
COASTAL THREATS	17
1.6 Flood History.....	19
1.7 Flood Mitigation Systems	24
1.8 Extreme Flooding.....	24
2.1 Community Profile.....	25
SPECIFIC RISK AREAS - FLOOD	28
2.2 Bega	28
2.3 Tarraganda and Angledale.....	32
2.4 Candelo	34
2.5 Tathra and Mogareeka	36
2.6 Bermagui / Wallaga Lake / Cuttagee / Murrah.....	39
2.7 Buckajo and Springvale.....	41
2.8 Jellat Jellat, Kalaru and Wallagoot.....	42
2.9 Bemboka	44
2.10 Merimbula	46
2.11 Eden	50
2.12 Boydtown.....	52
2.13 Towamba	55

ROAD CLOSURES AND ISOLATED COMMUNITIES 57

2.14 Road Closures 57

2.15 Summary of Isolated Communities and Properties..... 66

ANNEX 1: BEGA RIVER BASIN SCHEMATIC 69

ANNEX 2: FACILITIES AT RISK OF FLOODING AND/OR ISOLATION 70

MAP 1 - BEGA RIVER BASIN 73

MAP 2 - TOWAMBA RIVER BASIN 74

MAP 3 - TUROSS RIVER BASIN..... 75

MAP 4 - BEGA TOWN MAP..... 76

MAP 5 - TARRAGANDA TOWN MAP 77

MAP 6 - ANGLEDAL TOWN MAP..... 78

MAP 7 - CANDELO TOWN MAP 79

MAP 8 - TATHRA AND MOGAREEKA TOWN MAP 80

MAP 9 - BERMAGUI TOWN MAP..... 81

MAP 10 - WALLAGA LAKE 82

MAP 11 - BUCKAJO TOWN MAP..... 83

MAP 12 - SPRINGVALE TOWN MAP..... 84

MAP 13 - JELLAT JELLAT TOWN MAP 85

MAP 14 - KALARU TOWN MAP..... 86

MAP 15 - WALLAGOOT TOWN MAP 87

MAP 16 - BEMBOKA TOWN MAP 88

MAP 17 - MERIMBULA TOWN MAP..... 89

MAP 18 - EDEN TOWN MAP 90

MAP 19 - BOYDTOWN MAP 91

MAP 20 - TOWAMBA TOWN MAP 92

LIST OF REFERENCES 93

LIST OF TABLES

Table 1:	Declared Dams in Bega Valley Shire LGA; summary of information about each storage. .	12
Table 2:	Indicative Flow Travel Time for the Bemboka/Bega River (15)	16
Table 3:	Indicative Flow Travel Time for the Brogo River (15)	16
Table 4:	Indicative Flow Travel Time for the Tantawangalo Creek (15)	16
Table 5:	Estimated design flood heights related to the Bega North Gauge (219990) (1)	21
Table 6:	Flood History for floods above moderate level at the Bega North Gauge (219900).....	22
Table 7:	Census of Housing and Population data (2016) (23)	25
Table 8:	Estimated number of properties inundated above floor level in Bega related to the Bega North Gauge (219990) (14).....	29
Table 9:	Estimated number of properties flooded in design events by catchment overflow.....	48
Table 10:	Roads liable to flooding in Bega Valley Shire LGA.	57
Table 11:	Potential Periods of isolation for communities in the Bega Valley Shire LGA during flooding events	67

VERSION LIST

The following table lists all previously approved versions of this Volume.

Description	Date
Bega Valley Shire Local Flood Plan Annex A and B	May 2007
Bega Valley Shire Local Flood Plan	January 2017

AMENDMENT LIST

Suggestions for amendments to this Volume should be forwarded to:

South Eastern Zone
 NSW State Emergency Service
 56-58 Knox Street
 GOULBURN NSW 2580

Amendments promulgated in the amendments list below have been entered in this Volume.

Amendment Number	Description	Updated by	Date

Document Issue: Version 1-04112021

THE FLOOD THREAT

1.1 OVERVIEW OF BEGA VALLEY SHIRE

- 1.1.1 The Bega Valley Shire Local Government Area (LGA) is located on the far south coast of NSW, extending from Wallaga Lake in the north to the Victorian border in the south approximately 400km south of Sydney, 600km northeast of Melbourne and 230km southeast of Canberra. Major Highways located within the Shire include the Princes Highway, the Snowy Mountains Highway/Tathra Road and the Monaro Highway. (1) Its coastline comprises a wide variety of sandy beaches between rocky headlands, nearshore reefs and estuaries. A significant proportion of the Shire's coastline is located within National Parks. Development is focussed around the major urban settlements of Bermagui, Tathra, Tura Beach, Merimbula, Pambula Beach and Eden (2). The three river catchments in the Bega Valley Shire LGA are shown on Maps 1, 2 and 3.
- 1.1.2 The major business centre of the region is Bega. Major towns in the Shire are Bermagui, Eden, Merimbula and Pambula. Other smaller towns include Pambula Beach, Tathra, Tura Beach, Cobargo, Candelo, Wolumla, Bemboka, Kalaru and Towamba (1). Agriculture, forestry, fishing, aquaculture and tourism are the key water reliant industries in the area. Bega Valley shire was significantly impacted by the 2019-20 bushfires (the Black Summer fires). Bega Valley LGA has significant environmental assets with a large number of Intermittently Closed and Open Lakes and Lagoons (ICOLLS) and the largest area of coastal wilderness in NSW. (3)
- 1.1.3 The Bega Valley Shire LGA has a high density of creeks and rivers in addition to numerous coastal lakes, estuaries, lagoons and inlets. Flooding can occur on all these watercourses, but in general the serious consequences of flooding are confined to the valley of the lower Bega River. Flooding can also occur at and around the townships including Merimbula, Pambula, Eden and Towamba. On rare occasions, storm tides can also cause flooding along the coast itself. Flooding on other rivers and creeks within the council area occurs similarly to the Bega and Brogo Rivers however with shorter warning times (4).
- 1.1.4 Large parts of the Bega Valley Shire LGA area, especially in the west and south, are virtually unpopulated and largely undeveloped. The main impacts of flooding in these areas are isolations of small towns and properties due to road, bridge and causeway closures. Significant disruption to transport networks is experienced during periods of flooding (4).
- 1.1.5 The Traditional owners of the Bega Valley Shire LGA are the communities of the Yuin-Monaro Nations. Under the NSW Aboriginal Land Rights Act 1983 there are three Local Aboriginal Land Councils (LALC) across the Bega Valley Shire LGA. From north to south the LALC are Merrimans (Wallaga Lake) LALC, Bega LALC and Eden LALC. The Wallaga Lake historical Aboriginal Reserve, now known as the 'Wallaga Lake Koori Village' is situated on the northern side

of the lake, within Bega Valley Shire LGA. The Bega Valley Aboriginal Cultural Heritage Study (5) identified 296 places within the Bega Valley Shire LGA. In many cases areas of significance for Aboriginal people are places like ridgelines, areas adjacent to creeks and rivers, caves, rock formations and coastal headlands. In an effort to manage and minimise the risk of unintended damage to highly sensitive heritage conservation and cultural areas these places are included in the Local Environmental Plans (LEPs) (6) and the Aboriginal Heritage Information Management System (AHIMS) registration (7)

1.2 LANDFORMS AND RIVER SYSTEMS

THE BEGA RIVER BASIN

- 1.2.1 The Bega River Basin is shown on Map 1. The basin incorporates multiple river catchments and coastal lakes described below.
- 1.2.2 The main coastal entrances in the Bega Valley Shire are Wallaga Lake, Bega River, Back Lake, Merimbula Lake, Lake Curalo, Wonboyn Lake and Pambula Lake. The entrances may tend to close during periods of low rainfall and re-open by natural scour in high runoff events.

The Bega & Brogo River Catchments

- 1.2.3 The river systems associated with the Bega and Brogo River Catchments converge at the township of Bega (Map 1). In its upper reaches the Bega River is known as the Bemboka River. The entire system drains an area of 1940km², of which 1800km² are upstream of the township of Bega (4)
- 1.2.4 The headwaters of the river catchments are in the rugged bushland country of the Kybean Range, about 60 kilometres from the coast. The western most tributaries (Yankees Creek on the Brogo River and Georges, Rutherford and Bonar Creeks and Nunnock River on the Bemboka) are in deeply dissected upland country of over 1000 metres elevation. The country is steep and flow velocities are high (4).
- 1.2.5 In the higher parts of the catchments are two dams, Brogo Dam (about 15 kilometres upstream of the locality of Brogo) and the smaller Cochrane Dam on a tributary of the Bemboka River. In addition there are several weirs on the upper Bemboka and its tributaries. None of these devices provide significant flood mitigation capacity (4).
- 1.2.6 Below the dams, the rivers are contained within well-defined watercourses for several kilometres with little overbank storage. The main tributaries in these sections are the House and Double Creeks, which feed the Brogo River, and the Sandy, Tantawangalo, Candelo and Wolumla Creeks which enter the Bemboka. Downstream of its confluence with Sandy Creek, the Bemboka is known as the Bega River (4).
- 1.2.7 From around the confluences of the Double and Tantawangalo Creeks respectively, the Brogo and Bega rivers assume a sand and shingle bed morphology. The main channels contain relatively low flows, their banks being

slightly leveed and allowing containment of minor freshes, but in periods of higher flows the flood waters break out and create active anabranches along the valley edges. Broad flood plains have developed on these stretches of both rivers (4).

- 1.2.8 The Brogo River discharges to the Bega River north of the Bega Township, 24 kilometres above the ocean outlet, and the floodplain immediately widens considerably. Flooding of the Brogo River impacts Angledale Road, although the community does have access to the Princes Highway and can reach the Bega Township if required. The Bega River (downstream of the Princes Highway Bridge) flows adjacent to the Bega Township, the key flood mechanism is overbank flooding and can extend some 500 m across both the right and left sides of the floodplain. (2)
- 1.2.9 Tarraganda and the Jellat Jellat Flats further downstream act as large off-river storage areas. Downstream of the Jellat Jellat Flats, the river enters Bottleneck Reach which is both the tidal limit and a natural constriction formed by hills to the north and south (4).
- 1.2.10 Bottleneck Reach runs for approximately 7 km and fully contains all events up to and including the PMF. Bottleneck Reach also results in backwater effects extending upstream towards Bega. In the PMF event, this backwater effect extends as far as the Princes Highway. (2)
- 1.2.11 The outlet of the Bega River is located at Mogareeka Inlet, 11 kilometres below Bottleneck Reach (4). The tidal influence extends approximately 15 km upstream to Jellat Jellat, although in large flood events, the influence of ocean levels extends as far upstream as Bega. (2)

The Bermagui River Catchment

- 1.2.12 The Bermagui River is fed by Nutleys, Myrtle and Coolagolite Creeks. The system drains a catchment of 90km² and extends inland less than 15km. In its lower reaches the Bermagui River meanders within a floodplain of up to 1.5km in width before reaching the sea at Bermagui (4).

Minor Watercourses

- 1.2.13 Other watercourses draining the Bega River Basin are the Murrah River and Wapengo Creek (which fall between the Bermagui and Brogo catchments) (4).
- 1.2.14 The distribution of rainfall over their catchments is similar to that over the Bega and Brogo catchments, with high rainfall in the more elevated inland areas and rain shadows having developed in sheltered areas. Flood seasonality is also similar to that experienced on the Bega and Brogo rivers (4).

Coastal Lakes

- 1.2.15 Flooding can also occur on the various lakes and embayment's along the coast (Wallaga, Barragoot, Cuttagee, Murrah, Wapengo and Wallagoot Lakes), especially if their openings to the sea become restricted by the build-up of sand (4).

THE TOWAMBA RIVER BASIN

- 1.2.16 The Towamba Basin is shown on Map 2. It contains multiple river catchments and coastal lakes described below.

The Pambula River Catchment

- 1.2.17 The Pambula River rises in the rugged Gnupa State Forest east of Wyndham and flows into Pambula Lake where it is joined by the Yowaka River. The main tributaries in the upper and middle reaches are Crawleys, Seven Mile, Chalkhills, Burton and Back Creeks. Most of the catchment is hilly or mountainous and the only areas of floodplain are in the vicinity of Pambula itself (4).
- 1.2.18 The Pambula River, Pambula Lake and Yowaka River catchment covers an area of over 300 square kilometres within the Bega Valley Council Local Government Area (LGA). The catchment extends across forested and rural areas, as well as the villages of Pambula, South Pambula, Pambula Beach, Broadwater, Greigs Flat, Nethercote and Lochiel.
- 1.2.19 During periods of heavy rainfall in the catchment there is potential for water to overtop the banks of the various creeks and rivers and inundate the adjoining floodplain, including parts of the villages. Floodwaters in the catchment can damage property and vehicles and may pose a risk to life during large floods. In addition, flooding can overtop major transportation links within the catchment including the Princes Highway, Nethercote Road, Mount Darragh Road and Back Creek Road, which can inconvenience and isolate many individuals and families.
- 1.2.20 The Pambula River drains into the Tasman Sea near Pambula beach. Ocean level at the time of flooding can have an impact on flood behaviour across the lower-lying, estuarine sections of the catchment.

The Towamba River Catchment

- 1.2.21 Towamba River is the main waterway draining the catchment to Twofold Bay. The flood behaviour of the Towamba River carves a path from the foot of the steep escarpment, through rugged hills, flats and granite country, to empty into the ocean at the Kiah Inlet. (8)
- 1.2.22 The catchment area of the Towamba River is 1,026 km². The river rises approximately 9 km north of the Coolangubra Mountain, below Mount Marshall and flows generally south-east and then north-east, joined by twelve tributaries including (ordered by descending elevation) Back Creek (198m), Basin Creek (184m), New Station Creek (177m), Mataganah River (164m), Reedy Creek (158m), Wog Wog River (76m), Pericoe Creek (75m), Camping Ground Creek (57m), Stony Creek (41m), Jingo Creek (39m), Stanleys Creek (9m) and Shelleys Creek (1m), before reaching its mouth, emptying into Nullica Bay, within Twofold Bay, east of Boydtown. The river descends 533 metres over its 86 km course. The Towamba River catchment is bound by the Bega River catchment to the north, the Snowy River catchment to the west

and the Genoa River catchment to the south. The Princes Highway crosses the Towamba River at the locality of Kiah. (8)

- 1.2.23 Wyndham is located in the northern region of the wider Towamba River catchment, the Wyndham township has the smallest contributing catchment area of the five Towamba River study areas. Flooding is well contained within the creek in all events, up to and including the PMF.
- 1.2.24 Rocky Hall is located in the north-west of the wider Towamba River catchment. It is the most upstream catchment of the study areas located along the Towamba River. Flow is typically well contained along those reaches between tributaries.
- 1.2.25 The locality of New Buildings lies adjacent to Towamba River 3.5 kilometres downstream of Rocky Hall, immediately upstream of the Mataganah Creek confluence.
- 1.2.26 Burragate is located on the Towamba River, 6 kilometres downstream of New Buildings. Unlike Rocky Hall and New Buildings, there is a reasonable level of development at Burragate. The development is rural and large lot residential and is generally located on the eastern bank of the Towamba River. Roads throughout the study areas are cut in events as small as the 20% AEP, including river crossings at Rocky Hall, New Buildings and Burragate. Regional access routes in the Bega Valley Shire LGA are also likely to be cut in major flood events.

Minor watercourses

- 1.2.27 Other watercourses draining the Towamba River Basin are the Wonboyn, Merrica and Nadgee Rivers (which drain the hilly coastal country south of the catchment of the Towamba River), and the Wallagaraugh River which flows in a south-easterly and southerly direction to join the Genoa River in Victoria (4).
- 1.2.28 Little information exists on flooding on these rivers and creeks. It is known, however, that the distribution of rainfall over their catchments is similar to that over the Bega and Brogo catchments, with high rainfall in the more elevated inland areas and rain shadows having developed in sheltered areas. Flood seasonality is also similar to that on the Bega and Brogo Rivers (4).

MERIMBULA AND BACK LAKE CATCHMENTS

- 1.2.29 The Merimbula Lake and Back Lake catchments including their tributaries of Millingandi Creek, Boggy Creek, Bald Hills Creek and Merimbula Creek converge at the township of Merimbula where they drain into the Tasman Sea. (9)
- 1.2.30 Merimbula Creek flows through the Merimbula township before flowing into the Tasman Sea at Back Lake which is intermittently closed at the southern end of Short Point Beach near Mirador Estate.

- 1.2.31 Millingandi Creek, Boggy Creek and Bald Hills Creek drain into the Merimbula Lake before draining into the Tasman Sea through a sandbar entrance at the northern end of Merimbula Bay at Merimbula Beach.
- 1.2.32 Flooding can occur at the tributaries Millingandi, Boggy, Bald Hills and Merimbula Creeks and can be influenced by the restrictions and blockages at the ocean entrances due to the build-up of sand. Elevated water levels can also occur as a result of ocean storm surges (3).
- 1.2.33 The entrance of Back Lake is managed by Council and is opened when water levels in the lake reach a set trigger level of 1.4m AHD.

Other Coastal Lakes

- 1.2.34 Flooding can also occur on the various lakes and embayment's along the coast (Curalo and Pambula Lakes), especially if their openings to the sea become restricted by the build-up of sand. Pambula Lake is known locally as Broadwater (4).

TUROSS RIVER BASIN

- 1.2.35 The upper reaches of the Tuross River Basin extend from the Eurobodalla Shire LGA into the north-western corner of the Bega Valley Shire LGA (Map 3). The area is unpopulated and located within the Bodalla and Wandella State Forests.
- 1.2.36 The Yowrie and Wadbilliga Rivers, which drain the north-western portion of the council area, flow northwards to join the Tuross River in the Eurobodalla LGA (4).

1.3 STORAGE DAMS

1.3.1 There are four declared dams within the Bega LGA that pose some risk to downstream populations should they fail. These include:

- a. Ben Boyd Dam
- b. Brogo Dam
- c. Cochrane Dam and
- d. Yellow Pinch Dam.

1.3.2 These dams are further described in the tables below. Dam locations are shown on Maps 1-3.

Table 1: Declared Dams in Bega Valley Shire LGA; summary of information about each storage.

Ben Boyd (10) DSNSW I.D. 17 DEP NSW SES Library 219-17003 (2008)	
Owner / Operator	Bega Valley Shire Council
Description of Dam	Height = 29m, crest length = 225m and crest width = 8m. Capacity = 800ML, unlined open channel spillway with capacity 25m ³ /sec.
Location	Latitude -37.1182° S, Longitude 149.8576° E Located approx. 8km south-west of Eden. Part of the Tantawangalo Water Supply Augmentation Scheme.
Communities Downstream	The consequences of dam failure are - flooding of the Princes Hwy, North and South of Boyd Town; Two properties flooded immediately downstream from the dam (but not the residences). The flood wave travel time to arrive at the residential area is less than 15 minutes for both cases. Two Caravan Parks could potentially be isolated due to flooding of the Princes Highway. Further houses in new development areas in Boydtown are potentially at risk during dam failure.
Monitoring System	Hydraulic piezometers (monthly), electric piezometers (monthly), seepage weirs (weekly), groundwater observation holes (monthly), storage level (weekly) , rain gauge (weekly)
Warning System	No warning system identified
Other	Severe flooding would also be likely to cause significant damage to roads, bridges, power lines and other infrastructure.

Brogo Dam (11) DSNSW I.D. 34 DEP NSW SES Library 219-10167 (June 2021)	
Owner / Operator	WaterNSW
Description of Dam	Concrete lined dam with compacted rock fill; 43 metres high and 260m long at crest level. Storage capacity at FSL is 8,980ML with catchment area of 400 square kilometres. Lake size is 1km ² . An unlined rock cutting spillway is located just north of the dam wall. The dam provides water for irrigation, stock and domestic requirements on the NSW South Coast. Water released from Brogo

	Dam is taken from the river downstream for the townships of Quaama, Cobargo and Bermagui.
Location	Latitude -36.4902° S, Longitude 149.7414° E Situated on the Brogo River 28km upstream from its junction with the Bega River Basin. During major flooding, Warrigal Range Road can become impassable for short periods at House Creek, approximately 2.5km from the junction of the Princes Highway.
Communities Downstream	Towns of Brogo and Bega and farmers downstream along the Brogo River.
Monitoring System	Seepage monitoring (Daily), Deformation survey (Yearly), Visual Inspection (Daily/Weekly), Chemical Analysis (Yearly)
Warning System	No warning systems noted. WaterNSW does have an Early Warning Network for notifying self-enrolled downstream landholders and other interested parties. Flood notifications indicate the dam is releasing controlled or uncontrolled flows, likely to cause downstream flooding. High regulated release notifications are issued when operations may impact landholders immediately downstream or when releasing higher than normal flows.
Other	Dam break resulting from extreme rainfall would be preceded by flooding many times more destructive than from a flood equivalent to the 1971 flood of record in the Bega Valley, and consequently vast areas downstream of Brogo Dam would already have been evacuated.

Cochrane Dam (12) DSNSW I.D. 67 DEP NSW SES Library 219-11361 (2020)	
Owner / Operator	Cochrane Dam Pty Ltd
Description of Dam	Earth and Rock fill with concrete core wall. Storage capacity at FSL: 4,750ML
Location	Latitude -36.5652° S, Longitude 149.4512° E Cochrane Dam is located on Georges Creek about 29 km east of Nimmitabel and 17 km west of Bemboka. Located in the Bega River Basin.
Communities Downstream	7 buildings downstream. Impact on low lying areas in the towns of Bemboka and Bega - depth not likely to be significant. A dam break flood wave from a dam failure at Cochrane Dam would travel down the Bemboka River and finally into the Bega River. 'Sunny day' failure would inundate Brown Mountain Power Station and the Nobby Park Road and Pollacks Flat Road bridges. 'PMF' failure would also inundate one dwelling and the sports ground at Bemboka.
Monitoring System	Routine Visual Inspection - carried out twice a week by inspection staff, Routine Inspection and Monitoring - carried out at four-monthly intervals. Other inspections for particular purpose, flood event and conditions; Intermediate Inspection (annually), Special Inspection, Emergency Inspection, and Audit Inspections.
Warning System	A radio telemetry flood warning system is installed to provide advanced warning of severe flooding at the dam.
Other	Potential for the inundation of the Brown Mountain Power Station resulting in loss of operational functionality; The structural integrity of the bridge on the Snowy Mountains Highway over the Bemboka

	<p>River may be compromised and ongoing monitoring must occur; Inundation of 7 buildings downstream; Inundation of all low-lying areas along the Bemboka and Bega Rivers including picnic/camping areas, Bemboka sports ground, Bega Racecourse and sewerage treatment plant.</p> <p>Normal access to Cochrane Dam is via a 7 km long logging road through the Glenbog State Forest from the Snowy Mountains Highway, 22 km east of Nimmitabel. A locked gate at the end of the road prevents vehicular access to the dam. A key to this gate is held in the power station. Normal travelling times to the dam via the Snowy Mountains Highway are; Nimmitabel to Cochrane Dam 30 min. Brown Mountain Power Station to Cochrane Dam 25 min. Bemboka to Cochrane Dam 30 min.</p>
--	---

Yellow Pinch Dam (13) DSNSW I.D. 328 DEP NSW SES Library 219-17089 (2008)	
Owner / Operator	Bega Valley Shire Council
Description of Dam	Storage capacity is 3000ML. Max height 40m, crest length 200m, crest width 7m complete with intake tower, outlet works and spillway
Location	Latitude -36.8318° S, Longitude 149.80119° E Located 2km south of Wolumla, 10km northwest of Merimbula and 30km south of Bega part of the Bega River Basin.
Communities Downstream	Merimbula caravan park. In a PMF potential for break out flows to occur between Back Lake and Merimbula Lake, potential to affect over 20 properties (21 are identified below), including the Merimbula Public School, with flows of up to 1.8m depth which is located in the centre of the low point. (14)
Monitoring System	Hydraulic Piezometers (monthly), Electric Piezometers (monthly), Seepage weirs (weekly), Groundwater observation holes (6 monthly), Crest and surface settlement points (6 monthly), Storage level and rain gauge (weekly)
Warning System	No warning system identified
Other	Bridges crossing the Princes Highway south of Wolumla will be under water up to 5m deep; Reid Street bridge will be underwater by approx. 1m; the caravan park near Reid Street Bridge will be inundated. Up to 7 residences are at risk during a PMF dam failure. Short warning times of only 30 minutes for Sunny Day dam break and 40 minutes for PMF dam break.

1.4 WEATHER SYSTEMS AND FLOODING

- 1.4.1 Precipitation generally increases with land elevation as a result of orographic influences. Average annual rainfall varies from about 625mm in rain shadow areas to about 1250mm in the higher headwater areas of the Kybean Range (4).
- 1.4.2 Rainfall is distributed fairly evenly across the seasons, though the summer months are slightly wetter than the winter ones. The high country to the west of the council area shelters the far south coast of NSW from the moist south-westerly airstreams which are the predominant rain-producing systems over the southern inland of the state during the winter months (4).
- 1.4.3 Most flood-producing rains are the result of incursions of moist tropical air masses or occasional cold fronts, or of very heavy storm rainfalls generated by active depressions centred off the coast. Storms resulting from off-coast depressions have occurred about twice per year on average and can produce 24-hour falls of more than 500mm. The most severe such storms result from weather configurations in which a high-pressure system located over Victoria or Tasmania is combined with a deep, slow-moving low-pressure cell over the south coast of NSW. A vigorous onshore flow of moist, warm air occurs under these circumstances and very heavy rains fall on the coast and over the range country. The magnitude of the resulting discharges depends on the level of antecedent moisture as well as on the distribution, duration, and volume of the rainfall (4).
- 1.4.4 Rainfall intensities for the Bega and Brogo Rivers Catchment show that over a 12-hour period 8.08mm per hour equates to a 2-year ARI event and 18.8mm per hour equates to a 50-year ARI event. The critical duration of a storm over the Bega and Brogo River Catchment for modelled events between the 10% AEP (Annual Exceedance Probability) and 1% AEP event is between 36 and 48 hours (1).
- 1.4.5 Flooding in the Bega Valley is most likely to occur between February to June, although flooding can occur at any time of year. The majority of the floods recorded have occurred in these months, however some Major and Moderate floods have also occurred during December and January. Minor floods have occurred during all months of the year with the exception of September.
- 1.4.6 Coastal Storms: East Coast Low (ECL) events are intense extra-tropical storm systems that are generally the governing extreme weather system for the south-eastern Australia coastal fringe and surrounding ranges. ECL events are enclosed low-pressure systems that develop over or track into NSW or the adjacent Tasman Sea. (9)
- 1.4.7 Extreme winds, rain, waves and elevated coastal water levels are common hazards associated with ECL events in NSW, and the impact of these hazards on the NSW coastline and inland across the Great Dividing Range vary depending on the type, track, intensity and duration of the event. (9)

- 1.4.8 ECL events generally occur within an area between the NSW coast to 160° E and 25° S to 40° S which includes the Bega Valley Shire. (9)

1.5 CHARACTERISTICS OF FLOODING

- 1.5.1 Flooding in the Bega/Brogo Rivers catchment is a combination of riverine flooding and overland flooding. During a flooding event the Jellat Jellat Flats and Tarraganda acts as large flood storage areas (1). These areas start to fill with water when the Bega North (also known as the North Bye) gauge (219900 BoM site) at Bega reaches 1.28m. This is well below the minor flood level of 4.6m.
- 1.5.2 The Bega and Brogo Rivers act as floodways during all events ranging from minor flooding to the PMF event. During the 1% AEP and PMF events the areas surrounding the Princes Highway Bridge over the Bega River also act as a floodway. Flooding that inundates properties within the catchment is generally fringe flooding (15) (1).
- 1.5.3 Indicative flow travel times between key water level gauges are shown within Tables 2 to 4. A schematic diagram representing these gauges and travel times within the Bega River Basin is also provided in Annex 1.

Table 2: Indicative Flow Travel Time for the Bemboka/Bega River (16)

Locations	Travel Time
Morans Crossing Gauge (219003) to Bega North Gauge (219900)	6-9 hours

Table 3: Indicative Flow Travel Time for the Brogo River (16)

Locations	Travel Time
Brogo Dam Site Gauge (219024) to North Brogo Gauge (219013)	2 hours
North Brogo Gauge (219900) to Angledale Gauge (219025)	3-4 hours

Table 4: Indicative Flow Travel Time for the Tantawangalo Creek (16)

Locations	Travel Time
Candelo Dam site Gauge (219022) to Bega River Junction	4 hours

- 1.5.4 Overland flow flooding has been known to occur within Merimbula CBD. Overland flow issues may also be compounded if rainfall coincides with elevated lake levels, which restrict the ability of the local drains to discharge water (9). In September 2014 roads and shop fronts at Merimbula were impacted by flash flooding caused by an intense local rainfall burst. Council has subsequently undertaken drainage improvements and the Merimbula Bypass was completed in September 2017, both of which may have impacted

the overland flow behaviour within the CBD. The bypass runs from the roundabout on Merimbula Drive, into Park Street, taking in a re-aligned Palmer Lane and Monaro Street intersection before reaching the new traffic lights at Monaro and Market Streets. (9)

- 1.5.5 The five Towamba River catchment study areas all exhibit similar flood behaviour. The major flow path through each area is a large riverine flow path. Flows within the river channel are typically well contained at all sites for events up to and including the 1% AEP. (8)
- 1.5.6 Given the large flows, velocities through the main channel are high at all sites, with peak river velocities of between 5 and 6 metres per second occurring at all sites in the 1% AEP event. (8)
- 1.5.7 In the PMF event, flood extents expand beyond the main channel significantly, as a result of the substantially higher flow in this event. PMF event flow is approximately 3 times larger than the 1% AEP event flow at Towamba, and up to nearly 6 times higher in the upper catchment at Wyndham. (8)
- 1.5.8 Eden township covers both Lake Curalo and Lake Cocora and the flow is typically well contained in events up to and including the 2% AEP event. In the 1% AEP event, flow begins to break out of the creek, and affects the adjacent industrial properties. (8)
- 1.5.9 Flooding within the Bega LGA is driven by both lake flooding and catchment flooding. Catchment flooding controls the peak flood levels across much of the Bega LGA. Flow is well contained along most flow paths, although increasing levels of break out flow occurring with increasingly larger events. The critical duration across the study area ranges from 2 hours, for those areas with small upstream catchment areas (for example Wonboyn), up to 9 hours, for those areas with a larger contributing catchment (for example Palestine Creek).

COASTAL THREATS

- 1.5.10 Elevated ocean levels caused by unusually high tides or by strong winds, wave run-up or low barometric pressures can be experienced leading to inundation of low-lying areas.
- 1.5.11 East Coast Low (ECL) events are intense extra-tropical storm systems that are generally the governing extreme weather system for the south-eastern Australia coastal fringe and surrounding ranges. Extreme winds, rain, waves and elevated coastal water levels are common hazards associated with ECL events in NSW. Severe ECL's have resulted in major property losses and loss of life.
- 1.5.12 Assessment of the dune height along the Bega Valley Shire beaches has identified that direct oceanic inundation of hind dune areas as a result of elevated water levels is unlikely. However, during storm tide events, elevated ocean levels as a result of storm tide, surge and wave set-up can potentially inundate lower estuary areas (17).

- 1.5.13 Coastal area of concerns are Bermagui Coast, including the ocean beaches around Wallaga Lake and Bermagui River; Cuttagee / Murrah, including Baragoot Beach and Cuttagee Beach; Tathra, including the ocean beaches around the Bega River estuary; Merimbula Coast, including Merimbula/Pambula Beach and Tura Beach; Twofold Bay, including the ocean beaches around Lake Curalo, Nullica River, Towamba River, Fisheries Creek; and Wonboyn, including Disaster Bay Beach and Wonboyn Lake.
- 1.5.14 Erosion History: Bega Valley Shire's coastline experienced significant erosion during the 1970's, impacting various coastal assets, including roads, surf clubs, caravan parks, private property, and public foreshore recreational areas. (17)

1.6 FLOOD HISTORY

Bega

- 1.6.1 Floods have been recorded on the Bega and Brogo River system since European settlement began during the early 1840's. Floods in 1851 and 1852 proved disastrous to the early town which was located at the confluence of the two rivers, and Bega was moved to its present site on the higher ground to the south of the junction. Later floods in 1870, 1873 and 1898 caused great damage to crops, bridges, culverts, roads and fences and substantial stock losses were incurred (4).
- 1.6.2 Severe flooding was not common between 1900 and 1950, although serious events occurred in 1919 and 1934. These were the fifth and sixth highest floods recorded at the Bega North Gauge (also known as North Bega Gauge) (219900). Repeated flooding, mostly within the minor flood range, has been experienced since 1950, with more severe floods in June 1952, May 1963, February 1971, March 1975, June 1978, and March 2011. In some cases, notably in 1952, flood impacts were unusually severe because of a sequence of flood events in quick succession, later floods occurring before the drainage of earlier ones had been completed (4).
- 1.6.3 The most severe flood ever recorded at Bega (and in fact on most reaches of the Brogo and Bega rivers) was in 1971 when up to 900mm of rain fell over both catchments in a 15-day period with falls of over 600mm at locations such as Bemboka and Upper Brogo in two days (6th and 7th of February 1971). The flood was nearly a metre higher at Bega than any other flood recorded in the 20th century, and it caused considerable sand and vegetation movement and deposition in addition to road closures, bridge and culvert damage and agricultural losses. Several evacuations were necessary (4).
- 1.6.4 At the Bega North Gauge (219990) BoM site, Bega the minor flood height has been reached 50 times in 35 years. While some years have had separate flood events within a short space of time, flood-free periods of up to 12 years duration have also been experienced. The major flood height (8.0 metres) has been reached or exceeded on ten occasions since 1841, the latest occurring in 2011 (18) (1).
- 1.6.5 Significant flooding has occurred in Bega more recently with events being recorded in 2010, 2011, 2012 and 2016. The March 2011 event was described as the worst in 40 years. This event caused widespread damage to infrastructure and properties around and downstream of Bega and was caused by heavy localised rainfall coinciding with higher-than-normal tide levels (18). During this event 19 residential and commercial properties were impacted. Floodwaters rose relatively quickly in these areas (within minutes to hours) and lasted over a day on most properties, with some areas remaining inundated for weeks. A number of bridges and causeways were lost in rural areas. The damage for the 2010 event was estimated at \$6 million and the 2011 event was estimated at \$10 million (1) (18).

Merimbula

- 1.6.6 In September 2014 flash flooding caused up to 100mm of water to pass through Market Street in Merimbula and resulted in the damage of residential and commercial properties (14).
- 1.6.7 February 1971: worse floods since 1919. Merimbula water pipeline damaged.
- 1.6.8 March 1978: Merimbula airstrip closed due to rain and high seas.
- 1.6.9 A catchment event for Back Lake: 21-22 March 2011.
- 1.6.10 An ocean storm tide event for Merimbula: 23-24 June 1998.
- 1.6.11 The flooding event of 14-16 February 2010, which included both extreme rainfall as well as storm tide. However, it was noted that the overall levels in Merimbula Lake didn't reach foreshore flooding levels due to the surge coinciding with a low, neap tide. (9)

Pambula

- 1.6.12 Pambula River, Pambula Lake and Yowaka River catchment covers an area of over 300 square kilometre. During periods of heavy rainfall in the catchment there is potential for water to overtop the banks of the various creeks and rivers and inundate the adjoining floodplain, including parts of the villages of Pambula, South Pambula, Pambula Beach, Broadwater, Greigs Flat, Nethercote and Lochiel. (19)
- 1.6.13 Flooding has been experienced across the catchment on a number of occasions including 1970, 1971, 1973, 1978, 1983 and 1985, as well as more recent events in 2011, 2012 and 2016. The 1971 event is the largest flood on record. (19)

Bermagui

- 1.6.14 In March 2012 85mm of rain fell in Bermagui in 3 hours and resulted in flooding in the town including the supermarket, golf course, Caravan Park and Beach Hotel (20).
- 1.6.15 In October of 2014, 225mm of rain fell over Bermagui in less than 12 hours resulting in the flooding and closure of Bermagui Public School along with road closures and the flooding of premises affected in the March 2012 event (15).

Eden

- 1.6.16 In January 2016 100 to 150mm of rain fell near Eden within a 2hr period at a maximum hourly rate of 180mm/hour (20). This resulted in minor flooding causing the closure of roads and bridges around Bega, Merimbula and Eden and resulted in flooding of low-lying areas (21). The BUPA Aged Care Facility in Eden was flooded.
- 1.6.17 January 1933 - Heavy storm caused landslides and bridges were swept away.

- 1.6.18 January 1934 - Extensive damage at Eden; bridges washed away and great loss of crops.
- 1.6.19 1978 - Bridges destroyed at creek crossings upstream of Lake Curalo. Foreshore areas of Lake Curalo inundated. Lake Curalo entrance opened to the south of the current entrance.
- 1.6.20 2006 or 2007- Water from Snug Cove inundated Marine Discovery Centre building.
- 1.6.21 2011 and March 2021 - Highway at Golf Course overtopped.
- 1.6.22 January 2015- Overland flow issues were observed within the township of Eden co-incident with the prevailing tide within Lake Curalo.
- 1.6.23 2016 - Overland flow issues and coastal flooding. (8)

Towamba River Historical Flooding (8)

- 1.6.24 March 1919 - Severe flooding on the South Coast. Towamba River reached 45 feet at the Princes Highway Crossing. Bridge at Towamba washed away.
- 1.6.25 August 1922- Approach to Towamba River bridge at Kiah carried away.
- 1.6.26 November 1959 - The Towamba River at Kiah rose quickly and at its peak was 18 feet over the bridge, cutting the Princes Highway for three days. Damage to crops.
- 1.6.27 July 1960 - 4 inches of rain caused the Towamba River to rise 14 feet over the Kiah Bridge.
- 1.6.28 October 1966- Minor flooding occurred covering the bridge on the Princes Highway by 10 feet.
- 1.6.29 February 1971 - Water came close to going over the Princes Highway Bridge, Low level timber bridge at Burragate destroyed and Flooding of New Buildings Road at New Buildings, Big Jack Mountain Road at Rocky Hall.
- 1.6.30 2011- Significant damages to farms at Kiah due to the flood occurring at night time and very little warning provided, Overland flow issues at Burragate and Flood waters reached the top of the bus shelter at Towamba. The flood history of the Towamba River is lengthy, resulting in death to persons and stock, destroying assets, private property, crops, roads and causing significant erosion. During 2011, a major flood event on the Towamba River led to the communities at Rocky Hall, Burragate, New Buildings and Towamba being isolated for a number of days as key bridges in those areas were destroyed during the event.

Historical Floods and their probability

- 1.6.31 The assessed heights at the Bega North gauge (219990) for flood probabilities and average recurrence intervals are provided in Table 5.

Table 5: Estimated design flood heights related to the Bega North Gauge (219990) (1)

Gauge Height (meters)	Flood Probability (AEP %)	Estimated Average Recurrence Interval (ARI) (years)
17.13	PMF	
10.16	0.2%	500
9.79	1%	100
9.29	2%	50
8.78	5%	20
8.26	10%	10

Table 6 notes the heights of the most severe as well as some of the most recent minor floods recorded at North Bega. For most of the floods of the 19th century the height information should be regarded as being approximate only.

Table 6: Flood History for floods above moderate level at the Bega North Gauge (219900)

Month	Year	Gauge Height (metres)	Classification Min: 4.6m Mod: 7m and Maj: 8m
6 February	1971	9.78	Major
20 May (22)	1851	9.75	Major
1 May	1870	9.1	Major
14 February (22)	1898	8.9	Major
7 January	1934	8.79	Major
28 February	1873	8.68	Major
27 February	1919	8.69	Major
22 March (1)	2011	8.47	Major
7 March (23)	1893	8.3	Major
19 May	1963	8.1	Major
March	1975	7.4	Moderate
February (1)	1992	7.4	Moderate
March (23)	1875	7.3	Moderate
March	1914	7.3	Moderate
June	1928	7.3	Moderate
June	1978	7.3	Moderate
June	2016	7.3	Moderate
June	1952	7.2	Moderate

Month	Year	Gauge Height (metres)	Classification Min: 4.6m Mod: 7m and Maj: 8m
June (1)	1978	"high"	Unknown
December	1992	7.15	Moderate
July (1)	1988	7.00	Moderate
February (1)	2010	6.84	Minor
March (1)	1973	6.80	Minor
March (1)	1997	6.79	Minor
April (1)	1990	6.70	Minor
June (1)	1991	6.70	Minor
March (1)	2012	6.58	Minor
March (1)	1983	6.50	Minor
October (1)	1985	6.50	Minor

1.7 FLOOD MITIGATION SYSTEMS

- 1.7.1 There are no levees located within the Bega Valley LGA.
- 1.7.2 Works have been completed in the Bega Valley LGA around the Princes Highway Bridge crossing the Bega River. This work included the raising of the Highway and some local roads affected by flooding (1).
- 1.7.3 A small weir is located on Russell Creek in the Jellat Jellat Flats. The weir is approximately 2 metres wide and was installed to prevent the migration of tidal salt water up the creek in Jellat Jellat Flats. This weir is not a flood mitigation system and has no impact on flooding (1).
- 1.7.4 August 2021 Bega Valley Shire Council were seeking feedback on 10 options for improving the existing flood warning system as part of the Bega and Brogo Rivers Floodplain Risk Management Plan. This is part of a scoping and feasibility study for a potential enhancement of the existing flood warning system that will help impacted communities beyond the Bega township prepare for and respond to future floods.

1.8 EXTREME FLOODING

- 1.8.1 1971 Flood (9.87m): The highest flood event experienced in the Bega Valley Shire occurred in 1971. The Bega River peaked at 9.87m at the Bega North (219990) Gauge. The 1971 event broke the 1% AEP (1 in 100-year ARI) event and was estimated to be a 140 ARI event. Some 23 residences were flooded within the town along with 13 commercial-industrial properties (one to a depth of about two metres) and the ambulance station (4).
- 1.8.2 2011 Flood (8.47m): In March of 2011 the Bega Valley Shire experienced significant flooding. The localities of Rocky Hall, Mogilla and Wallagoot became isolated, and Towamba had limited access. Three major Council bridges were lost and 6 were severely damaged. 150+ other bridges and roads sustained damage (15).
- 1.8.3 PMF Flood Event: The PMF Event is estimated to reach 17.13m at the Bega North gauge (219990). This is over 7m higher than the 1971 Flood of record (9.87m) (1).

2.1 COMMUNITY PROFILE

Table 7: Census of Housing and Population data (2016) (24)

Census Description	Bega Valley LGA	Bega	Tarraganda	Angledale	Candelo	Tathra
Total Persons	33,253	4,668	334	154	686	1,675
Aged 0-4 years	1,468	286	12	12	29	66
Aged 5-14 years	3,789	632	40	19	109	160
Aged 65 + years	8,605	1,001	79	23	103	307
Of Indigenous Origin	1,042	271	5	0	13	20
Who do not speak English well	46	0	0	0	0	3
Have a need for assistance (profound/severe disability)	2,001	344	6	7	30	78
Living alone (Total)	4,024	591	33	11	74	252
Living alone (Aged 65+)	1,927	255	21	3	20	111
Residing in caravans, cabins or houseboats or improvised dwellings	430	0	0	0	0	20
Occupied Private Dwellings (Households)	16,270	2,124	119	56	268	702
No Motor Vehicle	577	159	0	3	3	25
Caravan, cabin, houseboat, or improvised dwell	270	3	3	0	0	14
Rented via State or Housing Authority	311	139	0	0	0	0
Rented via Housing Co-Op or Community Church Group	81	20	0	0	0	19
No Internet Connection	2,452	425	17	10	43	118
Unoccupied Private Dwellings	3,048	188	10	5	41	181
Average persons per occupied dwelling	2.2	2.3	2.5	2.4	2.2	2.1
Average vehicles per occupied dwelling	1.8	1.6	2	2.4	1.8	1.6

Census Description	Mogareeka	Bermagui	Wallaga Lake	Buckajo	Jellat Jellat	Kalaru
Total Persons	56	1,536	548	295	84	708
Aged 0-4 years	0	71	11	16	4	51
Aged 5-14 years	3	153	39	31	11	120
Aged 65 + years	17	499	217	51	10	141
Of Indigenous Origin	0	54	10	10	0	12
Who do not speak English well	0	0	0	0	0	14
Have a need for assistance (profound/severe disability)	0	99	32	14	3	46
Living alone (Total)	9	232	97	23	7	67
Living alone (Aged 65+)	3	126	48	6	4	27
Residing in caravans, cabins or houseboats or improvised dwellings	0	25	9	0	0	26
Occupied Private Dwellings (Households)	25	657	252	108	28	245
No Motor Vehicle	0	32	5	0	0	3
Caravan, cabin, houseboat, or improvised dwell	0	13	3	0	0	20
Rented via State or Housing Authority	0	13	0	0	0	0
Rented via Housing Co-Op or Community Church Group	0	3	0	0	0	0
No Internet Connection	4	117	50	15	0	21
Unoccupied Private Dwellings	14	1,536	95	13	5	23
Average persons per occupied dwelling	1.6	71	1.9	2.4	2.3	2.5
Average vehicles per occupied dwelling	1.7	153	1.6	2.4	2.3	1.9

Census Description	Wallagoot	Bemboka	Merimbula	Eden	Boydton	Towamba
Total Persons	518	577	3,544	3,151	70	234
Aged 0-4 years	23	30	117	168	0	10
Aged 5-14 years	78	69	266	335	0	25
Aged 65 + years	86	132	1,173	880	29	54
Of Indigenous Origin	21	14	66	226	0	19
Who do not speak English well	0	0	0	0	0	0
Have a need for assistance (profound/severe disability)	17	39	248	232	4	19
Living alone (Total)	43	79	586	434	8	31
Living alone (Aged 65+)	69	29	301	219	5	9
Residing in caravans, cabins or houseboats or improvised dwellings	0	16	47	67	3	0
Occupied Private Dwellings (Households)	184	238	1,514	1,562	30	98
No Motor Vehicle	0	9	110	96	0	0
Caravan, cabin, houseboat, or improvised dwell	0	9	28	42	5	3
Rented via State or Housing Authority	0	0	28	105	0	0
Rented via Housing Co-Op or Community Church Group	0	0	24	10	0	0
No Internet Connection	16	68	300	317	12	39
Unoccupied Private Dwellings	15	577	578	3,151	4	33
Average persons per occupied dwelling	2.4	30	2	168	1.9	2.1
Average vehicles per occupied dwelling	2	69	1.5	335	1.9	1.7

SPECIFIC RISK AREAS - FLOOD

BEGA AND BROGO RIVERS

2.2 BEGA

- 2.2.1 Bega is located 421km south of Sydney and 225km southeast of Canberra within the Bega Valley Shire (Maps 2 and 4). In the 2016 census the population of Bega was 4668 with 1001 (21%) over the age of 65. There were 2124 private dwellings and 20% of the population had no access to the internet (24).

Characteristics of flooding

- 2.2.2 Bega is affected by a combination of flash flooding, riverine flooding, and overland flooding. Typically, the Bega River system rises quickly causing flash flooding of road and creek crossings surrounding the Bega Township. Peak flood heights are generally between 24 and 48 hours from the beginning of the storm event, however in some cases this peak can be reached much earlier (2011 floods) (4) (1) (15).

Flood Behaviour

- 2.2.3 Minor Flooding: During a minor flooding event the Bega and Brogo Rivers and their adjacent banks act as floodways. On the western side of Bega this also will include Buckajo Road. Additionally, velocities will increase at the abutments of the river crossings including the Princes Highway and Tarraganda Lane.

Flooding located around the perimeter of Bega is primarily flood storage with low depths. This flooding may affect low lying roads and properties primarily in the north of Bega (1). Tarraganda and the Jellat Jellat Flats further downstream act as large off-river storage areas.

- 2.2.4 Moderate-Major Flooding: High velocity floodways occur during a moderate to major flood, generally following the path of the Bega and Brogo Rivers. These floodways also include the adjacent banks to the rivers. Increased velocities can also be seen at the bridge abutments of the Princes Highway crossing and the Tarraganda Lane crossing. The abutments can be a considerable distance from the river.

The flooding areas surrounding the township of Bega are predominately a combination of high and low hazard flood storage. These areas include properties, farmland and roads (1).

- 2.2.5 PMF: During the PMF event modelling indicates that there are multiple locations surrounding the township of Bega that become High Hazard floodways (high depths and velocities). These areas include: Buckajo Road and the Bega River along the western side of Bega; across the northwestern fringe of the town through Valley Field Sports Ground; around the northern edge of

the town along Poplar Street and into Apex Park; on the eastern side of the Bega and Brogo River junction and down the eastern perimeter of Bega including Tarraganda Lane. The Princes Highway Bridge is expected to be overtopped by 6.33m during a PMF (1). The floodway generally follows the course of the Bega River with the exception of the northwestern town perimeter (1).

- 2.2.6 The majority of the flooding that will impact residences and businesses are in flood storage areas. These locations will most likely rise slowly and have low velocities. Flood storage areas will be predominantly in farmland and fields and will surround the north, east and western sides of Bega (1).

Classification of Floodplain

- 2.2.7 Almost all properties in the town of Bega are classified as having Rising Road Access for events ranging from a minor flood to a PMF event. This is due to the natural topography of the area allowing flood free access to higher parts of the town. The town itself can potentially be isolated due to road closures including the Princes Highway.
- 2.2.8 The South East Regional Hospital can become isolated on a high flood island during a PMF event.
- 2.2.9 There are also rural properties located on the fringes of Bega that can become flood islands. It should be noted that there are rural farms and properties located outside the township of Bega, including Angledale, that may become flood islands or high and low trapped perimeters. Access to these properties may be dependent on the structural integrity of local river and creek crossings, due to the high level of damage to these assets seen in past flooding events (1).

Inundation

- 2.2.10 The Bega and Brogo River heights are monitored by the Bureau of Meteorology (BoM) at the Bega North gauge (219990), Bega. Flood warnings are provided by the Bureau of Meteorology (BoM). It should be noted that the catchment is largely un-gauged, and many existing gauges are manual gauges (4) (1).
- 2.2.11 Historically houses in Bega (Bega Street and East Street) began to flood over-floor from 6.8m on the North Bega gauge (Table 8). Since that time some of these properties such as the Bega Bowling Club have been modified.

Table 8: Estimated number of properties inundated above floor level in Bega township related to the Bega North Gauge (219990) (15)

Bega North Gauge Height (m)	Historical event	Annual Exceedance Probability AEP %	No. Properties with Over floor Flooding	No Properties flooded in Bega township including yards
6.8m	March 1973	18% AEP	2	unknown
7.3	June 2016		2	3

7.4	Feb 1992	12% AEP	1	unknown
8.45	March 2011	5% AEP	9	17
9.78	Feb 1971	0.7 % AEP	unknown	38
17.13	N/A	PMF	unknown	unknown

- 2.2.12 In the June 2016 event which reached 7.3m on the Bega North gauge (219990) there were two properties near Kiss’ Lagoon that experienced over-floor flooding. The Bega Bowling Club had its lower floor cellar flooded (25) (Table 8).
- 2.2.13 In 1975 a flood height of 7.4m meant that flood levels were up to the floorboards in one property on Nelson St (Table 8).
- 2.2.14 During 2011 when flood levels reached 8.45m on the Bega North gauge (219990) nine properties in Dowling Street, Kirkland Avenue, Bega Street, Nelson Street and Swan Street were flooded over floor level, with a total of 17 properties flood affected (Table 10).
- 2.2.15 During the largest historic event in Bega in 1971 which reached 9.78m on the North Bega gauge (219990), 38 properties were flood affected. During this flood event water was up to 2m deep in Bega Street. It is anticipated that a Probable Maximum Flood would reach 17.13m on the North Bega gauge (219990) which is 7.35m deeper than the 1971 event (1).

Table 10: Flood affected properties and damages under existing conditions for flood events in Bega LGA are shown in the table below showing flood affected properties in Bega LGA.

Flood Event Annual Exceedance Probability (AEP)	Properties with over floor flooding (inundation)	Properties with over-ground flooding
10% AEP	13	24
5% AEP	40	59
2% AEP	66	98
1% AEP	96	137
0.5% AEP	112	145
0.2% AEP	116	148
PMF	351	284

Isolation

- 2.2.16 During a PMF event (Bega North gauge (219990) height 17.13m) the north and south approaches to the Princes Highway Bridge over the Bega River would be overtopped. Other roads to the South can also be cut including the Princes Highway near Kingswood, effectively isolating Bega.
- 2.2.17 During a PMF event closure of Tathra Road in a number of places is expected to isolate the South East Regional Hospital.

- 2.2.18 There are a number of properties upstream of the Princes Highway Bridge on the Bega River that are located within the floodplain. Refuge on higher ground above the PMF can be readily accessed.
- 2.2.19 Communities needing to access Grosses Creek Road and Buckajo Road would become isolated in a 5% AEP event (Bega North gauge height 8.78m) due to road closures (1).
- 2.2.20 On the western edge of Bega, properties on Charlotte Street and Ravenswood Street may become isolated.
- 2.2.21 On the north side of the Bega River, industrial properties accessing Buckajo Road can become isolated in a 5% AEP event (Bega North gauge (219990) height 8.78m).
- 2.2.22 There is also a potential for rural properties surrounding the town of Bega to become isolated. These properties have evacuation access early during a flooding event but may become isolated during the 1% (9.79m at the Bega North gauge) and PMF events (17.13m at the Bega North gauge) (1). The period of isolation can be up to 48 hours (4).
- 2.2.23 Approximately five roads are affected by flooding and closed prior to a minor flood level. Between the minor and moderate flood level another 18 roads are either affected by flooding or closed (8). For more detailed information refer to Table 10.

Flood Mitigation Systems

- 2.2.24 There are no flood levees located in Bega.
- 2.2.25 There are no declared detention basins located in Bega.

Dams

Brogo Dam (11)

- 2.2.26 Brogo Dam is located on the Brogo River upstream of Brogo and Bega. It is considered to be in good condition but has not been designed to cater for a Probable Maximum Flood (PMF). Only an extremely rare flood such as a PMF could overtop the embankment and lead to dam failure by erosion of the dam's crest and downstream face (11).
- 2.2.27 A dam break resulting from extreme rainfall is expected to be preceded by flooding more destructive than from a flood equivalent to the 1971 flood of record in the Bega Valley Shire, and consequently vast areas downstream of Brogo Dam would already have been flooded.
- 2.2.28 A dam break from a non-flood "sunny day" failure is considered to have the most potential for loss of life due to the lack of warning time. Such a flood would take 40 minutes to reach Brogo and 2:50 hours to reach Bega. It could potentially inundate these towns and rural areas, destroy houses, damage power supply facilities, effect telephone lines and cut evacuation routes (11).

Cochrane Dam (12)

- 2.2.29 In the event of the breaching of the Cochrane Dam wall, impact would be on low lying areas in the town Bega with depths not likely to be significant. Inundation is expected at all low-lying areas along the Bega River including Bega River Reserve picnic/camping areas and the Old Bega Racecourse. (12)

At Risk Facilities

- 2.2.30 During a minor flooding event Club Bega (bowling club) Greens begin to be flooded when the Bega North gauge (219990) reaches 6.1m (15). Over floor flooding of the lower cellar level occurred during 2016 when flood levels reached 7.3m at the Bega North gauge (219990).
- 2.2.31 In the PMF event the following facilities are expected to be affected by flooding and require evacuation (1):
- a. Bega Valley Public School,
 - b. South East Regional Hospital,
 - c. Bega Valley Private Hospital,
 - d. Bega District Nursing Home (The Oaks Country Village),
 - e. Bega Valley Backpackers Hostel,
 - f. The large supermarket complexes located on Auckland and Carp Streets,
 - g. Veterinarian Hospital and the
 - h. Bega Cheese Factory.
- 2.2.32 The South East Regional Hospital is located on Tathra Road. The main access to the hospital along Tathra Road is expected to be closed during the PMF event. Nearby Boundary Road is a dirt road and is not considered to be a suitable alternative during wet weather (26) (1).
- 2.2.33 Refer to Annex 2 for further details.

Other Considerations

- 2.2.34 When Tathra Road is impacted by riverine flooding water fills Horse Shoe Lagoon, Richies Lagoon, Benooka Lake, and swampy areas at Betunga and Penuca. The area then generally takes several days for the water level to drop below road level, regardless of the flood activity at Bega Township. This leads to lengthy detours being in place for several days and is a flood rescue hotspot. Tathra Road is over a metre higher than the surrounding ground along some sections of this road, leading to a weir-like effect. (26)

2.3 TARRAGANDA AND ANGLEDAL

- 2.3.1 Tarraganda is located directly to the east of Bega, on the eastern side of the Bega River (Map 5). In 2016 the population of Tarraganda was 334, with 119 private dwellings. 23% of the population is aged over 65 (24).

- 2.3.2 Angledale is located northeast of Bega and is surrounded on the northern, western, and southern sides by the Brogo River (Map 6).
- 2.3.3 Access to both locations can be lost when the bridges over the Bega River at Angledale Road and Tarraganda Lane are cut by floods waters.

Characteristics of Flooding

- 2.3.4 Tarraganda and Angledale are affected by a combination of riverine and overland flooding (1).

Flood Behaviour

- 2.3.5 Minor: During a minor flooding event the flooded areas surrounding Tarraganda are primarily flood storage areas. The Brogo River itself and adjacent banks to the north of Tarraganda can be floodways (1).
- 2.3.6 Moderate-Major: The Brogo and Bega Rivers and their adjacent banks become floodways. Localised flooding to the south of Tarraganda acts as flood storage (1).
- 2.3.7 PMF: During a PMF event the Bega and Brogo Rivers are floodways with the Brogo River north of Tarraganda, heading towards Angledale being a high hazard floodway with high velocity and high depth. The eastern side of the Bega and Brogo River junction and down the western side of Tarraganda will also act as a high hazard floodway (1).
- 2.3.8 No flood modelling has yet been completed at Angledale.

Classification of Floodplain

- 2.3.9 Properties located on the eastern bank of the Brogo River become isolated during a 5% AEP flood (Bega North gauge (219990) height 8.78m). They would be classified as High Trapped Perimeter areas for all events including the PMF. Tarraganda becomes isolated from Bega during a minor flooding event and has Rising Road Access to the east for all events including the PMF (1). No modelling has been completed for rural properties surrounding Tarraganda.
- 2.3.10 No flood modelling has been completed at Angledale.

Inundation

- 2.3.11 Historical floods show that some rural properties are affected by flooding. Tarraganda Lane Main Bridge and Tarraganda Lane Anabranh Bridge are subject to frequent closure from overtopping.

Isolation

- 2.3.12 Properties on the eastern bank of the Brogo River that access Murrays Flat Road may become isolated during a 5% AEP flood (Bega North gauge (219990) height 8m. (1).

2.3.13 Angledale and Tarraganda may become isolated when Tarraganda Lane Main Bridge and Tarraganda Lane Anabranh Bridge crossing are closed and cut off. This occurs at the minor flood level of 5.0m at the Bega North gauge (219900). In a 1% AEP event these bridges would be submerged by approximately 4.5m of water. Closure of these bridges isolates Tarraganda and surrounding communities from the Bega Township for approximately 31 hours (1).

Other rural properties may become isolated in the areas surrounding Angledale and Tarraganda during the 1% AEP (Bega North gauge (219900) height 9.79m) and PMF flood events.

2.3.14 The main access roads of Angledale Road and Tarraganda Lane become closed at the minor flood level of 5.0m Bridges east of the Princes Highway can also be cut by floodwaters. Local rural roads also experience flooding.

2.3.15 Up to 30 houses can be isolated in the Tarraganda and Angledale areas (4).

Flood Mitigation Systems

2.3.16 There are no flood levees located in the Tarraganda and Angledale communities.

2.3.17 There are no declared detention basins located in the Tarraganda and Angledale communities.

Dams

2.3.18 No dams have been identified as posing a risk to Angledale or Tarraganda.

At Risk Facilities

2.3.19 There are no schools or other facilities located in Tarraganda or Angledale that are known to be at risk of flooding.

2.3.20 Refer to Annex 2 for further details.

Other Considerations

2.3.21 No other considerations.

2.4 CANDELO

2.4.1 Candelo is in the Bega Valley Shire and is 23km southwest of Bega (Map 7). The Candelo Creek runs through the centre of the town. In 2016 the population was 686 (24).

Characteristics of Flooding

2.4.2 Candelo is affected by a combination of flash flooding and riverine flooding from Candelo Creek (1).

Flood Behaviour

- 2.4.3 Minor Flooding: the Candelo Creek acts as floodway during a minor flooding event. The northern corner of Mogilla Road acts as a high hazard floodway with fast water velocities (1).
- 2.4.4 Moderate to Major Flooding: During these events the Candelo Creek acts as a high hazard floodway. Parts of William Street, Sharpe Street, Eden Street, Mogilla Street, Candelo Street and Candelo Bega Road located close to the creek can also form part of this floodway (1).
- 2.4.5 PMF: Candelo Creek acts as a high hazard floodway during the PMF event. Parts of William Street, Sharpe Street, Eden Street, Mogilla Street, Candelo Street and Candelo Bega Road located close to the creek can also form part of this floodway. Additionally, during the PMF event the land adjacent to Candelo Creek up to 200m from the creek can form part of the high hazard floodway (1).

Classification of Floodplain

- 2.4.6 During Moderate flooding events the bridge connecting the east and western sides of Candelo on Eden Street can be cut isolating the two halves of the town from each other (1).
- 2.4.7 Properties affected by flooding during a minor flooding event are located on Mogilla Street and are classified as having Rising Road Access (1).
- 2.4.8 During a 1% AEP and PMF event additional properties located on William Street, Sharpe Street and Eden Street are affected by floodwaters and are classified as having Rising Road Access (1).
- 2.4.9 Rural properties surrounding Candelo can also become isolated during all events (1).

Inundation

- 2.4.10 Properties along Mogilla Road, Sharpe Street, Candelo Street, William Street and Candelo Bega Road adjacent to Candelo Creek can experience flooding. Inundation mainly occurs at or above a 1% AEP event (1).

Isolation

- 2.4.11 Candelo Creek runs through the middle of the Candelo Township, with a single crossing in the middle of town. While access over this bridge is lost in flood events above the 5% AEP, both sides of the community have flood free evacuation roads out of Candelo.
- 2.4.12 During a Moderate to Major flooding event the eastern side of Candelo can become isolated from the western side due to the closure of the bridge over Candelo Creek. (1).
- 2.4.13 Rural properties surrounding Candelo may become isolated due to road closures or damage to crossing structures. Isolations periods can be up to 48 hours (1).

- 2.4.14 During the 10 March 2000 flash flood event Candelo was cut off from main road routes for more than 12 hours (18).

Flood Mitigation Systems

- 2.4.15 There are no flood levees located in Candelo.
- 2.4.16 There are no detention basins located in Candelo.

Dams

- 2.4.17 Candelo is not impacted by any dams in the area.

At Risk Facilities

- 2.4.18 The local bowling club located on Mogilla Road/ Sharp Street begins to be affected by flooding at the minor level. Commercial premises such as the service station can be affected by flooding at the major and PMF flooding events (1).
- 2.4.19 There is one school located on William Street that is not affected by flooding however William Street can be flooded so school access would have to be from Bega or Queens Streets (1).
- 2.4.20 Refer to Annex 2 for further details.

Other Considerations

- 2.4.21 The village of Candelo hosts a biennial one day festival called the Candelo Village Festival, a music and arts festival in March/April.
- 2.4.22 There may also be a small number of privately run accommodation facilities in the area including properties that may experience isolation. Airbnb and Stayz.com list a total of six properties in August 2021.

2.5 TATHRA AND MOGAREEKA

- 2.5.1 Tathra and Mogareeka are located adjacent the Bega River entrance on the coast of NSW, 18km east of Bega (8). The population of Tathra in 2016 was 1675 (24).
- 2.5.2 Tathra can be isolated from Bega and Bermagui, being cut off from Bega at Jellat Jellat Flats and at various locations to the north by creek flooding along the road to Bermagui. Access to Merimbula is likely to be retained, except in extreme floods. Mogareeka can become isolated from Tathra during a flooding event (1).
- 2.5.3 The 2018 Tathra bushfire was a bushfire that burned between 18 and 19 March 2018. Many buildings were destroyed. A total of 69 houses, 30 caravans and cabins as well as 39 houses damaged in Tathra. The total burned area was 1,250 hectares. (27)

Characteristics of Flooding

- 2.5.4 Tathra and Mogareeka are affected by a combination of riverine and overland flooding (1).

Flood Behaviour

- 2.5.5 Minor: During a minor flooding event the Bega River main channel acts as a floodway. Inundation does not affect properties during this event however the Bega River extensions to the south and the adjacent swamp and golf course act as low hazard flood storage (1).
- 2.5.6 Moderate to Major: During these events the Bega River main channel acts as a floodway. Inundation does not affect properties during this event however the Bega River extensions to the south and the adjacent swamp and golf course act as low hazard flood storage (1).
- 2.5.7 PMF: During the PMF event the Bega River main channel acts as a high hazard floodway. Inundation within the town of Tathra is primarily low hazard flood storage (1).
- 2.5.8 The topography to the east of Tathra is elevated ensuring the Bega River does not break its banks (1).

Classification of Floodplain

- 2.5.9 During flooding events ranging from minor to the PMF, Tathra becomes isolated from Bega to the east and Bermagui to the north. Inundation in the town is classified as having Rising Road Access (1).
- 2.5.10 Mogareeka becomes cut off from Tathra in a 5% AEP event 3.48m at Tathra gauge (219410)). Access to the north of Mogareeka may also be disrupted (1).

Inundation

- 2.5.11 The grounds of the golf course are affected by flooding along with access along Tathra Road and Tathra Bermagui Road beginning at a 10% AEP event (1). Tathra residential areas are not affected by inundation until events above 1%AEP.
- 2.5.12 The entire north-eastern section of Tathra would be inundated in a PMF event. Low-lying properties on Andy Poole Drive, Esther Street, Edna Drive, Francis Hollis Drive, Dikera Road and John Taylor Crescent would all be inundated (1).
- 2.5.13 Warnings in Tathra rely on readings from the Bega North gauge (219990) in Bega. Inundation at Tathra may also be subject to changes in the tides due to its proximity to the coast (1).
- 2.5.14 Bay Drive in Mogareeka becomes submerged during a 5% AEP event. Properties along Bay Drive can be isolated in riverine flooding when the river mouth is closed, or during storm surges. When the road becomes inundated approximately six properties bordering Tanja State Forest on very steep blocks will have trapped perimeter classification (28).

Isolation

- 2.5.15 Tathra becomes isolated from Bega and Bermagui due to road closure of a number of low-level crossings on the Tathra-Bermagui Road during a minor flooding event. Access to Merimbula remains open.
- 2.5.16 Tathra Road and Sapphire Coast Drive become flooded during a PMF event leaving Tathra isolated (1). Isolation could last up to 48 hours.
- 2.5.17 Mogareeka becomes isolated from Tathra during a 5% AEP event. Bay Drive in Mogareeka is also cut during a 5% AEP event isolating residents (Bega North gauge (219990) height 8.78m) (1) Isolation could be up to 18 hours during a 1% AEP event (Bega North gauge height 9.79m) (1).

Flood Mitigation Systems

- 2.5.18 There are no flood levees located in Tathra.
- 2.5.19 There are no detention basins located in Tathra.

Dams

- 2.5.20 There are no dams that affect Tathra or Mogareeka.

At Risk Facilities

- 2.5.21 During minor to major flooding events the only property affected is the local golf course (1).
- 2.5.22 During a PMF event the Tathra Beach Eco Camp (formerly Tathra Beach Motor Village), Big 4 Tathra Beach Holiday Park and multiple holiday units will be affected by flooding. (1)
- 2.5.23 The Tathra Beachside accommodation park is located between Andy Poole Drive and the ocean beach. Regions of the park are located on low-lying land adjacent to the ocean and are affected by flooding from both catchment rainfall and ocean inundation. The caravan park is of particular concern during flood events due to: access being lost before the site experiences flooding, the possibility of a number of people being concentrated at the property during a flood event, the likelihood that patrons will be from outside the catchment and may not appreciate the flood risks during a storm event, and a lack of vertical evacuation and shelter in place options.
- 2.5.24 Refer to Annex 2 for further details.

Other Considerations

- 2.5.25 Tathra has two caravan parks and multiple holiday units and houses. The area has a high tourist population during the summer months and holiday times.

2.6 BERMAGUI / WALLAGA LAKE / CUTTAGEE / MURRAH

- 2.6.1 Bermagui is located at the entrance of the Bermagui River on the Far South Coast of NSW (Map 9). In 2016 the population of Bermagui was 1536 and there were 657 private dwellings (24).
- 2.6.2 Wallaga Lake Township is located around 10km to the north of Bermagui on the foreshores of Wallaga Lake (Map 10). It had a population of around 548 people in 2016, however this can increase during holiday periods.
- 2.6.3 Cuttagee is located around 11km to the south of Bermagui on the foreshores of Cuttagee Lake.
- 2.6.4 Murrah is located around 20km to the south of Bermagui to the south of the Murrah River.

Characteristics of Flooding

- 2.6.5 Bermagui is affected by a combination of flash flooding, overland flooding and riverine flooding (4). Flooding in town can also be influenced by tidal conditions and storms surge.
- 2.6.6 Bermagui, Wallaga Lake, Cuttagee and Murrah can all be affected by the entrance conditions of the coastal lakes, with flooding being worse when heavy rainfalls combine with closed entrance conditions (25).

Flood Behaviour

- 2.6.7 Historically properties within Bermagui have been affected by flash flooding, overland flooding, and tidal inundation.
- 2.6.8 Bermagui Township can experience flooding when high tides combine with heavy rainfall. Low lying parts near the western end of Lamount Street can be particularly affected by flooding.
- 2.6.9 The effects of riverine flooding from the Bermagui River are largely unknown as a flood study in this catchment has yet to be completed.
- 2.6.10 Other localities including Wallaga Lake, Cuttagee and Murrah experience isolation due to road and bridge closures (refer to Table 10).
- 2.6.11 Elevated lake levels can cause flooding of the low-lying causeway roadway leading to the Wallaga Lake Bridge. This generally only occurs when the entrance to the sea is closed. Wallaga Lake entrance may be opened between 1.10 and 1.26 m if there has been an extended period of wetland inundation for at least 3 months and there is significant rainfall predicted within the catchment in the next 24 hours.

Classification of Floodplain

- 2.6.12 Unknown. Bermagui is not known to become isolated. It has high ground to retreat to within the town. Future flood studies will need to assess whether the bridge over the Bermagui River could potentially be cut during larger events.

Inundation

- 2.6.13 Historically, properties in Bermagui most commonly experience flash and overland flooding. Bermagui can be affected by unusually high tides in combination with heavy rainfall.
- 2.6.14 In more recent events Lamont Street, the Bermagui supermarket, the golf course, the Bermagui Beach Hotel (basement and restaurant), Dickson Oval, the local tourist park and Bermagui Public school were all affected by flooding (20; 20) (29).
- 2.6.15 Nutley's Creek Rd and Wapengo Lake Rd can be closed during flooding events (15).

Isolation

- 2.6.16 Flooding to the south of the Bermagui township along the Tathra- Bermagui Road can cut the southern access into and out of Bermagui during minor flood events. Access to the north has remained open during past flood events, however future flood studies will need to assess whether the bridge over the Bermagui River could potentially be cut during larger events. If this is the case, Bermagui would be isolated (4).
- 2.6.17 Road closures along the Tathra-Bermagui Road to the south of Bermagui near the Murrah River and north of Wapengo can lead to the isolation of properties to the West of Murrah Lagoon (refer to Table 10).
- 2.6.18 Bridge closures near Boggy Creek to the north of Cuttagee Lake can also lead to the isolation of a number of properties (refer to Table 10).
- 2.6.19 The subdivision known as Fairhaven, to the South of Wallaga Lake can become isolated due to road closures due to flooding (refer to Table 10).

Flood Mitigation Systems

- 2.6.20 There are no flood levees located in Bermagui.
- 2.6.21 There are no detention basins located in Bermagui.

Dams

- 2.6.22 No dams have been identified as impacting Bermagui.

At Risk Facilities

- 2.6.23 Historically, the Bermagui Public School has been affected by flooding. This can be due to flash flooding, overland flooding, or riverine flooding (29).
- 2.6.24 The holiday park in Bermagui can be affected by flash flooding (20).
- 2.6.25 There are numerous caravan parks at Wallaga Lake which are potentially flood affected including the:
- a. Big 4 Wallaga Holiday Park
 - b. Ocean Lake Caravan Park

2.6.26 Refer to Annex 2 for further details.

Other Considerations

2.6.27 Bermagui has a caravan park and multiple holiday units and houses. The area has a high tourist population during the summer months and holiday times.

2.6.28 Bermagui holds a seaside fair in March which draws thousands of people. The Bermagui Seaside Fair has been held each year on the second weekend in March since 1998 and now attracts up to 10,000 people. Due to the uncertainty of COVID, the Bermagui Seaside Fair was not held in March 2021.

2.7 BUCKAJO AND SPRINGVALE

2.7.1 Buckajo and Springvale are rural localities located to the west of Bega (Maps 11 and 12). Both locations have known isolations when Buckajo Road is closed.

Characteristics of Flooding

2.7.2 Buckajo and Springvale are isolated by road closures caused by riverine and overland flooding.

Flood Behaviour

2.7.3 Flash flooding caused by an intense local rainfall burst. The catchments can be affected by a combination of overland and riverine flooding.

Classification of Floodplain

2.7.4 Parts of Buckajo Road experience high hazard flooding.

2.7.5 Buckajo Road becomes closed when the Bega North (219990) Gauge reaches 5.5m (15). A large length of Buckajo Road (from Spring Creek downstream to the Princes Highway Bridge) will be inundated by high hazard flooding in events greater than and including the 10% AEP, with flood depths greater than 1 m likely to occur across the length of the Road. This will affect the ability of some residents to access the Bega Township during and following a flood event (30).

Isolation

2.7.6 Properties within Springvale and Buckajo localities become isolated when the Bega North (219990) Gauge reaches 5.5m. This affects 25-30 properties which become isolated usually for a period of 24 hours (15).

Flood Mitigation Systems

2.7.7 There are no flood levees located in the Buckajo and Springvale communities.

- 2.7.8 There are no declared detention basins located in the Buckajo and Springvale communities.

Dams

- 2.7.9 There are no dams that impact the area.

At Risk Facilities

- 2.7.10 Unknown, however this area is rural with no defined towns.

Other Considerations

- 2.7.11 Buckajo Road is one of the first parts of Bega to experience flooding and is a flood rescue 'hotspot' (28)

2.8 JELLAT JELLAT, KALARU AND WALLAGOOT

- 2.8.1 Jellat Jellat, Kalaru and Wallagoot are located to the east of Bega (Maps 13, 14 and 15). They are located on the large floodplain that acts as flood storage during flood events (1).
- 2.8.2 Large areas of farmland are flooded, causing stock and crop losses and sand deposition over fields. Numerous properties can become isolated, and evacuations have previously been required from farm properties (1).
- 2.8.3 In 2016 the population of Kalaru was 708 with 245 private dwellings and the population of Wallagoot was 518 with 184 private dwellings (24). The population of Jellat Jellat in 2016 was 84 people.

Characteristics of Flooding

- 2.8.4 Jellat Jellat is affected by riverine, overland, and flash flooding (1).
- 2.8.5 Flooding in Kalaru and Wallagoot is a combination of overland and riverine flooding (1).

Flood Behaviour

- 2.8.6 Minor: During a minor flooding event the Bega River and adjacent banks up to 500m on each side (1km across) act as a floodway. The Jellat Jellat Flats and areas surrounding Kalaru and Wallagoot act as flood storage. Flood depths can be above 5m in some locations (1).
- 2.8.7 Moderate to Major: During a minor flooding event the Bega River and adjacent banks up to 500m act as a floodway. The Jellat Jellat Flats and areas surrounding Kalaru and Wallagoot act as flood storage. Depths can be above 10m in some locations (1).
- 2.8.8 PMF: During the PMF event the Bega River and adjacent banks, up to 750m, act as a high hazard floodway. Additionally, the area east of Jellat following Tathra Road to the south leading into the Jellat Jellat Flats becomes a high hazard floodway (1).

The Jellat Jellat Flats become flood storage with depths above 15m in some locations. Inundation in Kalaru and Wallagoot act as flood storage areas (1).

Classification of Floodplain

- 2.8.9 Jellat Jellat, Kalaru and Wallagoot have Rising Road Access for all events up to the PMF. Rural properties located on the Jellat Jellat Flats are yet to be classified (1).
- 2.8.10 Above a 10% AEP (gauge height 8.26m at Bega North gauge), up to the PMF event Wallagoot becomes a high flood island. Rural properties surrounding Wallagoot are yet to be classified (1).

Inundation

- 2.8.11 Minor: rural properties with access off Tathra Road may experience inundation (1)
- 2.8.12 Moderate to Major: Jellat Jellat will experience some inundation in these flooding events. Low lying areas on the outskirts of Kalaru and Wallagoot may also experience inundation (1).
- 2.8.13 PMF: During a PMF event rural properties, Jellat Jellat and large portions of Kalaru and Wallagoot will become inundated (1).

Isolation

- 2.8.14 Kalaru becomes isolated from Bega when the Jellat Jellat Flats area becomes flooded. Wallagoot also becomes completely isolated.
- 2.8.15 Minor: During a minor event Tathra Road becomes closed resulting in isolation of rural properties and Jellat Jellat. Kalaru and Wallagoot become isolated from Bega but retain access to Tathra and to the south via Sapphire Coast Drive (1).
- 2.8.16 Above Moderate: Above the moderate flood level Wallagoot becomes completely isolated. Rural properties and Wallagoot may remain isolated for up to 5 days (1).

Flood Mitigation Systems

- 2.8.17 There are no flood levees located in the Jellat Jellat, Kalaru and Wallagoot communities.
- 2.8.18 There are no detention basins located in the Jellat Jellat, Kalaru and Wallagoot communities.

Dams

- 2.8.19 No dams have been identified as impacting the area.

At Risk Facilities

- 2.8.20 Kalaru has the Countryside Caravan Park which may be affected by flooding in the PMF event (1) (Refer to Annex 2).
- 2.8.21 There are no schools located in these areas.
- 2.8.22 Refer to Annex 2 for further details.

Other Considerations

- 2.8.23 A large number of tourist accommodations are located within Kalara and Wallagoot.
- 2.8.24 The Sapphire Coast Turf Club is located in Wallagoot.

2.9 BEMBOKA

- 2.9.1 Bemboka is located on the Snowy Mountains Highway, 36km west of Bega (Map 16). The population in 2016 was 577 and the number of private dwellings was 238 (24). Bemboka is situated alongside the upper reaches of the Bega River (also known as the Bemboka River). Traffic interruptions can be experienced on the Snowy Mountains Highway east of Bemboka (4).

Characteristics of Flooding

- 2.9.2 Bemboka is affected by a combination of overland and riverine flooding (4).

Flood Behaviour

- 2.9.3 No flood studies have been done for this area.

Classification of Floodplain

- 2.9.4 Unknown.

Inundation

- 2.9.5 Historically flooding in this area has resulted in road closures and isolation of properties.

Isolation

- 2.9.6 Rural properties accessing Yankees Gap Road and Sullivans Gap Road can experience isolation due to flooded access (4).

Flood Mitigation Systems

- 2.9.7 There are no flood levees located in Bemboka.
- 2.9.8 There are no detention basins located in Bemboka.

Dams

- 2.9.9 Cochrane Dam is located approximately 13 km northwest of Bemboka (12). Cochrane Dam also operates as a hydroelectric scheme for power generation.

- 2.9.10 In the event of a dam wall breach, impact will be on low lying areas in the town of Bemboka with depth not likely to be significant. Inundation would occur along all low-lying areas along the Bemboka River including picnic/camping areas and the Bemboka sports ground (12).
- 2.9.11 The structural integrity of the bridge on the Snowy Mountains Highway over the Bemboka River may also be compromised (12).

At Risk Facilities

- 2.9.12 Picnic/camping areas and the Bemboka sports ground may be at risk from low level flooding due to failure of Cochrane Dam (12).

Other Considerations

- 2.9.13 There are no other considerations.
- 2.9.14 Refer to Annex 2 for further details.

MERIMBULA AND BACK LAKE

2.10 MERIMBULA

- 2.10.1 Merimbula is located on the coast 35km southeast of Bega within the Towamba River basin (Map 17). The Merimbula Lake and Back Lake catchments including their tributaries of Millingandi Creek, Boggy Creek, Bald Hills Creek and Merimbula Creek all converge at the township of Merimbula where they drain into the sea (14). In 2016 the population of Merimbula was 3544 with 1514 private dwellings. 33% of the population is over the age of 65 (24).
- 2.10.2 Merimbula is a popular tourist destination, and the population increases during the summer months and holiday times.
- 2.10.3 Critical infrastructure such as the regional airport, Princes Highway and Merimbula CBD may be affected by creek, lake or ocean water levels (14).

Characteristics of Flooding

- 2.10.4 Merimbula is affected by a combination of flash flooding causing overland flow, creek flooding and estuarine flooding (31).
- 2.10.5 Overland flow issues may also be compounded if rainfall coincides with elevated lake levels, which restrict the ability of the local drains to discharge water. In September 2014 roads and shop fronts were impacted by flash flooding caused by an intense local rainfall burst.

Flood Behaviour

- 2.10.6 Flooding within the Merimbula Lake catchment is largely contained to creeks and open space. Some properties adjoining the Merimbula Lake foreshore begin to become inundated with approximate depths ranging from 0.1m in the 20% AEP event to 1.1 m in the 1% AEP event.

Merimbula Lake Catchment (Top Lake)

- 2.10.7 The Merimbula Lake catchment (also known as Top Lake) contains the majority of the Merimbula urban areas including the CBD fronting onto the Lake. Flooding within the Merimbula Lake catchment is largely contained to within the creeks and open space upstream of the Market Street Bridge on Merimbula Lake. However, downstream of the bridge floodwaters can expand into a number of residential streets on both the northern and southern foreshores of the lake. Due to the steep topography of the area, there are only minor differences in the flood extents between design events (14).

Back Lake Catchment

- 2.10.8 The Back Lake catchment includes the northern parts of the Merimbula Township. Flooding in Back Lake is largely contained to within the creek and open space areas between the lake entrance and Henwood Street. Upstream of Henwood Street low lying properties can be inundated including the

Sapphire Valley Caravan Park (14). Flood levels in Back Lake are extremely sensitive to the lake entrance berm condition (14).

Classification of Floodplain

- 2.10.9 **Low Flood Islands:** Large flood events in Merimbula and Back Lakes result in the creation of low flood islands and the loss of road access for some pockets posing a significant risk to life (14). Key areas affected include the:
- a. Sapphire Valley Caravan Park,
 - b. Acacia Ponds Retirement complex and the
 - c. Regional Airport.
- 2.10.10 **High Flood Island:** Properties on the Southern Headland, known locally as Fishpen, near the Merimbula Lake entrance can become isolated and a High Flood Island. Some of these properties, primarily on Fishpen Road fronting the lake, can also be inundated.
- 2.10.11 **Rising Road Access:** Properties which back onto Merimbula Creek between Henwood and Reid Street (including properties along Berrambool Drive, Garden Circuit and Munn Street), can be flooded at their rear, but are expected to have rising road access available out from the fronts of their properties in all flood events up to a PMF.

Inundation

- 2.10.12 Downstream of the Market Street Bridge on Merimbula Lake properties in Beach Street, Main Street, Market Street and Fishpen Road are first inundated in the 20% AEP. These can be flooded up to 0.5m in a PMF (14).
- 2.10.13 On the Back Lake system between Henwood and Reid Street (including along Berrambool Drive, Garden Circuit and Munn Street), low lying properties are inundated in 20% AEP events. However due to the topography the fronts of these properties remain flood free even during a PMF. Low lying properties between Henwood Street and Sapphire Coast Drive¹ become inundated in the 20% AEP event at the rear of their properties. All affected properties retain open road access in events up to the PMF.
- 2.10.14 Upstream of the Sapphire Coast Drive crossing the Sapphire Valley Caravan Park becomes inundated in the 10% AEP with site access being cut at the 5% AEP event. Caravans and buildings become inundated with depths ranging from 0.17m in the 5% AEP to 0.48m in the 1% AEP and 2.23m at the PMF. The number of property lots affected range from 219 at the 20% AEP to 323 at the PMF. The estimates of property inundation do not indicate the number of structures affected.
- 2.10.15 During a flash flooding event during September 2014 low lying properties along Market Street were inundated and Market Street was closed (31).
- 2.10.16 Oaklands Rd and Millingandi Rd can also be closed due to flooding (4).

2.10.17 Flood affected properties and damages under existing conditions for flood events in Merimbula and Back Lake are shown in the table below.

Table 9: Flood affected properties in Merimbula and Back Lake catchment

Flood Event Annual Exceedance Probability (AEP)	Merimbula and Back Lake - Properties with over floor flooding (inundation)	Merimbula and Back Lake - Properties with over- ground flooding
10% AEP	0	1
5% AEP	3	9
2% AEP	9	17
1% AEP	17	31
0.5% AEP	24	36
PMF	36	57

Isolation

- 2.10.18 Historically there have been no reports of Merimbula becoming isolated during a flooding event.
- 2.10.19 Within Merimbula the most recent flood study suggests that some areas can become isolated and potentially subsequently inundated on low flood islands. These areas include: the Sapphire Valley Caravan Park, Acacia Ponds Gateway Lifestyle retirement complex and the Merimbula Airport.
- 2.10.20 Properties at the end of Green Point Road and Stringybark Place can become isolated on High Trapped Perimeters.
- 2.10.21 The southern headland of Merimbula Lake can be isolated on a high flood island, with inundation of the lower lying parts facing the lake.

Flood Mitigation Systems

- 2.10.22 There are no flood levees located in Merimbula.
- 2.10.23 There are no declared detention basins located in Merimbula.

Dams

Yellow Pinch Dam (13)

- 2.10.24 In the event of a dam failure at the Yellow Pinch Dam, properties located in Merimbula downstream of the dam would be affected by flooding. The Reid Street / Sapphire Coast Drive Bridge in Merimbula would be underwater by approximately 1m. Once the bridge is closed properties in Berrambool and Tura Beach would become isolated from Merimbula (13).
- 2.10.25 The Sapphire Valley Caravan Park and Berrambool Sportsground would be inundated along with up 30 private residences. Evacuation access for these properties is available moving uphill away from the creek channel (13).

At Risk Facilities

- 2.10.26 **The Sapphire Valley Caravan Park** at Merimbula The caravan park experiences flooding at the edge of the site over internal roadways in the 20% AEP. Caravans and buildings are first affected in the 5% AEP event, with depths of 0.17m occurring onsite. These depths increase to 0.48m in the 1% AEP and to 2.23m in the PMF. The site is a high risk area as it operates as a low flood island, losing access along the driveway before the caravans themselves are inundated. The duration of flooding is typically dependent on the tidal cycle of the lakes, with flood water receding as the tide drops. Access from the caravan park is further restricted due to overtopping of Sapphire Coast Drive, albeit only for extreme events, with 0.35, of overtopping occurring in the PMF. This caravan park is also at some risk of flooding due to failure of Yellow Pinch Dam (14)
- 2.10.27 **The Berrambool Sport field buildings** located in the centre of the sportsground off Berrambool Drive can be inundated from Merimbula Creek in the 20% AEP by depths of 0.49m. This is expected to increase up to 2.03m during a PMF (22). Berrambool Sports Field buildings become inundated with depths ranging from 0.49m in the 20% AEP to 1.03m in the 1% AEP and 2.03m at the PMF events.
- 2.10.28 **Merimbula Airport** remains flood free in the 5% AEP event. Inundation of buildings and infrastructure begin to occur at the 2% AEP event with approximate depths of 0.02m ranging to 0.15m in the 1% AEP event to 0.55m in the PMF event. The airport runway becomes overtopped in the PMF event with flood waters reaching its edges in the 1% AEP. (14).
- 2.10.29 **The Acacia Ponds Retirement Complex** is considered to be located in a high hazard zone as it becomes isolated and subsequently inundated on a low flood island during a 1% AEP event or larger. The site is first inundated in a 5% AEP with low depths of 0.02m which is expected to increase to 0.56m during a PMF (14).

Other Considerations

- 2.10.30 Merimbula has multiple caravan parks and holiday units and houses that are not affected by flooding. The area has a high tourist population during the summer months and holiday times.

EDEN TWOFOLD BAY AND TOWAMBA RIVER

2.11 EDEN

- 2.11.1 Eden is located in Twofold Bay on the Far NSW South Coast within the Towamba River basin, 54km southeast of Bega (Map 18).
- 2.11.2 In 2016 the population of Eden was 3151 with 1562 private dwellings. 27% of the population is over the age of 65 (19).

Characteristics of Flooding

- 2.11.3 Eden is affected by a combination of flash flooding, creek flooding and estuarine flooding from Lake Curalo (31).
- 2.11.4 The extent of influence of lake flooding is limited, affecting primarily undeveloped areas along the lake foreshore. Some low-lying residential properties are impacted by lake flooding along the western edge of the lake (8).
- 2.11.5 Catchment flooding controls the peak flood levels across much of the study area. Flow is well contained along most flow paths, although increasing levels of break out flow occurring the larger AEP events and PMF. The critical duration across the study area ranges from 2 hours, for those areas with small upstream catchment areas, up to 9 hours, for those areas (such as Palestine Creek) with a larger contributing catchment (8).
- 2.11.6 During June 2016, a major East Coast Low event saw key wharf structures within Twofold Bay being destroyed or damaged by coastal driven inundation and wave action. (8)

Flood Behaviour

- 2.11.7 Lake Curalo is fed by a number of creeks including Palestine Creek which discharges to the ocean at the end of Aslings Beach, to the north of the Eden town centre. Lake Curalo has an untrained entrance that is predominantly closed. When the entrance is closed water from the upstream catchment has the potential to build up behind the entrance berm and inundate low lying areas around the lake. In these instances, the lake can be artificially opened (17).
- 2.11.8 In the 1% AEP event, flow begins to break out of the creek, and affects the adjacent industrial properties. The PMF event shows a marked increase in extent. Much of this increase occurs over pastureland, although flooding through the industrial precinct is also exacerbated. The central flow path runs from north to south. It crosses Government Road, but otherwise flooding is restricted to bushland or pastureland for all design events. Some breakout occurs in the 1% AEP at the Palestine Creek confluence.
- 2.11.9 There is a single flow path into the lake on the western side. It commences in the bushland upstream of the golf course, before passing through the golf

course, over the Princes Highway and discharging into the lake via a small open channel that runs along the northern boundary of the sports fields. For events up to the 0.2% AEP event, the flow is reasonably contained within the flow path. In the PMF, flooding is largely driven by backwatering from the Lake, rather than flow through Creek.

- 2.11.10 On the southern side of the lake, there are two flow paths. The western flow path is Freshwater Creek and conveys water from the bushland to the east and south of the study area. In events up to and including the 0.2% AEP, flooding is largely nuisance flooding. Where residential lots are impacted, depths are shallow (less than 0.2m). The flow upstream of the Princes Highway is typically well contained for events up to and including the 0.2% AEP.
- 2.11.11 Flooding with the Lake Cocora region, south of the township of Eden, is well contained within creek extents for events up to and including the 0.2% AEP. This is due to both the terrain, which rises relatively steeply from the channels, as well as the small catchment area that feeds into Lake Cocora. The PMF event, as a result of the greater rainfall intensity, does result in a slight lateral increase in flood extents arising from a substantial increase in lake levels.

Classification of Floodplain

- 2.11.12 A number of locations within Eden, Shadrachs, Nullica and Boydtown were classed as high flood islands, becoming isolated as flood waters rise (8).
- 2.11.13 Although Boydtown is located close to the foreshore, it is not impacted directly by ocean flooding, as it is located on a local rise that keeps developed properties flood free in all design events except the PMF (8).

Inundation

- 2.11.14 The BUPA Aged Care Facility located on Barclay Road in Eden has previously been flooded as a result of a combination of stormwater flooding from an adjacent creek and backwater flooding from a failed sewer pumping station. In January 2016, this flooding occurred as a result of 100 to 150mm of rain falling within a 2-hour period at a maximum hourly rate of 180mm/hour (20). In the PMF, driven by increased lake levels, the Aged Care Facility is inundated by depths of 0.5 to 1 metre.
- 2.11.15 In the PMF event there is substantial overbank flow, largely driven by the increased lake levels that results in inundation of the sports fields, and property flooding along Clare Crescent and Cook Drive. Lakeside Drive properties are also flooded in the PMF, but this is driven by lake levels, rather than catchment flow. A large region of residential development is undated, and properties along Curalo Street and Dolphin Crescent by depths of 0.5 to 1 metre (8).
- 2.11.16 In the PMF, flow from Freshwater Creek impacts properties on West Street, as well as much of the Eden Gateway Holiday Park. The Garden of Eden Caravan

Park is inundated in events as small as the 20% AEP, as are properties along Emblem Street.

- 2.11.17 In the Lake Cocora region the PMF results in road inundation, and some minor properties are affected. Buildings remain outside the flood extent, but some properties along Ida Rodd Drive experience flooding of their front yards.

Isolation

- 2.11.18 The Eden Golf Course can become isolated when the Princes Highway is closed.
- 2.11.19 Approximately 162 properties in Eden Cove Estate, Government Road, can experience short term isolations.

Flood Mitigation Systems

- 2.11.20 There are no flood levees located in Eden.
- 2.11.21 There are no declared detention basins located in Eden.

Dams

- 2.11.22 There are no declared dams located upstream of Eden.

At Risk Facilities

- 2.11.23 The BUPA Aged Care Facility located on Barclay Street in Eden is at risk of over-floor flooding. The sewer pumping station may cause additional risk if it fails.
- 2.11.24 At Eden Golf Course, the creek running through the Eden Golf Course can inundate parts of the course and flow over the neighbouring Princes Highway.
- 2.11.25 Eden High School on Barclay Street may have some risk of flooding as it is located next to the BUPA Aged Care facility.
- 2.11.26 Eden Holiday Park, Eden located opposite Aslings Beach on Aslings Beach Road is at risk of flooding from coastal inundation as well as flooding from Curalo Lagoon.

Other Considerations

- 2.11.27 The Princes Highway near the Eden Golf course can be cut, with depths of around 1m over the road reported during the 31 January 2016 flood event (26). The Highway was also cut in this event for short periods in other locations.

2.12 BOYDTOWN

- 2.12.1 Boydtown is located in Twofold Bay on the Far NSW South Coast within the Towamba River basin approximately 7km to the south of Eden (Map 19).

- 2.12.2 Boydtown Creek has a small catchment area (3.9 km²), which drains in a principally north-easterly direction to the south western shore of Twofold Bay. The majority of the catchment is bushland with only some minor urban subdivision development in the southern fringe of the lower catchment and the historic Sea Horse Inn and a nearby camping ground occupying the only sizeable area of flat ground adjacent to and north of the creek.
- 2.12.3 Boydtown has a population of 70 people, with 31 private dwellings (24).

Characteristics of Flooding

- 2.12.4 Boydtown is affected by a combination of flash flooding, creek flooding and estuarine flooding from Nullica River.

Flood Behaviour

- 2.12.5 The Towamba River discharges to the ocean to the south of Boydtown in an unpopulated area. The narrow barrier that forms Whale Beach lies across the mouth of the Towamba River and is at risk of beach erosion during oceanic storm events. During major flood events this barrier is often breached at various locations and occasionally has been completely washed away (17).

Classification of Floodplain

- 2.12.6 A number of locations within Eden, Shadrachs, Nullica and Boydtown were classed as high flood islands, becoming isolated as flood waters rise.
- 2.12.7 Although Boydtown is located close to the foreshore, it is not impacted directly by ocean flooding, as it is located on a local rise that keeps developed properties flood free in all design events except the PMF.

Inundation

- 2.12.8 There is a small risk of inundation within Boydtown due to the failure of Ben Boyd Dam. This primarily would affect those properties backing onto Boydtown Creek as well as the Princes Highway.
- 2.12.9 The caravan park at the Shadrachs Creek entrance have noted that sandbagging has been undertaken in the past to protect low lying sites from flooding from Shadrachs Creek after heavy rainfall.

Isolation

- 2.12.10 The Discovery Parks Holiday Park, Boydtown Beach Holiday Park and the Boydtown Caravan Park could potentially be isolated during a Ben Boyd Dam, dam failure event.

Flood Mitigation Systems

- 2.12.11 There are no flood levees located in Boydtown.
- 2.12.12 There are no detention basins located in Boydtown.

Dams

- 2.12.13 Boydtown has some properties potentially affected by a failure of the Ben Boyd Dam which is located within Boydtown Creek. A number of caravan parks are also at risk of isolation during dam failure.
- 2.12.14 In the event of a dam failure at the Ben Boyd Dam (10), 2 properties located immediately downstream of the dam at Boydtown would be reached within 12 to 16 minutes. The two residences on these properties, however, are not expected to be inundated during either a Sunny Day, or PMF Dam break flood. Dam break floodwater spilling over the planned development area on the western side of the Princes Highway could potentially be a risk to the houses in that area in the future (10).
- 2.12.15 Ben Boyd Dam is an off-stream water storage dam. Water stored in Ben Boyd Dam is used to supplement supply from the Kiah bore field to meet high water usage periods and to maintain supply during dry times when water from the Kiah bore field source is limited. The Kiah bore field and/or Ben Boyd Dam supplies water to Boydtown, Eden, South Pambula and 160 rural properties between Kiah and South Pambula.
- 2.12.16 The Princes Highway is also potentially cut during dam failure which could isolate people in the Discovery Parks Holiday Park, Boydtown Beach Caravan Park, and the Boydtown Caravan Park.

At Risk Facilities

- 2.12.17 The Discovery Parks Holiday Park, Boydtown Beach Holiday Park and the Boydtown Caravan Park could potentially be isolated.

Other Considerations

- 2.12.18 None known.

2.13 TOWAMBA

2.13.1 Towamba is a small town located about 32km inland from Eden on the Towamba River in the Far NSW South Coast (Map 20).

2.13.2 In 2016 the population of Towamba was 234 people with 184 private dwellings (19).

Characteristics of Flooding

2.13.3 Towamba can be isolated due to flooding.

2.13.4 The Towamba study area is unique in that the 1% AEP has a substantially larger flood extent than the 10% AEP event due to breakouts of the channel. While the majority of the flow is well contained, some breakouts do occur in the central portion of the model at the major bend in the river.

2.13.5 In the PMF event, the flood extent increases significantly. The extent of road inundation increases, with both Towamba Road and Towamba Street impacted for over 1 kilometre each.

2.13.6 The PMF also impacts buildings on both the northern and southern banks.

2.13.7 The Towamba Bridge on Pericoe Road over the Towamba River is overtopped in events as small as the 20% AEP event.

Flood Behaviour

2.13.8 Flooding within the Towamba River study areas is typically well defined, with little breakout flow from the main channel occurring, even in large flood events. The critical duration for flooding is relatively long; 9 to 12 hours, due to the large contributing upstream catchment area.

Classification of Floodplain

2.13.9 Unknown

Inundation

2.13.10 Historically the Towamba Bridge has been flooded. It has been reported that this bridge was flooded to depths of 7.8m in 1928 following 450mm of rain (recorded at Eden), and 6.1m in 1934 following 457mm of rain (26). The Towamba Bridge is overtopped in events as small as the 20% AEP event.

2.13.11 Towamba River flow both short cuts the bend in events larger than the 5% AEP event, and breaks out onto the northern banks in events above the 20% AEP. These breakouts inundated both Towamba Road and Towamba Street in the 1% AEP event, but do not impact residential developments.

2.13.12 In the PMF event, the flood extent increases significantly impacting roads and buildings on both the northern and southern banks. Pericoe Road crosses the Towamba River upstream of the major bend in the river, and connects Towamba Road, which runs along the northern side of the river, and Towamba Street, which runs along the southern side.

Isolation

- 2.13.13 Several main access roads and bridges can become inundated during a flood event, isolating residents.
- 2.13.14 Towamba can be isolated due to various road closures including the inundation of the Towamba Bridge.

Flood Mitigation Systems

- 2.13.15 There are no flood levees located in Towamba.
- 2.13.16 There are no detention basins located in Towamba.

Dams

- 2.13.17 There are no declared dams located upstream of Towamba.

At Risk Facilities

- 2.13.18 The Towamba Public School in Towamba Street can be isolated when the Towamba Bridge is closed.

Other Considerations

- 2.13.19 There is no mobile coverage in Towamba, so communications during flood events is difficult (26).

ROAD CLOSURES AND ISOLATED COMMUNITIES

2.14 ROAD CLOSURES

2.14.1 Table 10 lists roads liable to flooding in the Bega Valley Shire LGA.

Table 10: Roads liable to flooding in Bega Valley Shire LGA.

Affected Road	Usual point of closure location	Consequence of closure	Alternate Route	Gauge height (m) (AEP flood depth in m (30))
Bega River				
Tarraganda Lane, Bega	Tarraganda Lane where it crosses Bega River.	This will impact the ability for the community to travel between the left bank of the Bega River (Bega Country Club) to the Bega Township. Properties located east of the Bega River and south of the Brogo River (Tarraganda Lane and Corridgere Lane) will have all major access roads cut during a flood. Isolation and resupply risks when bridges are overtopped for 3-4 days	The only access is through State Forest, which is unlikely to be suitable as an effective access route.	5.10 (15)
Princes Highway Bridge, Bega	North and south bridge approaches	Remains flood free in the 1% AEP allowing traffic movement to and from the Bega township to the north.		17.13m PMF
Buckajo Road, Bega (32)	Bega river crossings	Isolation of 20-30 homes. A large length of Buckajo Road (from Spring Creek downstream to the Princes Highway Bridge) will be inundated by high hazard flooding in events greater	This will affect the ability of some residents to access the Bega township during and following a flood event.	5.5m (15)

Affected Road	Usual point of closure location	Consequence of closure	Alternate Route	Gauge height (m) (AEP flood depth in m (30))
		than and including the 10% AEP, with flood depths greater than 1 m likely to occur across the length of the Road.		
Carp Street, Bega	Low point frequently flooded, Kisses Lagoon Western end. <i>Note: the new Highway now bypasses this area.</i>		Available. Detour north via Kirkland Street and south via Swan Street	3.5m (15)
Tathra Road, Bega (32)	North-east end of East Street, Bega		Available	6.0m (15)
Tathra Road, Bega to Tathra (32)	At cattle crossing Jellat Jellat Flat		Available	1.28m (15)
Bega St, Bega	North-western end of Bega Street and low lying areas at Gipps Street.	Residential and commercial properties affected	Available	5.0m (15)
East St, Bega	Low-lying areas at Tarraganda Lane, Glebe Park and northern end. Downstream of Bega township. Causeway near racecourse.	Parking or camping is permitted at the corner of Park Lane and East Street.		6.0m (15)
Nelson Street, Bega (15)	Along drainage line to Apex Park	9 properties on the eastern side of the street.	Available	5.54m (15)
Upper Street, Bega (15)	Bega, western end		Available	6.57m (15)
Swan St, Bega (15)	Corner of Park St		Available	6.34m

Affected Road	Usual point of closure location	Consequence of closure	Alternate Route	Gauge height (m) (AEP flood depth in m (30))
Auckland Street, Bega	Northern end	No properties	No alternatives	5.0m (15)
Poplar Ave, Bega (15)	Sportsground access	No properties		6.57m (15)
Parrabel Street, Bega (15)	Eastern end	1 property corner Angledale Road isolated	No alternative	6.57m (15)
Angledale Road, Angeldale (32)	Multiple locations	Road flooded. Development is generally confined to areas that are more elevated. Low-lying areas impacted by flooding are generally used for agricultural purposes.	The community does have access to the Princes Highway and can reach the Bega Township if required.	5.5m (15)
Murrays Flat Road, Tarraganda (32)	Off Doctor George Mountain Road	Isolation of approximately 10 properties	No alternatives	6.57m (15)
Moore Wren Road, Tarraganda (15)	Western end	Possible flooding of approximately 4 properties		4.2m
Reedy Swamp Road, Tarraganda (32)	Reedy Swamp	Water starts to inundate Reedy Swamp Road. (Possible isolation of 9 properties at 5.6m)	No alternative	1.69m
Old Wallagoot Road, Kalaru	Low lying area	Water starts to inundate Old Wallagoot Road	Alternative route via Sapphire Coast Drive	6.57m (15)
Wallagoot Lane, Wallagoot	Jellat Jellat Creek and Betungabee Creek	May cause isolations	Alternative route through State Forest may be possible	6.57m (15) (5%AEP 2.42m)
Wallagoot Lake Road, Wallagoot (32)	Closed by high Wallagoot Lake levels		No alternatives	6.57m (15)
Bournda Rd, Wallagoot (15)		Access to Bournda National Park camping facilities	No alternative	6.57m (15)

Affected Road	Usual point of closure location	Consequence of closure	Alternate Route	Gauge height (m) (AEP flood depth in m (30))
Clarks Road, Greendale (15)	Road impassable Crossing of Abrahams Gully	Maybe 20 properties isolated	Jews Creek Road	6.57m (15)
Little Glen Oaks Road, Greendale (15)	Brogo River crossing. 19km north of Bega	Maybe 20 properties isolated	Jews Creek Road	6.57m (15)
Tathra Bermagui Rd, Tathra (15)	Handcock Bridge over Bega River at Tathra, Highway 9		Alternative access Sapphire Coast Drive	6.57m (15)
Princes Highway, Bega (25)	12km south of Bega near "Kingswood" property	Potential isolation from Bega	No alternative	
Frogs Hollow Lane, Frogs Hollow (15)	14km south of Bega 500m from Princes Hwy. Crosses Frogs Hollow Creek	Potential isolation of community	No alternative	6.57m (15)
Rocky Hall				
Big Jack Mountain Road, Rocky Hall (32)	Crossing over Stockyard Creek	Isolation of Rocky Hall 6-8 properties	No alternatives	(20% AEP 1.7m)
Orchard Road, Rocky Hall (32)	Off Big Jack Mountain Road		No alternatives	(20% AEP 3.7m)
New Buildings				
New Buildings Bridge, New Buildings	Causeway over Mataganah Creek		No alternatives	(2% AEP)
Big Jack Mountain Road (at New Buildings), New Buildings	Causeway between Burragate and New Buildings Road			(2% AEP 0.40m)
Burragate				
Big Jack Mountain Road, Burragate	Bridge over Towamba River		No alternatives	(20% AEP 2.8m)

Affected Road	Usual point of closure location	Consequence of closure	Alternate Route	Gauge height (m) (AEP flood depth in m (30))
Davidson Street, Burragate	Unsealed road to approximately 8 properties	Unsealed road to approximately 8 properties		(1% AEP 0.30m)
Towamba				
Towamba Bridge, Towamba	Causeway on Pericoe Road	Isolation of Towamba >200 people	Alternative access through Towamba State Forest	(20% AEP 3.7m)
Pericoe Road, Towamba	Bens Creek between Towamba Road and Pericoe Road	Isolation of Towamba >200 people	Alternative access through Towamba State Forest	(20% AEP 1.6m)
Towamba Road, Towamba	North side of Towamba River	Isolation of Towamba >200 people	Alternative access through Towamba State Forest	(20% AEP 2.9m)
Pericoe Road, Towamba (32)	Causeway over Camping Ground Creek	If this alternative access for Towamba is cut then isolation of Towamba >200 people	Alternative access through Towamba State Forest	
Upper Kiah Road, Kiah (32)	At Mustering Ground Creek crossing 26km South of Eden		Available. fire trails through State Forest	
Eden North				
Barclay Street, Eden North	Eastern end of Barclay Street			(20% AEP 0.20m)
Imlay Street, Eden North	At Freshwater Creek	May cause isolations	Unknown	(1% AEP 0.10m)
Imlay Street Eden North	At Golf Course from local catchment	May cause isolations	Unknown	(20% AEP 0.10m)
Imlay Street, Eden North (Princes Highway A1)	Unnamed tributary south of Government Road intersection	May cause isolations	10 minute detour via Nethercote to access Pambula. 30 minute detour (unsealed road) to get from southern parts of Eden to	(PMF 0.60m)

Affected Road	Usual point of closure location	Consequence of closure	Alternate Route	Gauge height (m) (AEP flood depth in m (30))
			northern parts of Eden	
Imlay Street, Eden North	At Palestine Creek. Intersection with Princes Highway	May cause isolations	Unknown	(PMF 1.70m)
Government Road, Eden North	At Palestine Creek. from local catchment	May cause isolations	Unknown	(PMF 2.70m)
KB Timms Road, Eden North	At Bellbird Creek.	May cause isolations	Unknown	(PMF 0.40m)
Eden South				
Cosham Close, Eden South		May cause isolations	Unknown	(20% AEP 0.10m)
Ida Rodd Drive, Eden South		May cause isolations	Unknown	(20% AEP 0.10m)
Cattle Bay Road, Eden South		Unknown		(20% AEP 0.10m)
Causeways on roads in the Bega Valley Shire LGA				
Wandella Road, Cobargo (15)	Causeway over Wilgo Creek 5km from Princes Highway, Cobargo	Unknown		
East Sams Corner Road, Mogilla (15)	Causeway over Sandy Creek 1km from Mogilla Road. 15km from Candelo	Unknown		
McGregors Road, Greendale (15)	Off Pearces Road, 4km from Princes Highway, Stony Creek.	May isolate 4 properties	Unknown	

Affected Road	Usual point of closure location	Consequence of closure	Alternate Route	Gauge height (m) (AEP flood depth in m (30))
Field Buckets Road, Quaama (15)	Causeway crossing Pipeclay Creek.	Unknown		
Nutleys Creek Road, Bermagui (32)	Causeway at Nutleys Creek and/or at Cuttagee Creek, Quaama	Unknown		
Wapengo Lake Rd, Wapengo (32)	Culvert at 1.3km	Isolation of 4 properties	No alternatives	
Westrops Road, Coolagolite (32)	Coolagolite Creek	Isolation of 5 properties		
Billaroy Rd, Cobargo (32)	Bredbatowra Creek 500m from Princes Highway turnoff.	Isolation of 6 properties	No alternatives	
Upper Brogo Road, Brogo (15)	Brogo Swamp Creek 12km from Verona Rd	Isolation of 12 properties	No alternatives	
Oaklands Road, Pambula (32)	Closed by Pambula River	Unknown		
Millingandi Short Cut Road, Millingandi (32)	800m from Princes Highway. Tributary to Boggy Creek	Unknown		
Millingandi Road, Millingandi (32)	Boggy Creek	Unknown		
Nethercote Road, Nethercote (32)	Causeway over Centipede Creek?	Unknown		
Nethercote Road, Nethercote (32)	Old Hut Creek crossing,	Unknown	Yes - up to PMF Back Creek Road may provide an alternative (19)	
Nethercote Road, Greigs Flat (32)	Bridge over Yowaka River 5km from Princes Highway Greigs Flat The road is also predicted to be	Cut during the 10% AEP flood between the Princes Highway and Greigs Flat. Inundation would commence about 5 hours after the initial onset of	Yes - up to PMF Back Creek Road may provide an alternative (19)	

Affected Road	Usual point of closure location	Consequence of closure	Alternate Route	Gauge height (m) (AEP flood depth in m (30))
	cut near the Yowaka River bridge crossing as well as near Ruggs Road making it one of the most susceptible major roads to inundation in the catchment.	rainfall and the road would remain cut for at least 7 hours. H5 hazard is predicted across parts of the road during floods as frequent as the 5% AEP event which also making it one of the most dangerous roads.		
Mount Darragh Road, Lochiel	At South Pambula	Predicted to be inundated from local catchment runoff at South Pambula during the 5% AEP flood. The flooding is "flashy" in this area. As a result, limited advanced warning time is available, but the water drains away quite quickly (i.e., in less than 2 hours during more frequent floods). During more severe floods, the road may be cut for up to 4 or 5 hours.	Up to PMF Back Creek Road may provide an alternative (19)	
Back Creek Road, Lochiel (32)	1km north Yowaka River. Cut near Blairlands Road	Inundation is only predicted between the 1%AEP and a PMF. As a result, Back Creek Road will remain trafficable during most floods. May provide an alternate transportation route if Mount Darragh Road and/or Nethercote Road are cut by floodwaters.	Isolation of extensive areas west of the Princes Highway	
Wonboyn Road, Nadgee (32)	Watergums Creek	Isolation of Wonboyn Lake suburb		

Affected Road	Usual point of closure location	Consequence of closure	Alternate Route	Gauge height (m) (AEP flood depth in m (30))
	7km from Princes Highway, Narrabara	approximately 103 people		
Wonboyn Road, Wonboyn North (32)	Wonboyn River 3km from Princes Highway, Narrabara	Isolation of Wonboyn Lake suburb approximately 103 people		
Sullivans Gap Road, Bemboka (32)	Causeway over Polacks Flat Creek	Possibly 1 dwelling isolated	No alternatives	
Greens Lane, Bemboka (15)	Crossing Brown Mountain Creek. Off Yankees Gap Road	Possibly 1 dwelling isolated	No alternatives	
Desert Creek Road, Numbugga (15)	Bridge over Numbugga Creek 800m from Snowy Mountains Highway	Isolation of approximately 17 properties	No alternative	
Tantawangalo Lane, Candelo (32)	Causeway 100m Tantawangalo Mountain Road (MR275)			
Church Lane, Candelo (15)	Crossing Tantawangalo Creek, St Johns Church on Slaters Lane			
Tarlingtons Lane, Tantawangalo (32)	Causeway crossing Tantawangalo Creek near speedway			
Tantawangalo Mountain Road, Tantawangalo (15)	Bridge at Six Mile Creek at picnic campground area.			
Dorrigo Road, Brogo (15)	Causeway over House Creek	May cause isolation of 9 properties	No alternative	

Affected Road	Usual point of closure location	Consequence of closure	Alternate Route	Gauge height (m) (AEP flood depth in m (30))
Princes Highway, Pambula (32)	Monaro Street bridge over Pambula River	Pambula and South Pambula isolated from each other		
Tathra Bermagui Road, Murrah (25)	Causeway at Murrah River between Barragga Bay and Murrah	Can isolate properties to the west of Murrah Lagoon	Not if road also closed in other locations	
Tathra Bermagui Road, Murrah (25)	Causeway at Brockelos Creek between Murrah and Wapengo	Can isolate properties to the west of road	Not if road also closed in other locations	
Tathra Bermagui Road, Wapengo (32)	Causeway over Wapengo Creek	Unknown	Available	
Wallaga Lake Road, Wallaga Lake (32)	Wallaga Lake causeways at Merriwanga Creek	Unknown	Available	
Towamba Road, Towamba (32)	Stoney Creek	Unknown	Available	
Towamba Road, Burragate (32)	Jingo Creek	Possible isolations	Unknown	
Punkalla-Tilba Road, Narooma (15)	Punkally Creek at Wild Horse Creek Road intersection	Possible isolations	Unknown	

2.15 SUMMARY OF ISOLATED COMMUNITIES AND PROPERTIES

- 2.15.1 Table 11 summarises communities liable to isolation and potential periods of isolation. Information presented here is based on flood studies as well as historical experience and does not reflect the duration of isolation expected in larger and extreme events.
- 2.15.2 Refer to specific risk areas for further detail on isolations.

Table 11: Potential Periods of isolation for communities in the Bega Valley Shire LGA during flooding events

Town / Area (River Basin)	Population/ Dwellings	Flood Affect Classification	Approximate period isolation	NOTES
Bega	33,253	Isolated	Unknown	The Princes Highway can cut south of Bega near “Kingswood”. The highway is also expected to be cut at the bridge during a PMF.
Bega (parts) and rural surrounds	Unknown	Various isolated		Rural properties surrounding Bega may be isolated. Properties on Grosses Creek Road, and Buckajo Road would become isolated in a 5% AEP event (Bega North gauge height 8.78m) (1). Properties on Charlotte Street and Ravenswood Street may also become isolated.
Burragate	Estimated 200-300 pp	Isolated		Likely to be isolated for 3-4 days due to closure of numerous causeways.
West of Cobargo	638 pp in district	Isolated		Can be isolated. Large number of people living in hills.
Cuttagee Lake (some properties)	Unknown	Isolated		Some properties can be isolated when a bridge cuts to the north of Cuttagee Lake (25).
Angledale and Tarraganda	Tarraganda 246pp, 90 dwellings	Isolated	31 hours	Isolated from Bega when Tarraganda Lane Main Bridge and Tarraganda Lane Anabranh Bridge crossings are closed and cut around 5m at the Bega North gauge.
Eden Cove Estate (Government Road, Eden)	Unknown	Isolated		Can experience short term isolations due to flooding of Palestine Creek and Bellbird Creek
Rural properties surrounding Candelo	Unknown	Isolated	Up to 48 hours	Rural properties surrounding Candelo may become isolated due to road closures or damage to crossing structures.
Tathra	1,992pp, 805 dwellings	Rising Road Access within town but town may be Isolated (High Flood Island)	Up to 48 hours	May be potentially cut off during an extreme event leaving Tathra completely isolated (1).

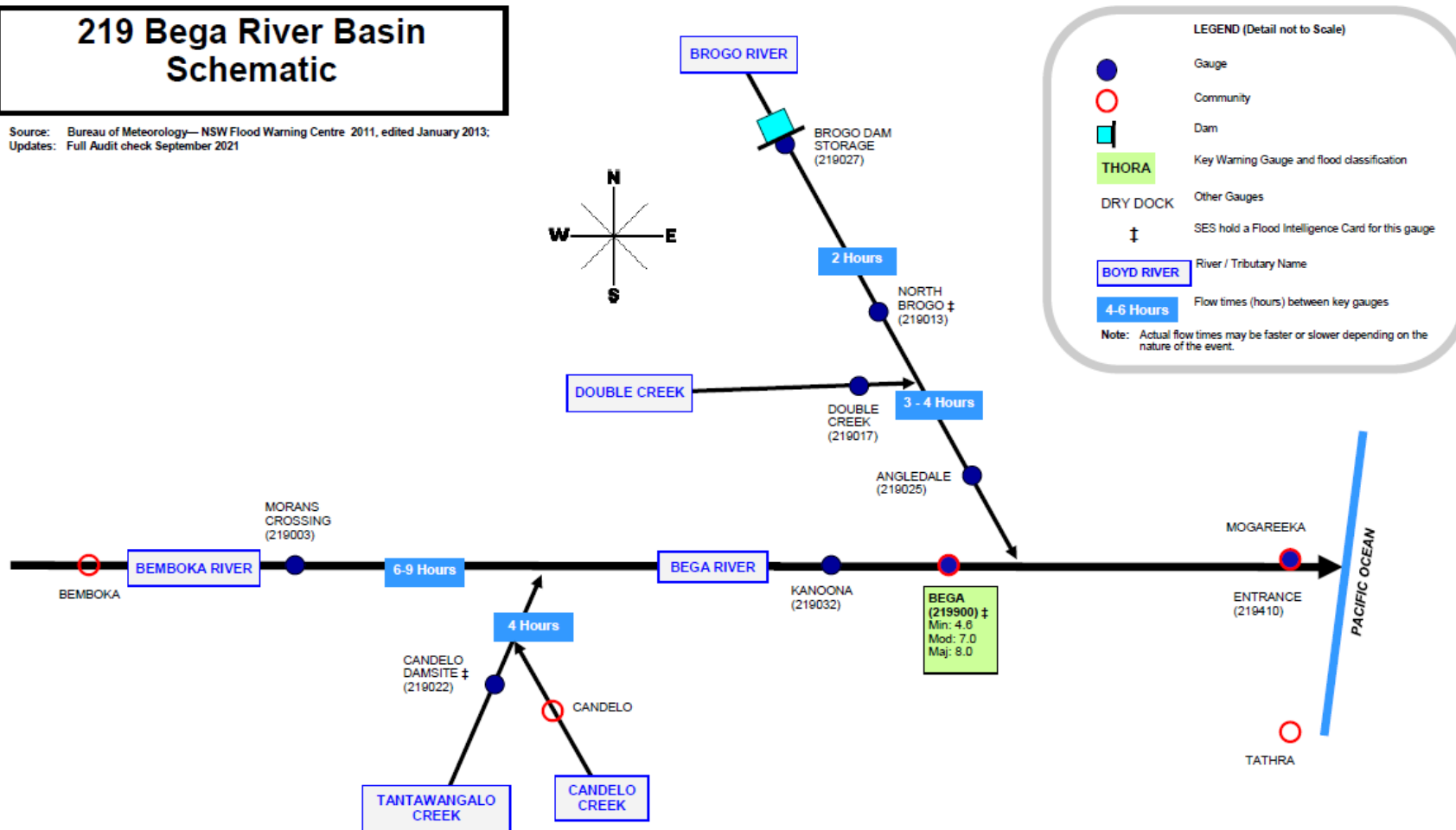
Town / Area (River Basin)	Population/ Dwellings	Flood Affect Classification	Approximate period isolation	NOTES
Mogareeka	Unknown	Isolated	Up to 18 hours during a 1% AEP event	Becomes isolated during a 5% AEP event (Bega North gauge height 8.78m) (1)
Murrah	Unknown	Isolated		People living on rural properties west of the Tathra –Bermagui Road can become isolated when the road is cut at the Murrah River and to the north of Wapengo.
Nethercote	366 pp in district	Isolated		Can be isolated when Nethercote Road is cut.
Rocky Hall	610 pp in district	Isolated		Can be isolated when Big Jack Mountain Road is cut at multiple causeways.
Springvale and Buckajo	25-30 properties	Isolated	24 hours	Become isolated when the Bega North (219900) Gauge reaches 5.5m (8).
Towamba	372 pp in district	Isolated		Towamba can be isolated due to road closures including the closure of the Towamba Bridge.
Wallagoot and surrounding rural properties	Unknown	High Flood Island (Wallagoot)	5 days	Wallagoot is a high flood island above a 10% AEP (gauge height 8.26m at Bega North gauge). Rural properties have not been classified but can become isolated.
Womboyn	Unknown	Isolated		Can be isolated due to road closures as occurred in 2014, 2015 and 2016. Popular camping area.
Rural properties near Bemboka	Unknown	Isolated	Unknown	Rural properties accessing Yankees Gap Road and Sullivans Gap Road can experience isolation due to flooded access (2).
Wyndham	Unknown	Isolated	More than 12hrs	During March 2000 flash flood event Wyndham was cut off from main road routes for more than 12 hours. Wyndham Road, between Wyndham and Pambula, was closed after a small bridge on the route was washed away (18).

Note: Periods of isolation are a guide only. Liaison with the Local Controller and communities/residents involved is essential during periods of potential and actual isolation.

ANNEX 1: BEGA RIVER BASIN SCHEMATIC

219 Bega River Basin Schematic

Source: Bureau of Meteorology—NSW Flood Warning Centre 2011, edited January 2013;
 Updates: Full Audit check September 2021



DISCLAIMER
 This publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information is not intended for general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map unless they are under supervision of trained and qualified emergency management personnel. The NSW State Emergency Service disclaims any liability to any persons in respect of anything and the consequence of whole or partial reliance upon the whole or part of the information in this map publication.

ANNEX 2: FACILITIES AT RISK OF FLOODING AND/OR ISOLATION

Facility Name	Street	Suburb	Comment
Schools			
Bega Valley Public School (1)	27 Auckland St	Bega	Affected between a 1% AEP event and a PMF
Bermagui Public School	George St	Bermagui	
Candelo Public School	56 William Street	Candelo	Is not affected by flooding however William Street can be flooded so school access would have to be from Bega or Queens Streets
Eden High School	9-21 Barclay Street	Eden	May have some risk of flooding as it is located next to the BUPA Aged Care facility which has previously flooded.
Towamba Public School	7 Towamba Street	Towamba	Can be isolated when the bridge over the Towamba River closes.
Merimbula Public School	47/55 Main Street	Merimbula	Yellow Pinch Dam PMF dam breakout has the possibility to affect the school which is located in the centre of the low point. Flows of up to 1.5m may be possible through the school grounds.
Child Care Centres			
Bega Valley Family Day Care	5/81-85 Auckland Street	Bega	5% AEP 0.1m, 10% AEP 0.8 increasing to PMF depth 7.8m
Mackillop Family Services	38 Parker Street	Bega	2% AEP 0.4m and increasing to PMF 7.6m
Mission Australia	110 Carp Street	Bega	PMF 4.9m
Sunshine and Puddles Family Daycare	3 Walker Street	Bega	PMF 2.6m
Pambula Pre-School	Dingo Street	Pambula	Max hazard 5% AEP (19)
Facilities for the aged and/or infirm			
Bega Valley Private Hospital (1)	31 Parker St	Bega	Affected between a 1% AEP event and a PMF
Bega District Nursing Home (The Oaks Country Village) (1)	17 Tarraganda Lane	Bega	Affected between a 1% AEP event and a PMF
Uniting Eden (BUPA Aged Care Facility)	22 Barclay St	Eden	Has previously experienced over floor flooding. Flow path runs through and behind the centre causing nuisance flooding in the 0.2% AEP. In a PMF a large region would be inundated by depths of 0.5m to 1m. (8)
Acacia Ponds Village	3197 Princes Highway	Pambula	First affected in 5% AEP event. Low Flood Island, high hazard in 1% AEP events. Flood depths up to 0.56m in a PMF event. Duration

Facility Name	Street	Suburb	Comment
			of flooding typically dependant on the tidal cycle of the lakes.
Southeast Regional Hospital (1)	4 Virginia Drive, Tathra Road	Bega	The main access to the hospital along Tathra Road is expected to be closed during the PMF event isolating the hospital. The hospital may also experience some flooding during a PMF.
Utilities and infrastructure			
Airport (Merimbula)	371 Arthur Kaine Drive	Merimbula	Low Flood Island. Buildings begin to be inundated and isolated in a 2% AEP. Flood depths up to 0.5m expected during a PMF. Access is lost along Arthur Kaine Drive to the north in the PMF event and to the south in the 2% AEP event.
Merimbula Marine Rescue	Main Street, Spencer Park	Merimbula	The Marine Rescue site is first inundated in the 20% AEP event by depths of up to 0.6m. These depths increase to 1.1m in the 1% AEP and 1.3m in the PMF The duration of flooding is typically dependent on the tidal cycle of the lakes, with flood water receding as the tide drops.
NSW Volunteer Rescue Association Inc. (VRA)	22 Tarraganda Lane	Tarraganda	Isolated from Bega township
Telecommunications		Bega Valley	Telecommunications systems may be affected over large areas of the Bega Valley Shire due to flood waters damaging necessary infrastructure
Bega Cheese Factory (1)	11-13 Lagoon Street	Bega	Affected between a 1% AEP event and a PMF
Berrambool Sporting Complex	16 Berrambool Drive	Berrambool	Can be inundated in the 20% AEP by depths of 0.49m increasing up to 2.03m during a PMF (22).
Supermarket Complexes (1)	Auckland and Carp Streets	Bega	Affected between a 1% AEP event and a PMF
Veterinarian Hospital (1)	9 Ridge Street	Bega	Affected between a 1% AEP event and a PMF
Candelo Bowling Club	1 Sharpe Street	Candelo	
Tathra Beach Bowling Club	7099 Dilkeria Road	Tathra	May be affected in a PMF
Sewage Pumping Facilities	Near Barclay St	Eden	These have previously failed contributing to flooding of the Uniting Eden (BUPA Aged Care facility)
Camping Ground / Caravan Parks / Hostels			
Bega Valley Backpackers Hostel (1)	31 Kirkland Crescent	Bega	Affected between a 1% AEP event and a PMF

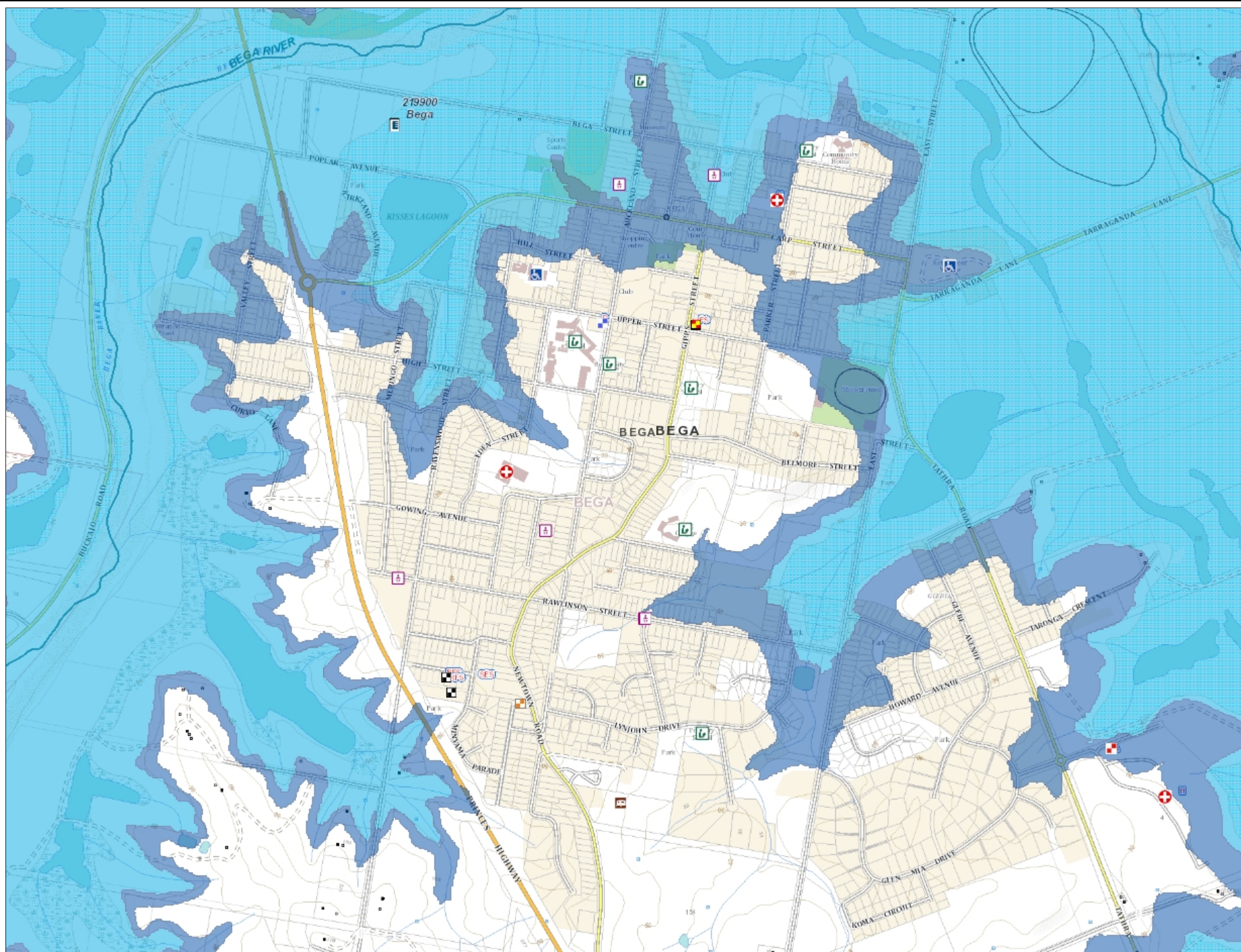
Facility Name	Street	Suburb	Comment
Big 4 Tathra Beach Holiday Park	41 Andy Poole Drive	Tathra	Affected between a 1% AEP event and a PMF
The Discovery Parks Holiday Park	731 Princes Hwy	Boydton	Could potentially be isolated during a Ben Boyd Dam, dam failure event.
Discovery Parks Pambula Beach	1 Pambula Beach Road	Pambula Beach	Small section of the park is exposed to flood conditions across open space during 5% AEP (19)
Boydton Beach Holiday Park	1 Boydton Park Rd	Boydton	Could potentially be isolated during a Ben Boyd Dam, dam failure event.
Boydton Caravan Park	Princes Highway	Boydton	Could potentially be isolated during a Ben Boyd Dam, dam failure event.
Kalaru Holiday Park	3 Old Wallagoot Rd	Kalaru	May be affected in a PMF.
Tathra Beach Eco Camp	5 Andy Poole Drive	Tathra	Affected between a 1% AEP event and a PMF. Located on low-lying land, access being lost before the site experiences flooding.
Tathra Beachside	2 Andy Poole Drive	Tathra	Affected between a 1% AEP event and a PMF. Located on low-lying land, could potentially lose access before the site experiences flooding.
Zane Gray Tourist Park (20)	1 Lamont St	Bermagui	Was flooded in March 2012 with up to 8 permanent cabins flooded with stormwater.
Sapphire Valley Caravan Park (13)	29 Sapphire Coast Drive	Merimbula	High risk low flood island. Becomes isolated during a 5% AEP and inundated from 10% AEP. Flood depths of up to 2.23m expected during a PMF. Is also at risk of flooding due to failure of Yellow Pinch Dam (13) ~ 145 sites including caravan and cottages (18)
Regatta Point Holiday Park	35 Regatta Point Road	Wallaga Lake	~160 sites including caravan and cottages (18). Could potentially be isolated. Is located within a low-lying area.
Eden Holiday Park	Aslings Beach Rd	Eden	~ 200 sites including caravan and cottages (18)
Eden Gateway Holiday Park	Princes Highway and Barclay Street	Eden NSW 2551	PMF flow from Freshwater Creek
The Garden of Eden Caravan Park	99 Princes Highway	Eden NSW 2551	Inundated in events as small as the 20% AEP

MAP 1 - BEGA RIVER BASIN























MAP 2 - TOWAMBA RIVER BASIN





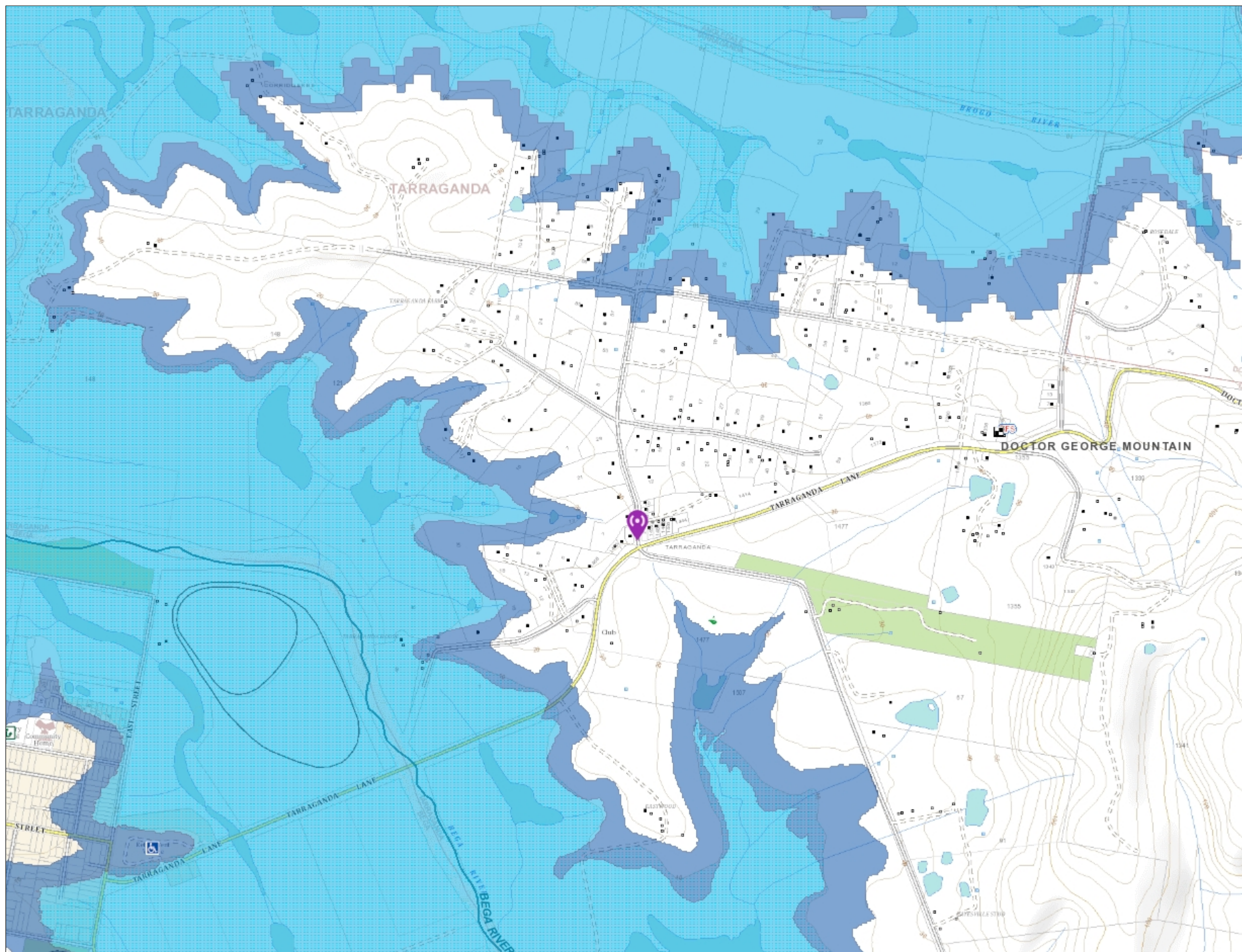
Legend

-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
- Key Towns**
- Major Towns**
- Regional Towns**
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations





















DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.



THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.



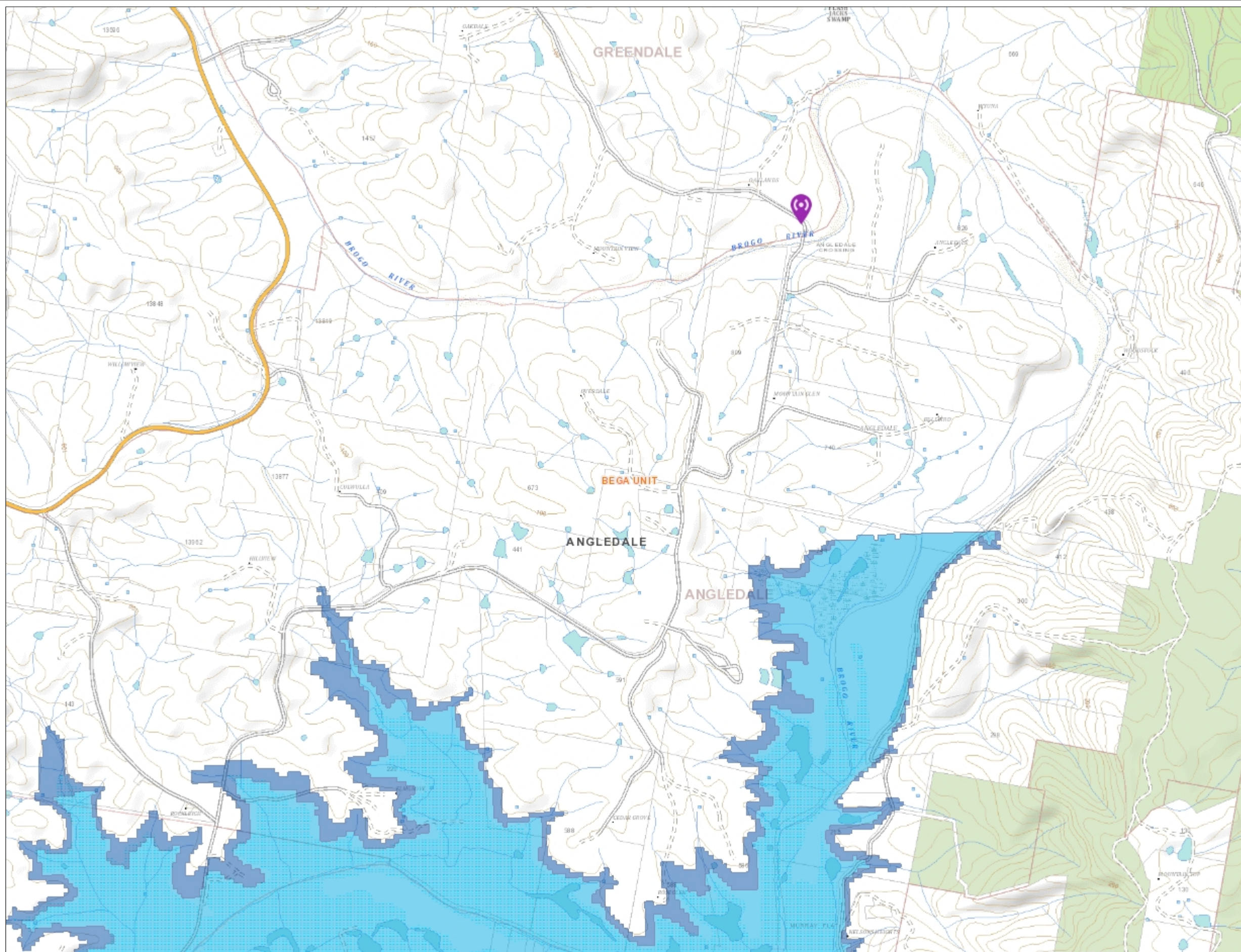
Legend

-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns





















DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.



THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.



Legend

-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns

DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.






















THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.

Printed: 27/07/2021



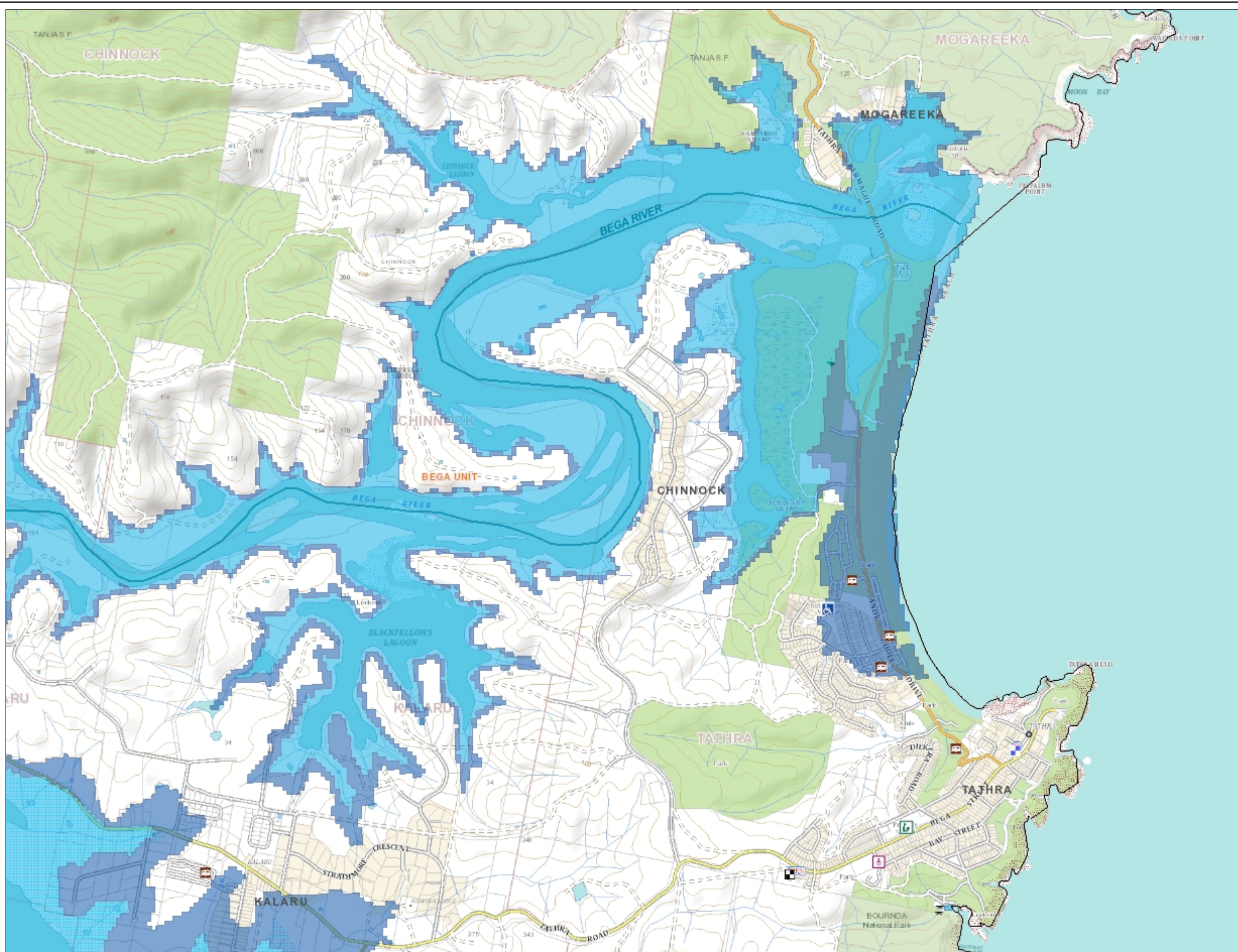
Legend

-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns

DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.



THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.



Legend

- Educational Facilities
- Child Care Facilities
- Health Care Facilities
- Aged Care Facilities
- Caravan Park / Camping
- Airports
- Rail Stations
- SES Headquarters
- SES Zones
- SES Units
- Gauges (BOM Forecast)
- Declared Dams
- Levees
- Rivers (Major)
- 1% AEP
- Probable Maximum Flood
- Police Stations
- Ambulance Facilities
- RFS Facilities
- FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns





















DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.



THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.



Legend

-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns





















DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.



THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.



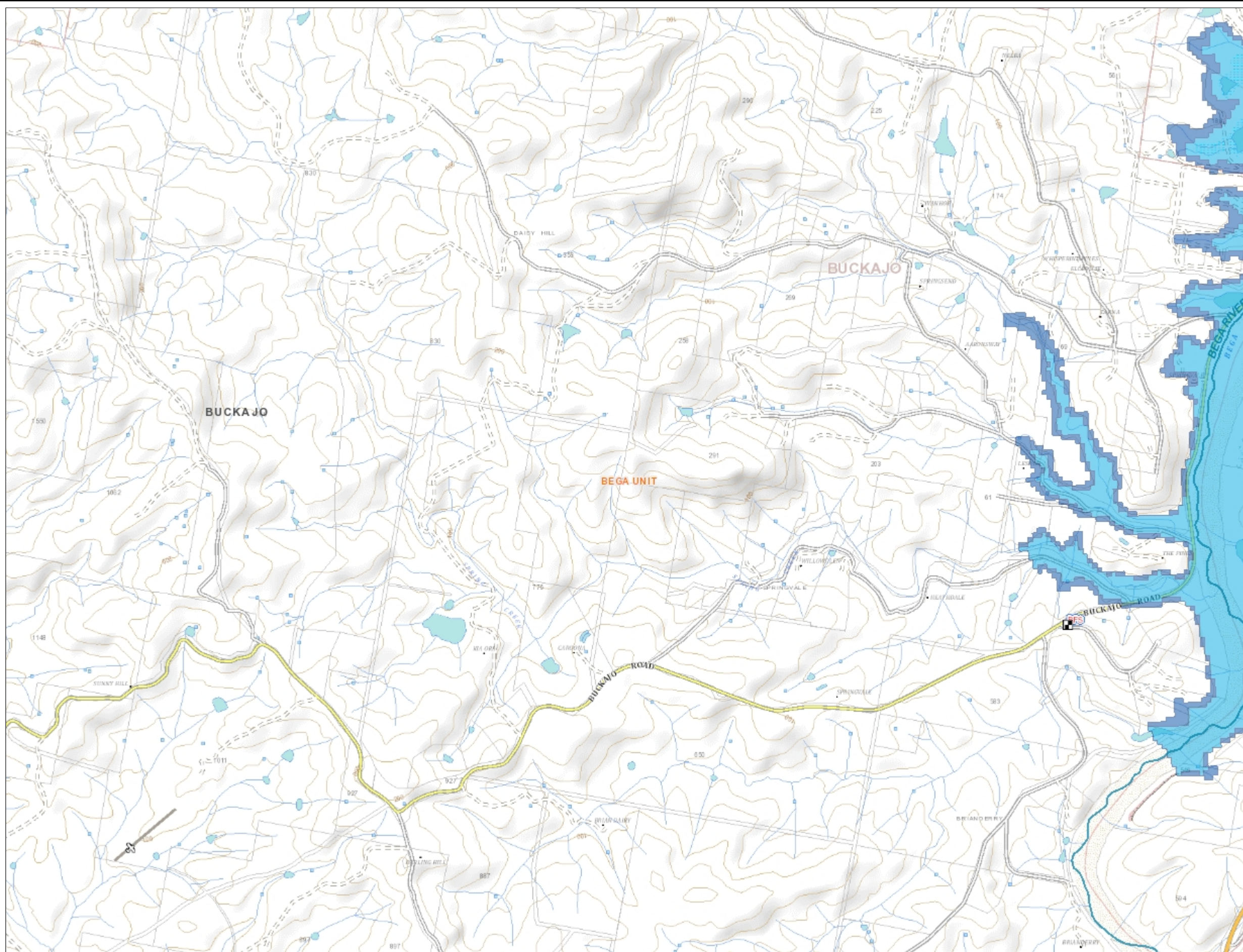
Legend

-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns





















DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.



THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.



Legend

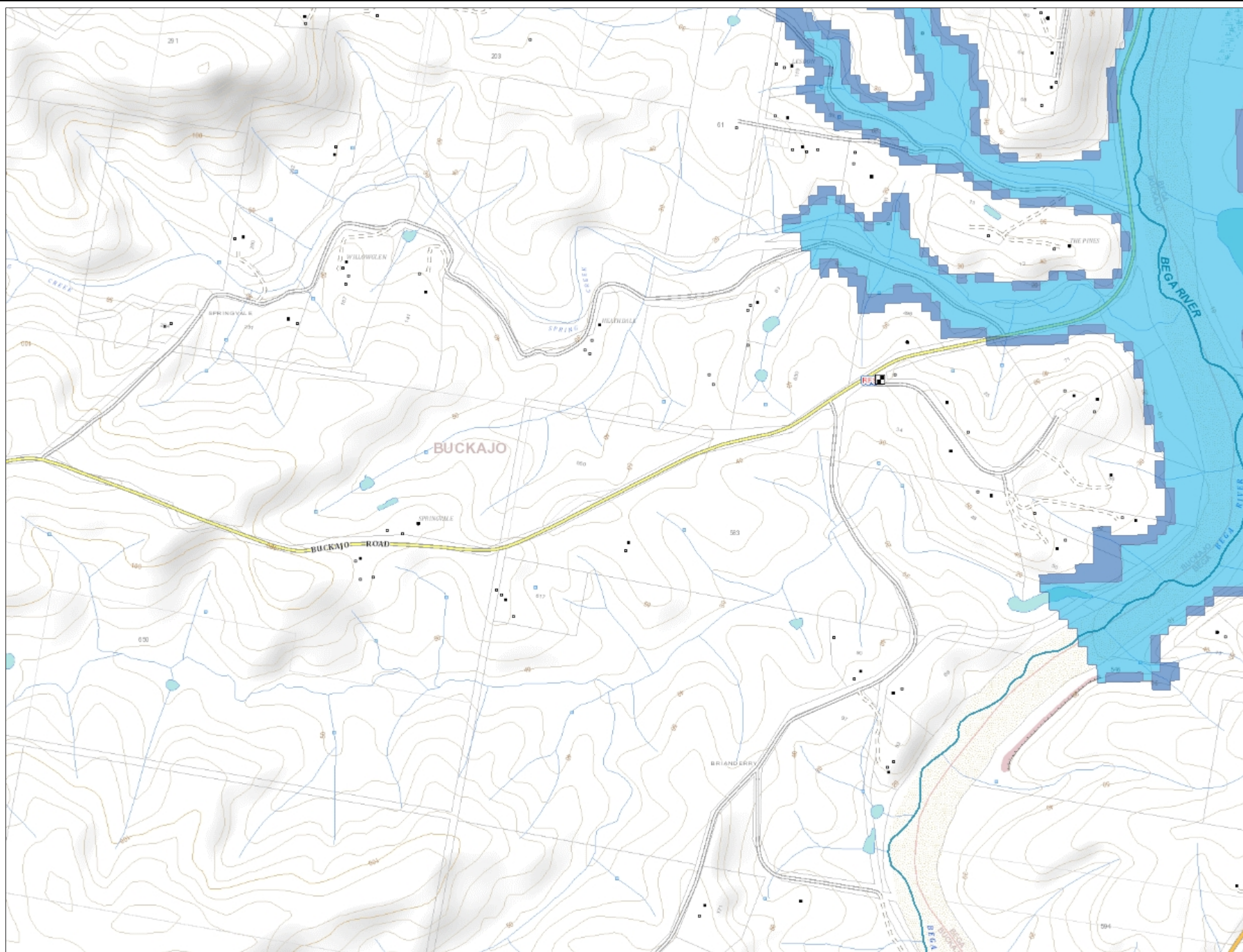
-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns

DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.























THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.

Printed: 27/07/2021



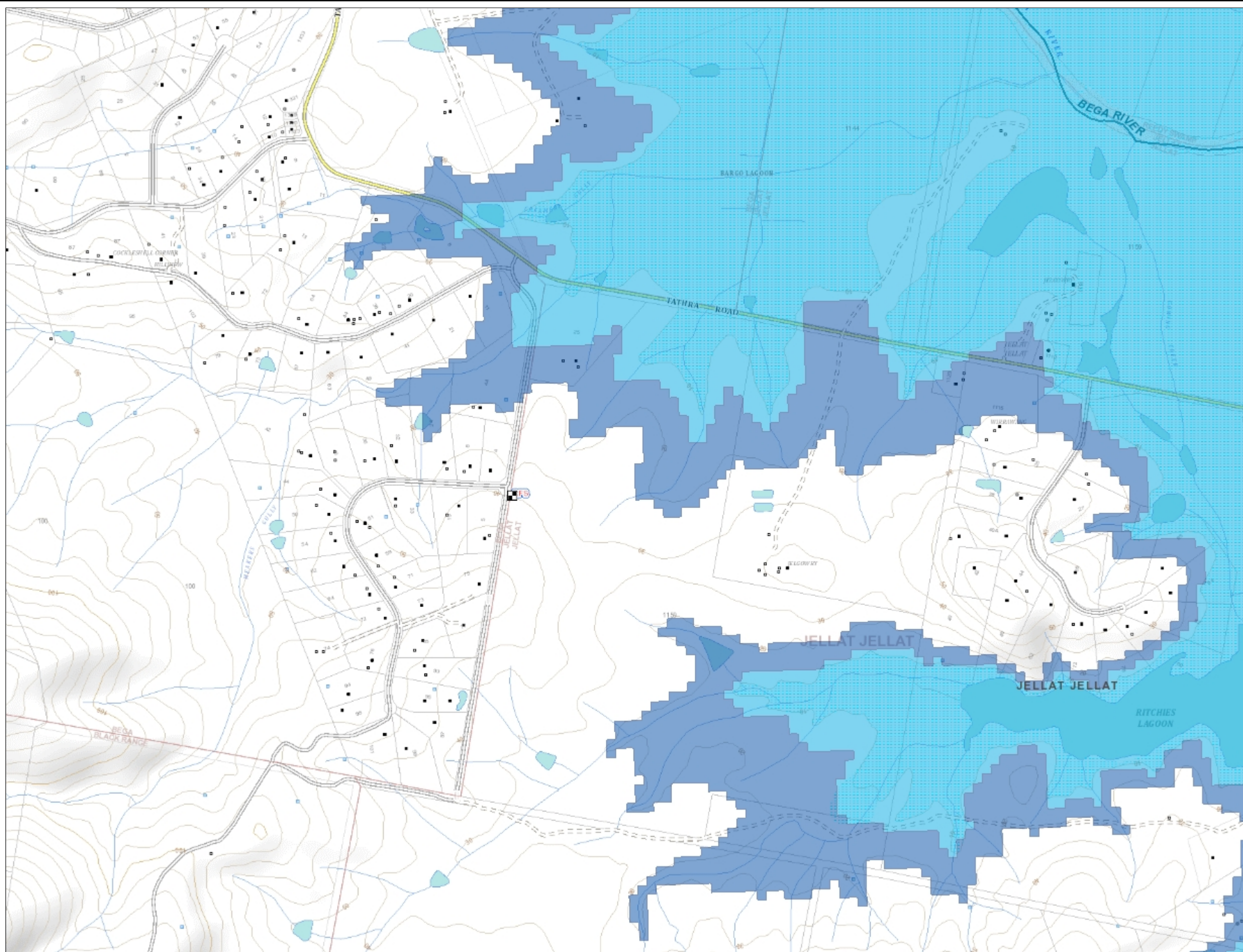
Legend

-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns





















DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.



THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.



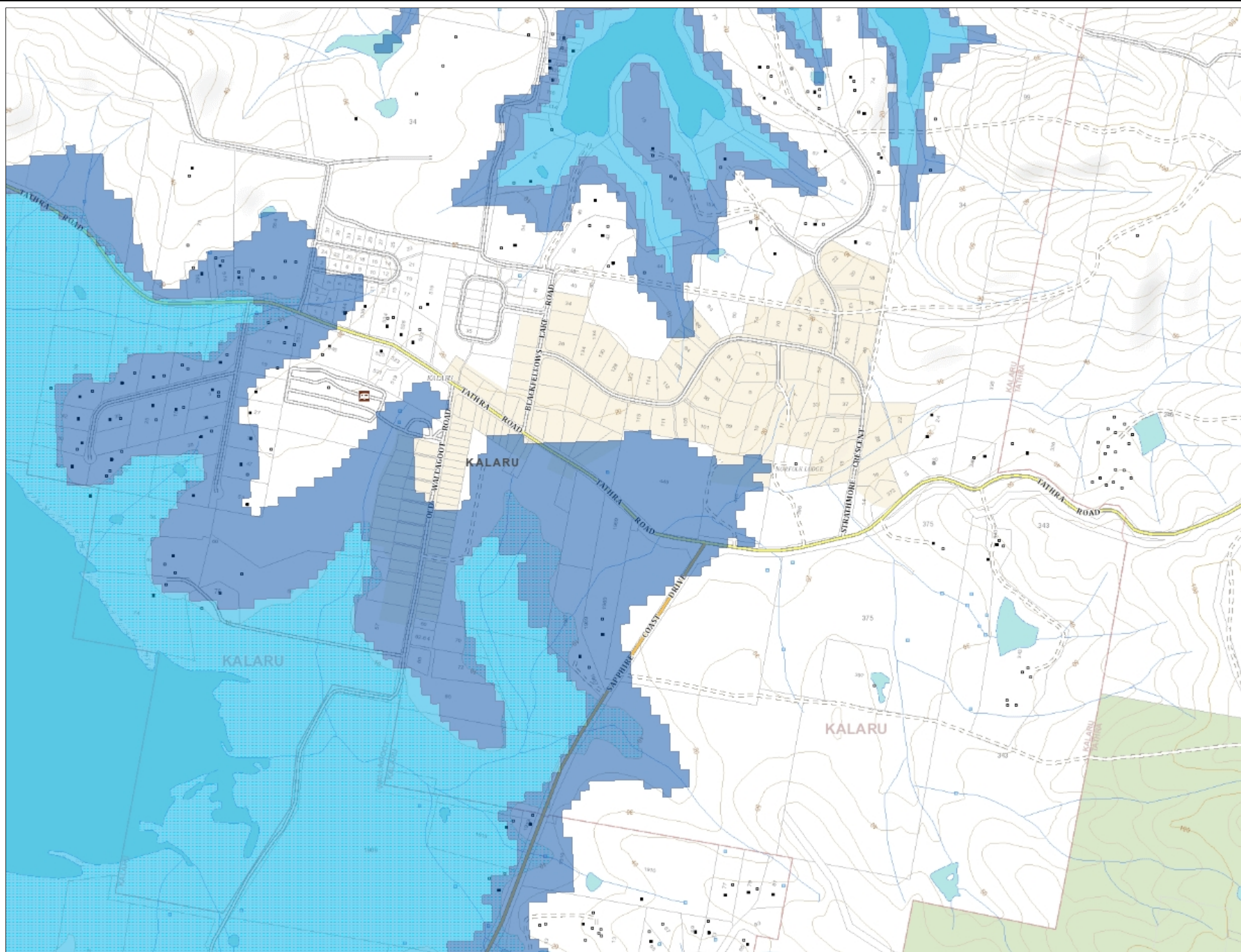
Legend

-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns





















DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.



THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.



Legend

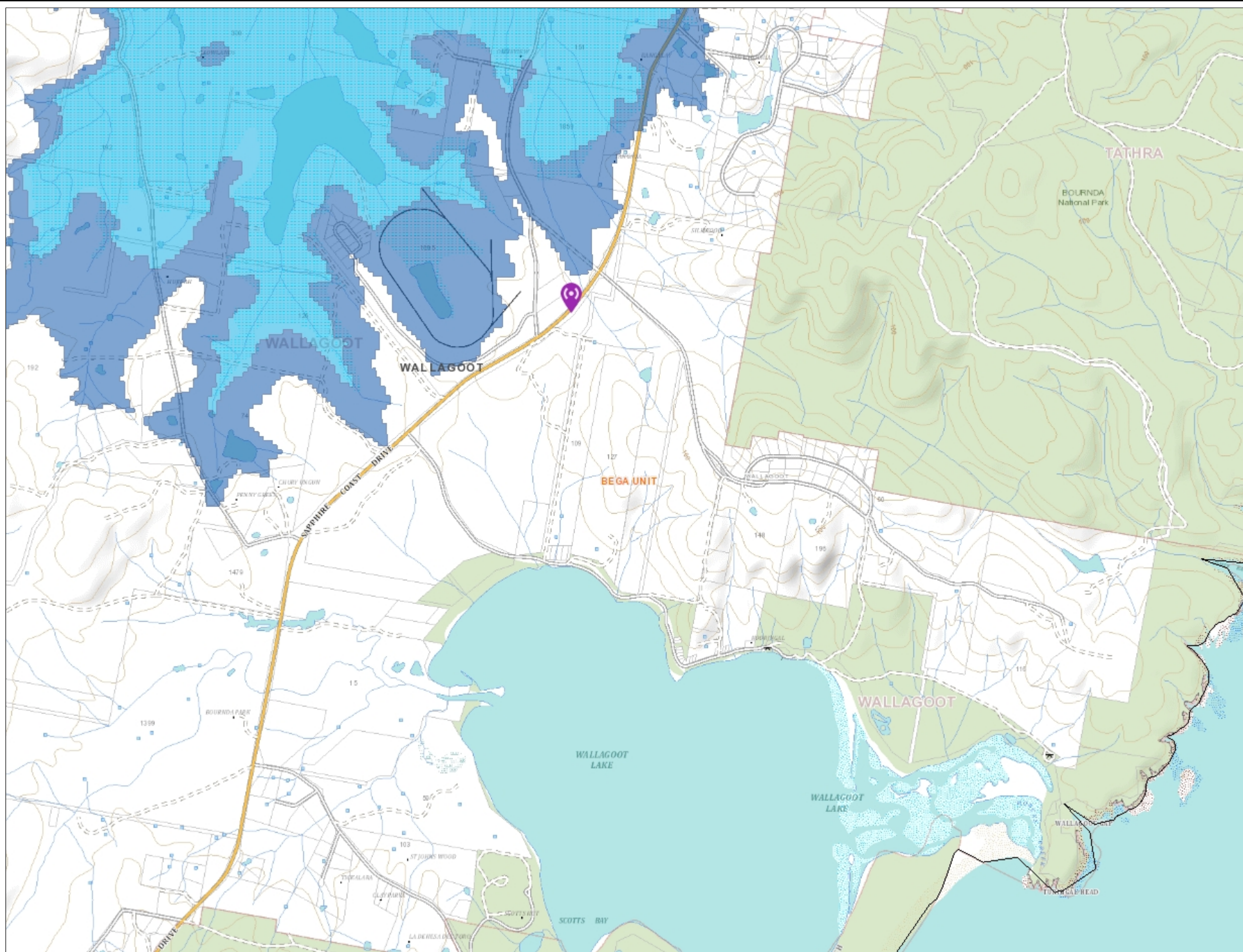
-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns

DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.























THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.

Printed: 27/07/2021



Legend

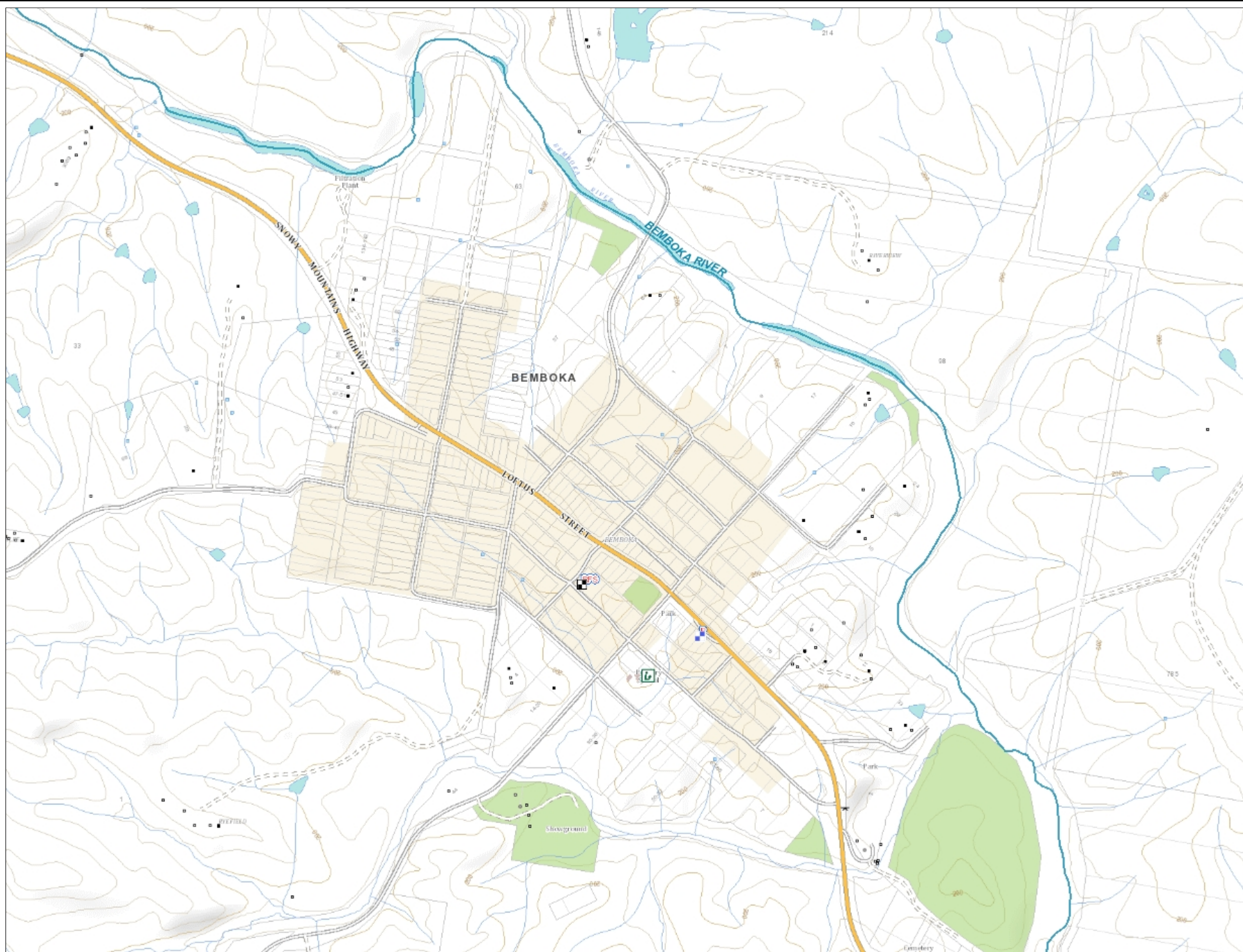
-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns

DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.























THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.

Printed: 27/07/2021



Legend

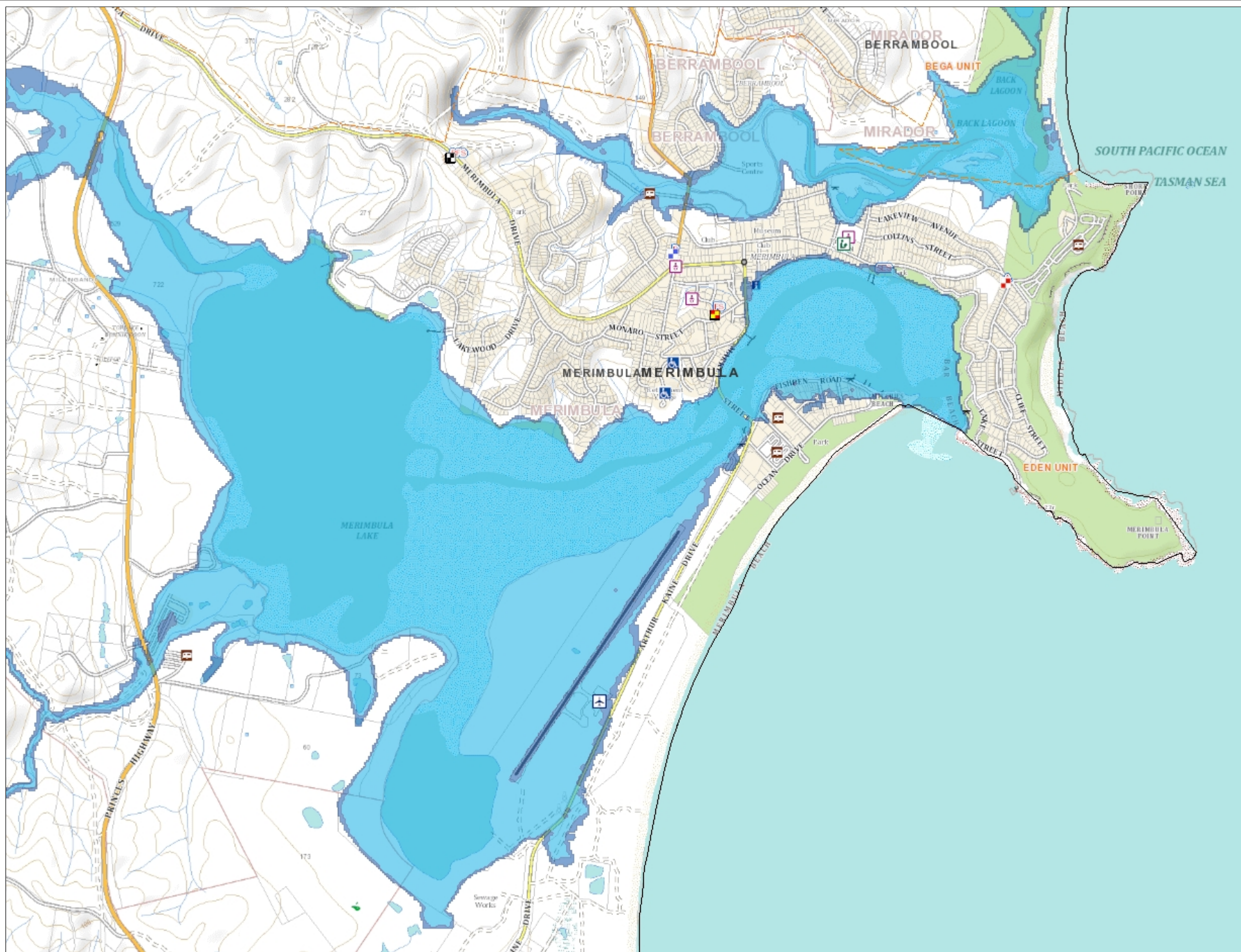
-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns

DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.



THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.

Printed: 27/07/2021



Legend

- Educational Facilities
- Child Care Facilities
- Health Care Facilities
- Aged Care Facilities
- Caravan Park / Camping
- Airports
- Rail Stations
- SES Headquarters
- SES Zones
- SES Units
- Gauges (BOM Forecast)
- Declared Dams
- Levees
- Rivers (Major)
- 1% AEP
- Probable Maximum Flood
- Police Stations
- Ambulance Facilities
- RFS Facilities
- FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns





















DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.



THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.



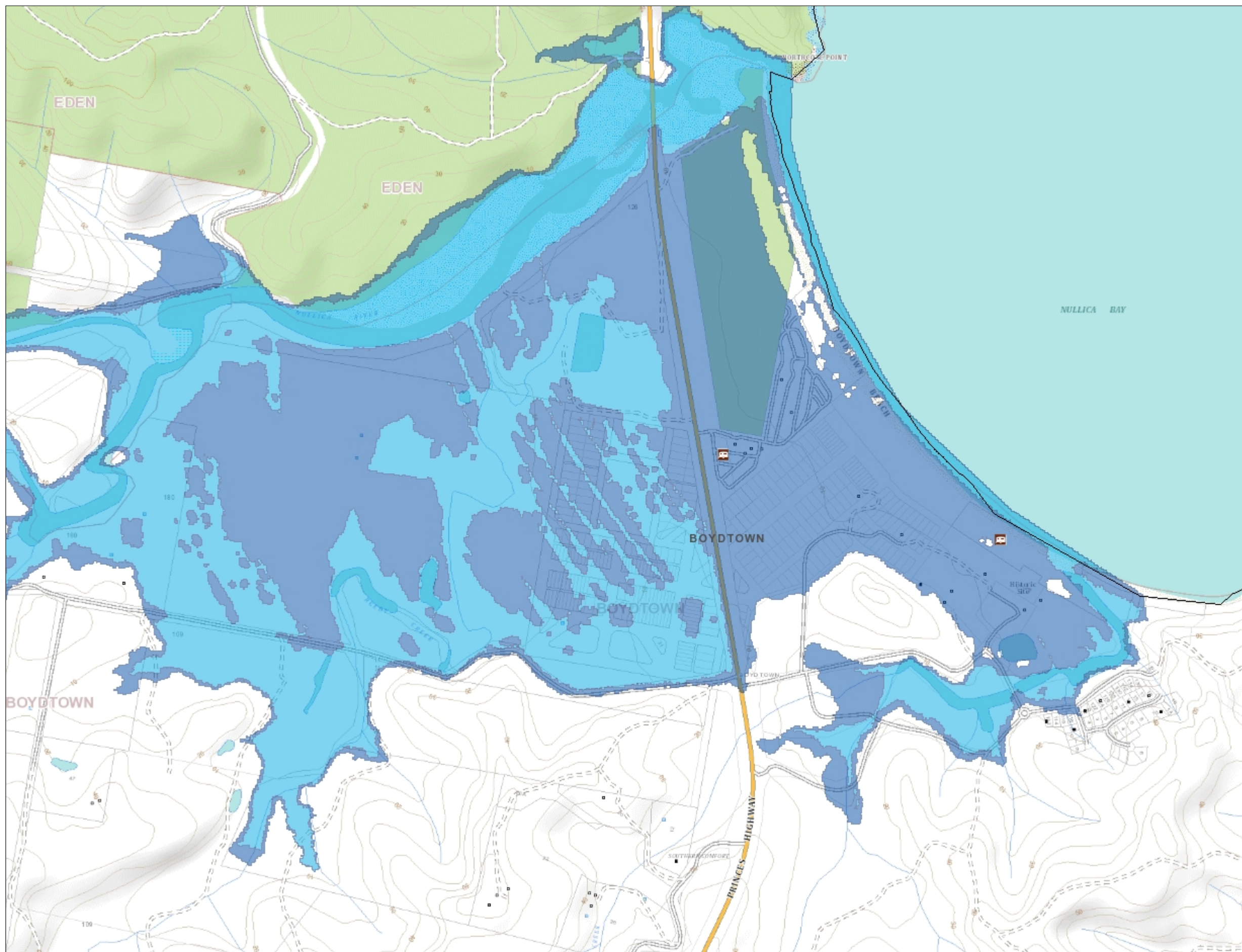
Legend

-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns





















DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.



THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.



Legend

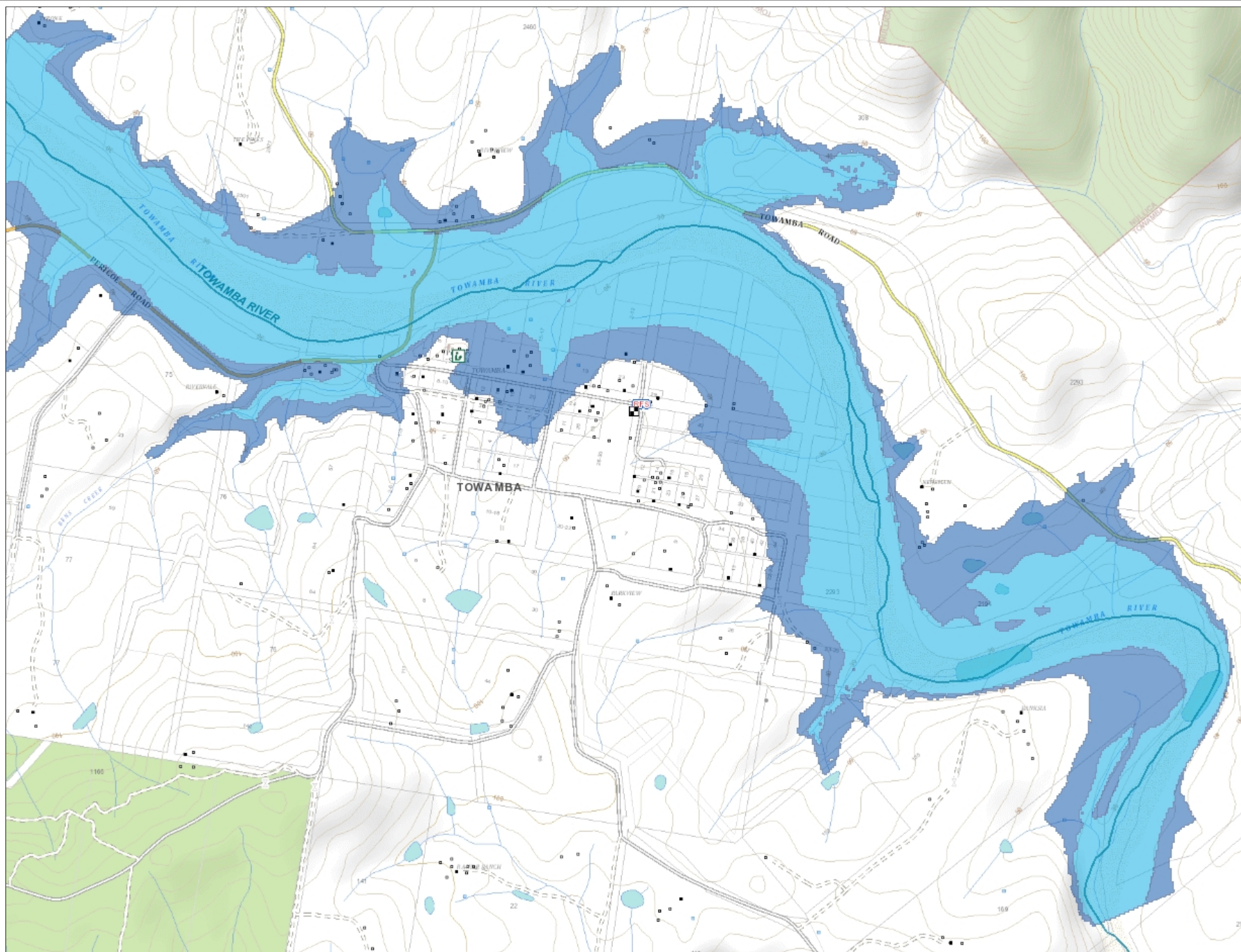
-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns

DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.























THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.

Printed: 27/07/2021



Legend

-  Educational Facilities
-  Child Care Facilities
-  Health Care Facilities
-  Aged Care Facilities
-  Caravan Park / Camping
-  Airports
-  Rail Stations
-  SES Headquarters
-  SES Zones
-  SES Units
-  Gauges (BOM Forecast)
-  Declared Dams
-  Levees
-  Rivers (Major)
-  1% AEP
-  Probable Maximum Flood
-  Police Stations
-  Ambulance Facilities
-  RFS Facilities
-  FRNSW Stations
- Key Towns
- Major Towns
- Regional Towns

DISCLAIMER This map publication is presented by the NSW State Emergency Service for the purpose of disseminating emergency management information free of charge to members of emergency management organisations. The information in this map publication is not intended for use by the general public or untrained persons, and is not a substitute for professional advice and/or training. Untrained persons should not use this map publication unless they are under the supervision of trained and qualified emergency management personnel. The State Emergency Service disclaims any liability (including for negligence) to any person in respect of anything and the consequences of anything, done, or not done by any such person in whole or partial reliance upon the whole or part of the information in this map publication.



THIS MATERIAL IS COPYRIGHT No part of this map may be reproduced without written permission.

Printed: 27/07/2021

LIST OF REFERENCES

1. **SMEC.** *Bega and Brogo Rivers Flood Study at Bega.* s.l. : SMEC, 2014.
2. **Cardno.** *Floodplain Risk Management Study Bega & Brogo Rivers FRMSP.* Bega Valley Shire Council. Bega Valley Shire : s.n., 2018.
3. **Commission, Natural Resources.** *Review of the water sharing plans for the Bega and Brogo Rivers Area, Murrah-Wallaga Area, and Towamba River water sources.* Natural Resources Commission, NSW Government. s.l. : NSW Government, 2021. Report Summary.
4. **NSW State Emergency Service.** *Bega Valley Shire Local Flood Plan.* Bega Valley Shire : NSW State Emergency Service, 2007. Local Flood Plan (Sub Plan of the State Flood Plan).
5. **Donaldson, Susan Dale.** *Understanding Aboriginal Cultural Heritage.* Bega Valley Shire LGA : Environmental & Cultural Services, 2010. Stage 3a FINAL.
6. **Council, Bega Valley Shire.** *Local Environmental Plan - Bega Valley Shire Council.* Bega Valley Shire : s.n., 2013.
7. **Heritage, NSW.** Aboriginal Heritage Information Management System (AHIMS). *Aboriginal Heritage Information Management System (AHIMS).* [Online] <https://www.environment.nsw.gov.au/awssapp>.
8. **Rhelm.** *Eden, Twofold Bay, Towamba River Flood Study.* Bega Valley LGA : Bega Valley Shire Council, 2020. Flood Study.
9. —. *Merimbula Lake and Back Lake Floodplain Risk Management Study and Plan.* Bega Valley : Bega Valley Shire Council, 2021.
10. **Bega Valley Shire Council.** *Ben Boyd Dam - Dam Safety Emergency Plan.* Bega : s.n., 2008.
11. **State Water Corporation.** *Brogo Dam - Dam Safety Emergency Plan.* 2014.
12. **Aurecon.** *Brown Mountain Power Station Cochrane Dam - Dam Emergency Plan.* [Report] 2020.
13. **Bega Valley Shire Council.** *Yellow Pinch Dam - Dam Safety Emergency Plan.* 2008.
14. **Cardno.** *Flood Study Report - Merimbula Lake and Back Lake Flood Study.* s.l. : Prepared for Bega Valley Shire Council, September 2016.
15. **NSW State Emergency Service.** *Flood Intelligence Card - Bega North.* 2015.
16. **Bureau of Meteorology - NSW Flood Warning Centre.** *Bega Basin No 219 River System Schematic.* 2011.

17. **BMT WBM Pty Ltd.** *Bega Valley Shire Coastal Processes and Hazard Definition Study - Volume 1 Final Report*. s.l. : Prepared for Bega Valley Shire Council, 2015.
18. **Risk Frontiers.** *An Integrated Research Assessment of the physical and social aspects of the March 2011 flash flooding in Shellharbour, Kiama and Bega Valley, NSW*. s.l. : Risk Frontiers, 2013.
19. **Solutions, Catchment Simulation.** *Pambula River, Pambula Lake and Yowaka River Flood Study*. s.l. : Bega Valley Shire Council, 2021. Flood Study. Volume 1 fo 2: Report and Text & Appendices.
20. **Narooma News.** Bermagui hit by deluge as storms continue. *Narooma News*. [Online] Fairfax Regional Media, 8 March 2012.
<http://www.naroomanewsonline.com.au/story/190986/bermagui-hit-by-deluge-as-storms-continue/>.
21. **ABC News.** NSW flooding. *ABC News*. [Online] 5 January 2016. [Cited: 19 April 2016.]
<http://www.abc.net.au/news/2016-01-05/severe-weather-warning-in-place-for-nsw-for-second-day/7067452>.
22. **Bega Pioneers' Museum.** SOME HISTORY OF BEGA FLOODS: 1851-1978. *Bega Pioneers' Museum*. [Online] Word Press, 2014. [Cited: 19 April 2016.]
<https://pioneersmuseum.wordpress.com/old-news-images/some-history-of-bega-floods-1851-1978/>.
23. **Anthony Scott.** CSIRO. *CSIRO*. [Online] 1999. [Cited: 19 April 2016.]
<http://www.clw.csiro.au/publications/technical99/tr54-99.pdf>. Technical Report 54/99.
24. **Australian Bureau of Statistics.** 2016 Census Community Profiles series. *ABS*. [Online] 2016.
<https://www.abs.gov.au/websitedbs/D3310114.nsf/Home/2016%20Census%20Community%20Profiles>.
25. **Unit, NSW SES Eden and Bermagui.** *Advice recieved from NSW SES Eden unit members*. 1 December 2016.
26. **NSW SES Bega Unit.** Advise provided by Local Bega NSW SES Unit Members. November 2016.
27. **News, Bega District.** Tathra bushfires remembered three years on; climate group still awaiting political action. <https://www.begadistrictnews.com.au/story/7172575/three-years-on-tathra-bushfires-lessons/>. [Online]
<https://www.begadistrictnews.com.au/story/7172575/three-years-on-tathra-bushfires-lessons/>.
28. **Deputy Zone Commander, Thomas Jory.** 21 October 2021.

29. **The Canberra Times.** South coast towns Narooma, Tathra and Bermagui flooded by deluge. *The Canberra Times*. [Online] 14 October 2014. [Cited: 18 August 2016.] <http://www.canberratimes.com.au/environment/weather/south-coast-towns-narooma-tathra-and-bermagui-flooded-by-deluge-20141014-115x6d.html>.
30. **Cardno.** *Bega & Brogo Rivers FRMSP*. Bega Valley Shire Council. 2018.
31. **ABC News.** Merimbula Flash Flooding. *ABC News*. [Online] 19 September 2014. [Cited: 19 April 2016.] <http://www.abc.net.au/news/2014-09-19/more-storm/5754828>.
32. **NSW State Emergency Service.** *NSW Bega Valley Shire Local Flood Plan*. Bega Valley Shire : NSW State Emergency Service, 2007.
33. **Bega Valley Shire Council.** Merimbula Flood Study. *Bega Valley Shire Council*. [Online] 2015. [Cited: 18 April 2016.] <https://extranet.cardno.com/merimbulafloodstudy/SitePages/Home.aspx>.
34. **Bega District News.** Heavy rains, flooding on South Coast. *Bega District News*. [Online] 14 October 2014. [Cited: 19 April 2016.] <http://www.begadistrictnews.com.au/story/2623429/heavy-rains-flooding-on-south-coast/?cs=509>.
35. **Bega Valley Shire Council.** Merimbula Flood Study. *Bega Valley Shire Council*. [Online] 2016. [Cited: 12 August 2016.] http://www.begavalley.nsw.gov.au/cp_themes/default/page.asp?p=DOC-ZDQ-08-82-64.