

Ballina Shire

Local Flood Emergency Sub Plan



BALLINA SHIRE FLOOD EMERGENCY SUB PLAN

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

Volume 1 of the Ballina Shire Council Flood Emergency Sub Plan

**Endorsed by the Ballina Shire Council Local Emergency Management
Committee**

Endorsed Date 10th August 2023

AUTHORISATION

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

Authorised

Signature:



NSW SES Local/Unit Commander

Print Name:

Gerard Buenaflor

Date:

10th August 2023

Endorsed

Signature:



Chair, Local Emergency Management Committee

Print Name:

John Truman

Date:

10 August 2023

VERSION HISTORY

Version Number	Description	Date
1.0	Ballina Shire Local Flood Plan	July 2013

AMENDMENT LIST

Suggestions for amendments to this plan should be forwarded to:

Manager Emergency Planning
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
1.1	Updates from Gerry Burnage – LC	T Ware	8.12.22

DISTRIBUTION LIST

Available for general use and distribution on the NSW State Emergency Service website

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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 Ballina Shire Council Local Government Area (LGA).

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 Ballina Shire Council Local Emergency Management Plan (EMPLAN) and is endorsed by the Ballina Shire Council Local 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 Ballina Shire Council 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 Ballina Shire Council LGA. The Ballina Shire Council LGA and its principal towns, villages, rivers and creeks are shown in Appendix A.
- 1.4.2 The Council area is in the NSW SES North Eastern Zone and for emergency management purposes, is part of the North Coast Emergency Management Region.
- 1.4.3 The plan sets out the Ballina Shire Council emergency management arrangements for prevention, preparation, response and initial recovery for flooding in the Ballina Shire Council LGA.
- 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 tsunami) 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 Sub 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 flooding due to 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 Emergency 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 an 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.
- 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 NSW State EMPLAN and NSW State Flood Sub Plan.

1.7.2 Specific roles and responsibilities for agencies, functional areas and organisations in relation to flooding within Ballina Shire Council are detailed within this plan, Appendix B and Appendix C.

1.7.3 Any agency with agreed responsibilities in this plan that are temporarily unable, or no longer able to fulfil their responsibilities in response operations must as soon as possible notify:

- a. The NSW SES Incident Controller (for local or zone level responsibilities during response operations).
- b. The NSW SES Zone Duty Commander (for regional level responsibilities outside of response operations).

1.8 PLAN MAINTENANCE AND REVIEW

1.8.1 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. Conduct a minimum of one exercise every five years or within two years of the plan being reviewed.
- 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 recommendations from after action reviews, reports, or inquiries.
 - As determined by the NSW SES Commissioner.
- d. The plan is to be reviewed no less frequently than every five years or after a significant flood event.

1.9 SUPPLEMENTARY DOCUMENTS

- 1.9.1 Supplementary and supporting material of the Local Flood Emergency Sub Plan is maintained on the [NSW SES website Flood, Storm and Tsunami Plans](#) including:
- a. Flood Plan Glossary.
 - b. NSW SES 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 NSW SES maintains information on the nature of flooding and effects of flooding on the community in the Ballina Shire Council LGA.
- 2.1.2 Declared dams in or upstream of the Ballina Shire Council Local Government Area.

Dam Name	Owner	Dam Hazard Rating
Emigrant Creek Dam	Rous County Council	High C

3 PREVENTION/ MITIGATION

3.1 INTRODUCTION

- 3.1.1 The Flood Risk Management Manual outlines the NSW Government's Flood Prone Land 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:** Effective land use planning is a key focus for minimising the impacts of flooding. NSW SES will work with land use planning and consent authorities to inform and influence the consideration of the risks arising from flood, storm and tsunami, 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 to life and/or property due to flooding.
- b. NSW SES will provide responses to land use planning proposal referrals that have or will create significant flood risk to life and/or property due to flooding.

3.3 FLOODPLAIN RISK MANAGEMENT

3.3.1 **Strategy:** Advocate for consideration of emergency management in decision making to reduce risks to the existing community and minimise the growth in future, continuing and residual risk due to development through input to the floodplain 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.
- b. NSW SES will provide advice, support, technical resources and training for NSW SES representatives to contribute effectively on 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 Emergency Sub Plans.

Actions:

- a. Develop and review this NSW SES Local Flood Emergency Sub Plan as required. Local Flood Emergency Sub Plans outline the specific arrangements for

management of flood events within an LGA, and may include cross boundary arrangements.

- b. Review plans as per Section 1.8.

4.2.2 Local EMPLAN Consequence Management Guides (CMG's) for flood are not required for communities covered by NSW SES Local Flood Emergency Sub Plans however may be utilised in place of Local Flood Emergency Sub Plan if agreed to by NSW SES.

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.
- 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 will maintain 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 NSW State Flood Plan (see Section 1.9).
- c. NSW SES will recommend new warning services and changes to warning alert levels for gauges to the NSW and ACT 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. Ballina Shire Council has implemented and maintains a flash flood warning alarm system for the Teven and Tintenbar Valleys, with a data feed to Ballina SES.
- f. Dam Owners will provide Dam Emergency Plans (where required) and consult with NSW SES on alert levels and messaging. Alert level definitions are listed in Dam Emergency Plans.
- g. NSW SES maintains a dedicated dam failure hotline and procedures to ensure priority dissemination of dam failure warnings.
- h. NSW SES develops and maintains warning and flood information products by:

- Utilising flood intelligence data.
 - Developing warning and flood information products.
 - Continuously reviewing warning and flood information products.
 - Consulting with affected communities, key stakeholders, Dam Safety NSW and the NSW and ACT Flood Warning Consultative Committee, and maintains Operational Readiness.
 - Participating in the development of public information and warning systems.
- i. Gauge owners adequately maintain flood warning gauges and systems, including those identified in the 'Service Level Specification' maintained by the Bureau of Meteorology (Bureau) and those identified in the 'Provision and Requirements for Flood Warning in New South Wales' maintained by NSW SES.

4.5 BRIEFING, TRAINING AND EXERCISING

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

Actions:

- a. NSW SES will consult stakeholders throughout the development of plans.
- b. NSW SES will inform stakeholders of content changes after revisions.
- c. NSW SES will ensure their facilities and resources are maintained and operationally ready.
- d. NSW SES will train personnel for their expected flood operation roles.
- e. NSW SES will regularly brief stakeholders on the exercise arrangements contained in the NSW Flood Emergency Sub Plan.

4.6 COMMUNITY RESILIENCE TO FLOODING

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

Actions:

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

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

Actions:

- a. Partner with and engage 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.

- b. Collate, assess and disseminate flood information to the community.
- c. Collaborate with individuals, businesses, government agencies and communities when developing flood intelligence, preparedness and response information.
- d. Plan for floods collaboratively with communities through community and stakeholder participation and engagement.
- e. Collaborate with community sector and recognise the needs of individuals within communities who have an increased susceptibility during floods.

5 RESPONSE

5.1 INTRODUCTION

5.1.1 Flood response operations will begin:

- a. On receipt of a Bureau Severe Weather Warning or Thunderstorm Warning that includes heavy rain or storm surge; or
- b. On the receipt of a Bureau Flood Watch or Flood Warning; or
- c. On receipt of warnings for flash flood; or
- d. On receipt of a dam safety 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 NSW.

Actions:

- a. 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 (or delegate) will appoint Incident Controllers and establish Incident Control Centres (see NSW SES facilities on map in Appendix A).
- d. The NSW SES Incident Controller, in consultation with participating supporting emergency services and functional areas will determine the appropriate breakdown of an Area of Operations into Divisions and/or Sectors in accordance with the principles of AIIMS.

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.
- Coordinate information flow, including warnings, public information and social media.

5.2.3 **Strategy:** Provide effective liaison between 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 Centre(s) and/or Emergency Operation Centres as required.
- b. NSW SES will provide Liaison Officer(s) to Emergency Operations Centres as required.
- c. Where possible Emergency Operation Centres to be co-located with NSW SES Incident Control Centres for Flood Emergency Response.

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-deploying of resources.
- b. 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 utilised, communicated and collected during and after 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, functional areas and Council 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. Road closure information is managed by www.livetraffic.com (TfNSW and local government). This may be in the form of a combined Emergency Operations Centre (EOC) report, or direct from agencies where an EOC has not been established.

- c. NSW SES may establish and operate a Joint Intelligence Unit to coordinate the collection, collation, interpretation, mapping, actioning and dissemination of information.
- 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.
- e. NSW SES may request Engineering to assist with the gathering of flood intelligence including (not limited to) maximum flood extents, peak flood heights, recording major flood damage at key high velocity locations and preparation of After-Flood Report.

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

Action: NSW SES will use flood intelligence, official forecasts, warnings, and flood scenario products 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 Bureau issues public weather and flood warning products before and during a flood. These may include:
 - Severe Thunderstorm Warnings - Broad-based - issued for the entire Australian State or territories affected highlighting broad areas where severe storms may occur within the next 3 hours.
 - Severe Weather Warnings with reference to heavy rainfall and/or storm surge.
 - Flood Watches.
 - Flood Warnings.
- b. NSW SES will use the following established flash flood warning system for Ballina Shire to provide warnings and information to key stakeholders and the community.
- c. Dam Owners will utilise the Dam Emergency Plan to provide warnings and information to NSW SES (where appropriate).
- d. NSW SES Incident Controllers will issue the following NSW SES Flood Warnings aligning to the Australian Warning System:
 - Advice
 - Watch And Act
 - Emergency Warning
- e. NSW SES liaises with the Bureau to discuss the development of flood warnings as required.

- f. NSW SES provides alerts and deliver flood information to affected communities using a combination of public information.
- g. NSW SES may request supporting agencies redistribute NSW SES alerts and information, including through the provision of doorknocking teams.
- h. Road closure information will be provided to the community through the following agencies/methods:
 - Local Government Council websites.
 - Transport for NSW 'Live Traffic' website: <https://www.livetraffic.com/> or 'Transport InfoLine': 131 500. VMS messaging on roadways may also be used to advise motorists.
- i. The Public Information and Inquiry Centre will be established by NSW Police Force where required to provide information regarding evacuees and emergency information. Contact details will be broadcast once the centre is established.
- j. The Disaster Welfare Assistance Line will be established by Disaster Welfare Services where required to provide information on welfare services and assistance. Assistance line contact details will be broadcast once Disaster Welfare Services commence.

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, feasible and safe to do so) in:

- a. The protection of properties including critical infrastructure through flood protection systems (e.g. sandbagging) to minimise entry of water into buildings.
- b. The raising 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. Ballina Shire Council will coordinate the closure and reopening of council managed roads once inspections have been carried out by the relevant authority.
- b. Transport for NSW will coordinate the closure and reopening of the state road network.
- c. NSW Police Force may close and re-open roads but will normally only do so (if the Ballina Shire Council or Transport for NSW 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.
- e. Burns Point Ferry – Operated by Ballina Shire Council – 1300 864 444

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 suitable 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 the local and regional EMPLANS. Local and Regional EMPLAN's contain infrastructure inventories.

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

Actions:

- a. Transport Services Functional Area is to coordinate the provision of information about the assessment and restoration of transport network infrastructure.
- b. Energy and Utility Services Functional Area is to coordinate the assessment and restoration of essential energy and utility services (not including telecommunications).
- c. Telecommunications Services Functional Area is to coordinate the assessment and restoration of telecommunications and the Public Safety Network.
- d. Engineering Services Functional Area is to:
 - Coordinate the assessment and restoration of critical public buildings for example hospitals.
 - Assessment and operation of flood protection levees.
 - Protection of property.
 - Construction and repair of levees.
 - Dam safety assessment and dam stability.
 - Water supply and sewerage operations.
 - Other critical infrastructure.
- e. Functional Areas and Council will keep NSW SES informed of the status of utilities and infrastructure.

5.8 EVACUATION

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

5.8.2 **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.
 - Evacuation of people where essential energy and/or utility services are likely to fail or where buildings have been or may be made uninhabitable.
- b. 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.
 - The ability for existing levees or other flood protection works to fulfil their intended function.
 - Time available for evacuation.
 - Evacuee management requirements.
 - Resources and delivery of evacuation information.
 - Length of isolation.
- c. NSW SES Incident Controllers, planning and intelligence officers will carefully consider the risks involved in conducting evacuations.
- d. All evacuation decisions will be made as per the current NSW SES policies and procedures, and consistent with the NSW Evacuation Management Guidelines.
- e. NSW Police Force will coordinate the provision of overall security for evacuated areas.

5.8.3 **Strategy:** Evacuate people pre-emptively from dangerous or potentially dangerous places and or locations 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 Commissioner (or delegate) will warn communities to prepare for a possible evacuation, where circumstances allow such lead time.
- c. The NSW SES Commissioner (or delegate) 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 the 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 NSW SES and Welfare Services and ensure that appropriate business continuity plans are developed for essential health infrastructure and are activated during the floods as per the NSW Health Services Supporting Plan (HEALTH PLAN, 2013).

In the event of an emergency impact of any magnitude or type affecting a Residential Aged Care Facility or private hospital facility, the decision making and resolution regarding the requirement to evacuate will be the responsibility of the facility management in consultation with the relevant combat agency.

- f. School administration offices (Government and Private) will coordinate the evacuation of schools in consultation with 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 Emergency Warning will be referred to 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 Welfare Services Functional Area as soon as possible. NSW SES will brief Welfare Services Functional Area at the earliest opportunity regarding the level of assistance required.
- b. Welfare Services Functional Area will manage evacuation centres for affected residents and travellers in accordance with Welfare Services Functional Area Supporting Plan.
- c. Schools Administration (Government and Private) will manage the safety of students directly affected by flooding and will work with NSW SES in the temporary closure of schools and will coordinate with NSW SES, Transport and Welfare Services in the management of school evacuees.
- d. Disaster Victim Registration will be controlled and coordinated by NSW Police Force with the assistance of NSW SES and the 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 SEOCON may establish Major Evacuation Centres or Mass Care facilities.
- g. The decision to establish Major Evacuation Centres or Mass Care Facilities will be made by NSW SES and SEOCON 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:** 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.
- b. Agriculture and Animal Services Functional Area role will coordinate the 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 NSW State 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 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 NSW SES. Notification arrangements with NSW Police Force are outlined in the State Rescue Board NSW State Rescue Policy.
- d. Rescue agencies will conduct rescue of domestic small and large animals as per the State Rescue Board NSW State 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 support the delivery of 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.
- g. NSW SES may conduct resupply operations as per the designated resupply plan for the event.
- h. Where additional supplies are required Engineering Services Functional Area be requested to coordinate the supply of goods and services in response to and recovery from the emergency.

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.
- c. Isolated households unable to afford resupply items will be referred to Welfare Services Functional Area for assistance.

5.12 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. The 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 ongoing risk to public safety.
- b. The NSW SES Incident Controller will specify the level of access to affected communities as the following:
 - Not suitable for access; or
 - Limited access by emergency services and response agencies; or
 - Limited access by residents and/or business operators; or
 - Full access.
- c. The NSW SES Incident Controller will issue an Advice Warning advising 'Reduced Threat: Return with Caution' when the immediate danger to life and property has passed for areas.
- d. 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:
 - There is a reduced likelihood of additional flooding within the Area of Operation and flood waters have receded.
 - All requests for assistance related to the flood have been completed.
 - The need for warning and evacuation no longer exist.
 - There is no further likelihood 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).
 - All affected areas have had a 'Reduced Threat: Return with Caution' 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, Welfare Services and Ballina Shire Council representatives.

- b. NSW SES will conduct After Action Reviews, at the conclusion of response operations, which will involve all stakeholders. Findings will be shared and incorporated into improved disaster resilience planning.
- c. NSW SES will provide information and data throughout the emergency response to inform community recovery. A report will be developed at the request of the SERCON at the conclusion of the response within an area. Should a response summary report be required it will include the following:
 - The emergency action plan in place at conclusion of the response emphasising any continuing activities including community meetings/ engagement activities.
 - Resources allocated to the emergency response and associated exit strategies.
 - Details of any areas or situations with potential to re-escalate the emergency.
 - A recommendation for the conclusion of NSW SES as lead agency to transition to the NSW Reconstruction Authority as the lead agency for Recovery.
 - Any actions that are incomplete or outstanding.
 - Damage Assessment Data and Information obtained throughout the response phase which will further support the long-term recovery of communities.
- 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 works with relevant stakeholders and Ballina Shire Council 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 NSW State EMPLAN and as further detailed in the NSW Recovery Supporting Plan. The Ballina Shire Recovery Plan provides a framework for the management and coordination of local recovery operations.

6.2 NSW SES RECOVERY ROLE

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

6.2.2 **Actions:**

- a. NSW SES will provide representation to Recovery Committees as required and may have an ongoing role in the Recovery phase.
- 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 and/ or expert.
- c. NSW SES will provide information to the NSW Reconstruction Authority to support applications to Treasury for Natural Disaster Relief and Recovery Arrangements.
- d. NSW SES, in conjunction with a Recovery Committee, will provide a service to support the information needs of a community immediately following a flood.
- e. NSW SES and where required supporting agencies will assist with clean-up operations after floods, where possible when resources and personnel permit.
- f. NSW SES may coordinate immediate relief in collaboration with the SEOCAN and SERCON.

7 ABBREVIATIONS

For a full list of abbreviations refer to the NSW State Flood Plan - Abbreviations

8 GLOSSARY

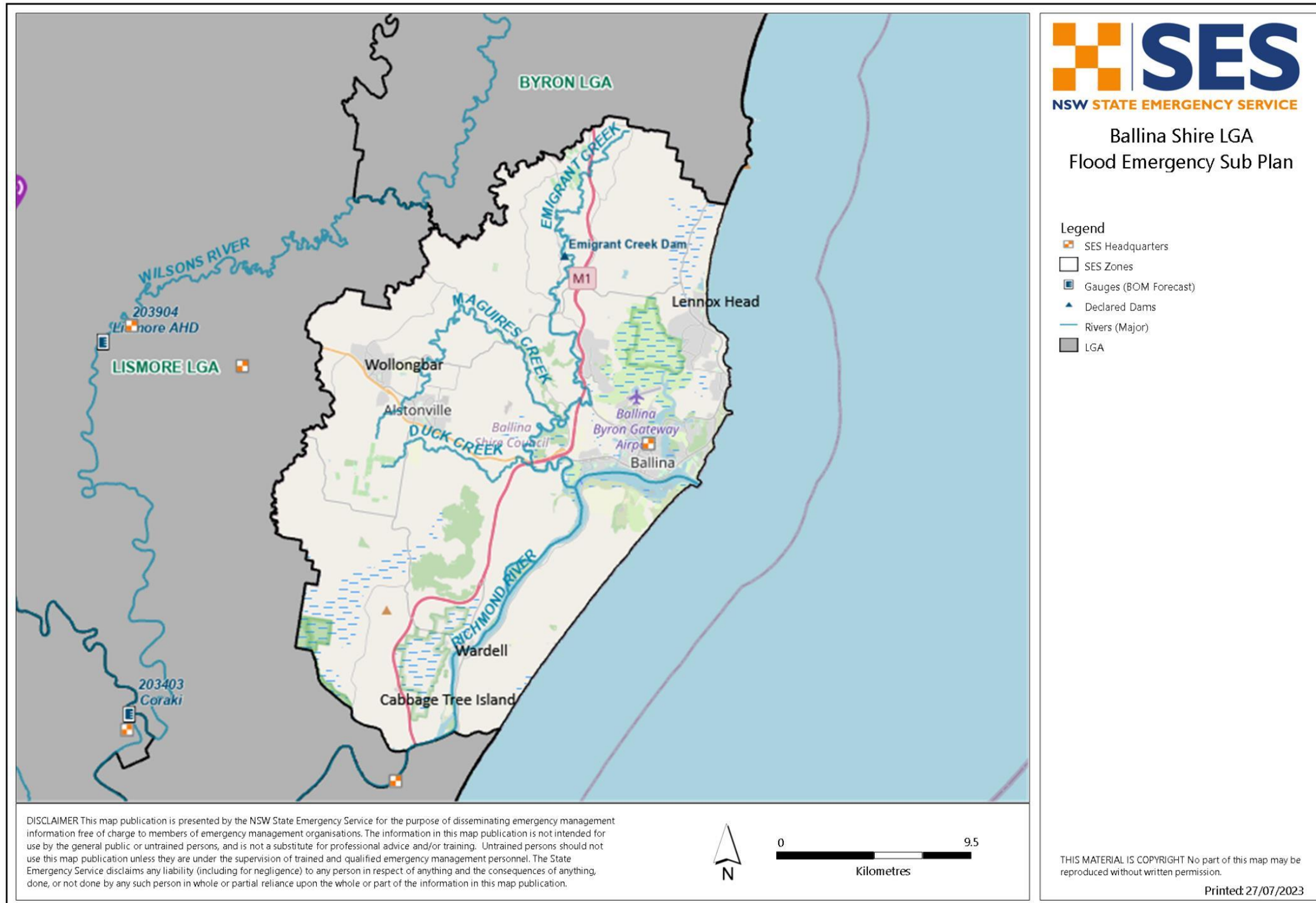
Common emergency service terminology can be found within the Australian Disaster Resilience Glossary.

Readers should refer to EMPLAN Annex 9 – Definitions.

Refer to the NSW State Flood Plan for a complete glossary of terminology used throughout this plan and within NSW SES Flood Plans.

For a full list of definitions refer to the Supporting Document - State Flood Plan Glossary
<https://www.ses.nsw.gov.au/media/2650/glossary.pdf>

9 Appendix A – Map of Ballina Shire Council Area



10 Appendix B – Roles and Responsibilities

AGENCY	RESPONSIBILITIES
NSW State Emergency Service	NSW SES is the designated Combat Agency for floods, storms and tsunamis and controls response operations. NSW SES roles and responsibilities in relation to floods are outlined in the NSW State Flood Emergency Sub Plan .

AGENCY	RESPONSIBILITIES
Agriculture and Animal Services Functional Area	The roles and responsibilities for Agriculture and Animal Services are outlined in the Agriculture and Animal Services Supporting Plan and NSW State Flood Plan.
Australian Government Bureau of Meteorology	The roles and responsibilities for the Australian Government Bureau of Meteorology (Bureau) are outlined in the NSW State Flood Plan.
Ballina Shire Council	<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 Flood Risk Management Manual. • Provide levee studies, flood studies and floodplain management studies to NSW SES. • 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 NSW SES with flood operations including: <ul style="list-style-type: none"> – Traffic management on council managed roads. – Provision of assistance to NSW SES (plant, equipment and personnel where able and requested). – Property protection tasks including sandbagging.

AGENCY	RESPONSIBILITIES
	<ul style="list-style-type: none"> – Ensure caravan parks have emergency evacuation plans. – Assist with warning and/or evacuation of residents and other people in flood liable areas. – Technical advice on the impacts of flooding. – Close and reopen council roads (and other roads nominated by agreement with Transport for NSW) and advise NSW SES, NSW Police Force and people who contact the council for road information. – Assist 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 domestic pets and companion animals of evacuees during evacuations. • Maintain Teven Special Warning System - Ballina Shire Council has facilitated the installation of an Alert Flood warning system on Maguires Creek to provide warnings of impending flash flooding in the Teven Valley via direct data to SES Ballina. • Operate flood mitigation works including critical structures such as detention basins and levees and advise NSW SES regarding their operation. • Manage and protect council-owned infrastructure facilities during floods. • Provide advice to 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 Authority of any sewerage overflow caused by flooding. • Work with NSW SES and NSW Department of Planning and Environment to collect flood related data during and after flood events. <p>Recovery</p> <ul style="list-style-type: none"> • Provide services, assistance and advice to State Government in accordance with the State Recovery Plan 2021.
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

AGENCY	RESPONSIBILITIES
	<p>that if they are expecting to be absent for extended periods, they should:</p> <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. – 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). <ul style="list-style-type: none"> • 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. – Prepare for evacuation and movable dwelling (cabins) 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. • Inform 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, childcare centres and preschools should. <ul style="list-style-type: none"> – Liaise with NSW SES and arrange for the early release of children whose travel arrangements are likely to be disrupted by flooding and/or road closures. – Assist with coordinating the evacuation of preschools and childcare centres.
Dams Safety NSW	The roles and responsibilities for 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).
Energy and Utilities Services	The roles and responsibilities for Energy and Utilities Services are

AGENCY	RESPONSIBILITIES
Functional Area	<p>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, wastewater) to: <ul style="list-style-type: none"> – Provide advice to NSW SES of any need to disconnect power/gas/water/wastewater supplies or of any timetable for reconnection. – Advise 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 / wastewater installations, when certified safe to do so and as conditions allow. – Assist 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 and NSW State Flood Plan.
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 for Floodplain Management Australia are outlined in the NSW State Flood Plan.
Fire and Rescue NSW	The roles and responsibilities for Fire and Rescue NSW are outlined in the NSW State Flood Plan.
Forestry Corporation of NSW	The roles and responsibilities for Forestry Corporation of NSW are outlined in the NSW State Flood Plan.
Health Services Functional Area	The roles and responsibilities for Health Services are outlined in the Health Services (HEALTHPLAN) Supporting Plan and NSW State Flood Plan.
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	The roles and responsibilities for Manly Hydraulic Laboratory are outlined

AGENCY	RESPONSIBILITIES
(MHL)	in the NSW State Flood Plan.
Marine Rescue NSW	The roles and responsibilities for Marine Rescue NSW are outlined in the NSW State Flood Plan.
NSW Ambulance	The roles and responsibilities for NSW Ambulance are outlined in the Health Services (HEALTHPLAN) Supporting Plan and NSW State Flood Plan.
NSW Department of Education, Association of Independent Schools of NSW, and National Catholic Education Commission	The roles and responsibilities for NSW Department of Education, Association of Independent Schools of NSW, and National Catholic Education Commission are outlined in the NSW State Flood Plan.
NSW Department of Planning and Environment (Environment and Heritage Group)	The roles and responsibilities for NSW Department of Planning and Environment (Environment and Heritage Group) are outlined in the NSW State Flood Plan (referred to as DPIE EES).
NSW Department of Planning and Environment (Water)	The roles and responsibilities for NSW Department of Planning and Environment (Water) are outlined in the NSW State Flood Plan.
NSW Food Authority	The roles and responsibilities for NSW Food Authority are outlined in the Food Safety Emergency Sub Plan.
NSW National Parks and Wildlife Services	The roles and responsibilities for NSW National Parks and Wildlife Services are outlined in the NSW State Flood Plan.
NSW Police Force	The roles and responsibilities for NSW Police Force are outlined in the NSW State Flood Plan.
NSW Reconstruction Authority	The roles and responsibilities for the NSW Reconstruction Authority are outlined in the NSW State Flood Plan.
NSW Rural Fire Service	The roles and responsibilities for NSW Rural Fire Service are outlined in the NSW State Flood Plan.
Owners of Declared Dams within or upstream of the LGA	The roles and responsibilities for Owners of Declared Dams are outlined in the NSW State Flood Plan.
Public Information Services Functional Area	The roles and responsibilities for Public Information Services are outlined in the Public Information Services Supporting Plan and NSW State Flood Plan.
Rous County Council	<ul style="list-style-type: none"> • Fulfil the roles and responsibilities as Owners of Declared Dams outlined in the State Flood Plan. • Undertake dam safety and dam stability assessments in consultation with Dam Safety Consultants. • Maintain responsibility for the operations of Rous County Council owned assets; including the Emigrant Creek Water Treatment

AGENCY	RESPONSIBILITIES
	Plant and water infrastructure.
SEOCN/SEOC	The roles and responsibilities for the SEOCN/SEOC are outlined in the NSW State Flood Plan.
Surf Life Saving NSW	The roles and responsibilities for Surf Life Saving NSW are outlined in the NSW State Flood Plan.
Telecommunications Services Functional Area	The roles and responsibilities for Telecommunications Services are outlined in the Telecommunications Services (TELCOPLAN) Supporting Plan.
Transport for NSW (TfNSW)	<ul style="list-style-type: none"> • Transport for NSW (TfNSW) coordinates information on road conditions for emergency services access. • Transport for NSW (TfNSW) coordinates the management of the road network across all modes of transport. • Transport for NSW (TfNSW) in conjunction will assist NSW SES with the evacuation of at-risk communities by maintaining access and egress routes. • Assist NSW SES with the communication of flood warnings and information provision to the public through Live Traffic and Social Media according to the VMS protocols and procedures. • Assist NSW SES with identification of road infrastructure at risk of flooding.
Transport Services Functional Area	The roles and responsibilities for Transport Services are outlined in the Transport Services Functional Area Supporting Plan and NSW State Flood Plan.
VRA Rescue NSW	The roles and responsibilities for VRA Rescue NSW are outlined in the NSW State Flood Plan.
Water NSW	The roles and responsibilities for Water NSW 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 and NSW State Flood Plan.

11 Appendix C – Community Specific Roles and Responsibilities

Community Members	<p>Preparedness</p> <ul style="list-style-type: none"> • Understand the potential risk and impact of flooding and dam safety alerts. • 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. • Be involved in local emergency planning processes. <p>Recovery</p> <ul style="list-style-type: none"> • Assist with community clean-up if required and able to do so. • Participate in After Action Reviews if required.
Private companies or other organisations	<ul style="list-style-type: none"> • N/A
Service and sporting clubs	<ul style="list-style-type: none"> • N/A
Aboriginal organisations or groups – Cabbage Tree Island	<ul style="list-style-type: none"> • Act as the point of contact between NSW SES and the Cabbage Tree Island community. • Inform the NSW SES Ballina Unit Commander about flood conditions and response needs. • Disseminate flood information, including flood and evacuation warnings, to the residents of the Island community. • To assist in the coordination and evacuation of the island residents and animals.
Communication	<ul style="list-style-type: none"> • Ballina SES along with the Community has established a warning network for the Teven Valley and Tintenbar Valley by way of a telephone tree.
Name of farmer or flood warning	<ul style="list-style-type: none"> • Provide flood information to the NSW SES <SESLN> Unit Commander.

networks	<ul style="list-style-type: none">• Distribute flood warnings and flood information provided by the NSW SES <SESLN> Incident Controller.
Community assistance groups	<ul style="list-style-type: none">• N/A

HAZARD AND RISK IN BALLINA SHIRE

Volume 2 of the Ballina Shire Flood Emergency Sub Plan

Last Update: October 2023

AUTHORISATION

The Hazard and Risk in Ballina Shire 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 Manager Emergency Planning / NSW SES~~
Coordinator Planning

Print Name: Michael Stubbs

Date: 17/10/2023

Approved

Signature:



~~NSW SES~~ North Eastern Zone Commander

Print Name Supt. Joanna Jones

Date: 17/ 10/ 2023

Date Tabled at LEMC 01/ 11/ 2023

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VERSION LIST

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

Description	Date
Volume 2 of the Ballina Shire Local Flood Plan	Feb 2008

AMENDMENT LIST

Suggestions for amendments to this Volume should be forwarded to:

Manager, Emergency Risk Manager

NSW State Emergency Service

PO Box 6126, Wollongong NSW 2500

nswses.communityplanning@ses.nsw.gov.au

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

Amendment Number	Description	Updated by	Date

Document Issue: Version 3-02052016

1 THE FLOOD AND COASTAL EROSION THREAT

1.1 OVERVIEW

- a. The Ballina Shire Council Local Government Area (LGA) is within the Richmond River Catchment, which covers an approximate area of 6900 square kilometres (km²), in the Northern Rivers Region of NSW (1).
- b. It lies near the Richmond River mouth and the Ballina Shire includes the lower 25km of the river from north of Broadwater to the Pacific Ocean. The major local creeks, Maguires, Emigrant and North Creeks have a combined catchment area of 102 km². They all enter the Richmond River near its mouth.
- c. The region is characterised by a settlement pattern that is dispersed, and includes towns, villages and residential hamlets (2). The current population for the Ballina LGA is 46,296 (3) The majority of the population reside in the urban localities of Ballina, Lennox Head, Alstonville, Wollongbar and Wardell (2), with more detail provided in Table 5.
- d. The region has an area of approximately 484 km², and much of the land is utilised for rural use. Much of the southern part of the LGA is in the floodplain of the lower Richmond River and is sparsely populated except for sugar cane growing farms (1).
- e. The Ballina Shire has a mild, subtropical climate with an average annual daily temperature of 23.3 degrees Celsius. Approximately 60% of the annual average rainfall of 1860.9mm falls between the months of January to June (2).

1.2 LANDFORMS AND RIVER SYSTEMS

Richmond River Basin

- a. The Ballina Shire Council area is part of the Richmond River Catchment. The catchment has a total area of 6,900km² and spans from the Queensland border in its upper reaches, to low-lying floodplains in its lower reaches.
- b. The Richmond River flows in a north-easterly direction along the coastline through a large rural floodplain. It enters the Ballina Shire Council area at its southern border.
- c. It is possible to have a major flood in one of the arms of the Richmond River (Richmond River, Wilsons River or Bungawalbin Creek) without having a major flood on the lower river. However, flooding can occur as a result of heavy rain in any of the catchments. Extensive flooding in the lower Richmond River area is usually the result of significant rain falls in all three catchment areas (4).
- d. Flood waters in the Ballina Shire LGA originate from three primary sources:

- i. Widespread rainfall over the Richmond River catchment causing swelling and overtopping of the river. These floods rise and fall relatively slowly at Ballina, with flood conditions lasting a few days (5).
- ii. Localised, intense rainfall over Maguires, Emigrant and North Creeks, and other minor creeks in the Shire, and over the floodplains themselves, leading to local catchment flooding. Flood waters rise and fall quickly in these events, and presents a high hazard due to short warning times and fast flowing water (5).
- iii. Elevated ocean levels and storm wave conditions from low pressure systems or cyclonic depressions, influenced by tides (6) .

The timing and magnitude of each of these flood sources is complex and indefinite, although historically it is unusual to have one source occurring without minor occurrences of the others (4).

- e. Refer to Annex 1 for a representation of the Richmond River Basin.

North, Emigrant and Maguires Creeks

- f. These creeks are tributaries of the Richmond River which join the main river at Ballina. Local catchment flooding dominates flood levels in their valleys, with Richmond River flooding becoming more dominant in their lower reaches. They are often in flood at the same time as the main river. When this occurs, flooding may be severe and cuts main roads isolating the town. Most of this flooding occurs to the north and west of the North Creek Canal (4).
- g. North Creek flows in a north easterly direction adjacent to the coastline through a wide rural floodplain. The northern edge of the North Creek catchment is in the hills surrounding Newrybar swamp drainage basin, which drains via a series of gullies. Natural drainage is inhibited by flat slopes in the central areas of the catchment, as well as tidal influence from the lower catchment. A network of drains and floodgates exists on the Newrybar and North Creek floodplains, with two main drains upstream of Ross Lane moving water downstream towards North Creek. If localised, intense rainfall occurs over the catchment, and coincides with high tide conditions, long inundation and slow drainage may occur.
- h. Emigrant Creek has a long, narrow catchment, and flows in a southerly direction before joining the Richmond River. It includes Emigrant Creek Dam in its catchment area. Its tributaries are Sandy Flat Creek, Chilcotts Creek and Duck Creek (5).
- i. Maguires Creek originates on the Alstonville Plateau and flows north-east, then turns south to pass through Teven, joining Emigrant Creek at Teven Rd on the lower floodplains. It has a catchment area of 48 km² to the bridge at Teven.

1.3 STORAGE DAMS

- a. Dam locations are shown in Annex 1: Richmond River Basin.

Table 1: Prescribed Dams in Ballina Shire LGA; summary of information about each storage.

Emigrant Creek Dam (7)	
Owner / Operator	Rous County Council
Description of Dam	Post-Tensioned gravity section flanked by zoned earthfill embankments with parapet walls. It has a dam height of 13m (top of parapet wall); Crest length 140m; Capacity at FSL (RL 62.35m AHD) is 820 ML; Spillway – post tensioned gravity ogee shaped crest, crest level RL 62.35m AHD, height 10m and length of 36.6m.
Location	Emigrant Creek Dam is situated at the headwaters of Emigrant Creek to the west of Knockrow, in the Tintenbar Valley
Communities Downstream	Downstream communities are Tintenbar and one property in Cumbalum. Houses that are considered downstream are located along Friday Hut Rd, Fernleigh Rd, Crosbys Lane, Tintenbar Store, George St, Foresters Way, Old Bangalow Rd, Cumbalum Rd. Five properties have been identified as being at risk in a Sunny Day Dambreak, and 18 properties affected in a PMF with no dambreak, and 21 properties affected in a PMF with dambreak.
Monitoring System	It has a monitoring system where depth of flow over spillway is electronically monitored by a SCADA system; two manual piezometers; seepage weirs.
Warning System	Pre-set alarm points are configured into the SCADA system to alert appropriate personal when certain flooding levels are reached. Rous County Council hold contact numbers for houses downstream, which are updated annually.
Other	The dam was upgraded in 2002 to pass the PMF and withstand a Maximum Design Earthquake and a new upper filter layer was connected to the existing filter to mitigate the risk of piping failure. Current safety concerns possibly 5 of the 18 restressable anchors, installed as part of the upgrade works in 2002 enable the dam to pass the PMF and withstand a Maximum Design Earthquake, are defective due to water ingress and corrosion. The flood alert levels in this DSEP have been determined on the basis of these defects and shall remain in place until anchors remediation works and lift-off testing has been completed.

Other major water storages

- b. Lake Ainsworth is a freshwater, lowland dune lake located behind the frontal dunes at the northern end of Lennox Head, covering an area of 12.4 hectares. Lake levels are related directly to the amount of rainfall in the locality (8) .

1.4 WEATHER SYSTEMS AND FLOODING

- a. The majority of recorded floods in the Ballina Shire have occurred seasonally between February and September as the result of two distinct weather patterns; tropical cyclones and intense depressions, or East Coast Lows, close to the coast (4).
- b. In the early months of the year, tropical cyclones originating near the equator may move south. While it is rare for a cyclone to enter north-eastern New South Wales, those that approach southern Queensland or which travel southwards past the coast of northern New South Wales may bring rain of sufficient intensity and duration to cause flooding. There are also occasions when a heavy rain area advances well ahead of the cyclone which may be 200 to 300 kilometres distant (4).
- c. The most frequent origin of flooding rain events is the development of intense depressions close to the coast. Generally, these systems maintain a supply of deep moisture as they move southwards in proximity to the coast (4).
- d. These depressions may develop at any time, but the flood rain events are most likely during that part of the year when sea surface temperatures are high, and the air is humid. As tropical cyclones can also be expected at this time, most flood events in the Richmond River catchments occur in the first half of the year with a peak period from February to April (4).

Riverine and Local Catchment Flooding (8)

- e. Riverine flooding in the Richmond River is typically caused by widespread storm systems, with precipitation occurring over many days over the catchment. The resulting flooding rises and falls relatively slowly in Ballina, with flood conditions lasting many days.
- f. Creek flooding of Emigrant, Maguires and North Creek is caused by smaller rainfall systems with shorter, intense rainfall bursts (typically less than 12 hours). Flood waters rise and fall quickly and are considered high hazard due to high velocity water and little warning time.

Storm Surge

- g. Ocean storm surge flooding caused by low pressure systems, strong onshore winds and storm wave conditions, which lead to higher than usual ocean levels. This form of flooding is influenced by tides and will typically occur in combination with one or two high tides.

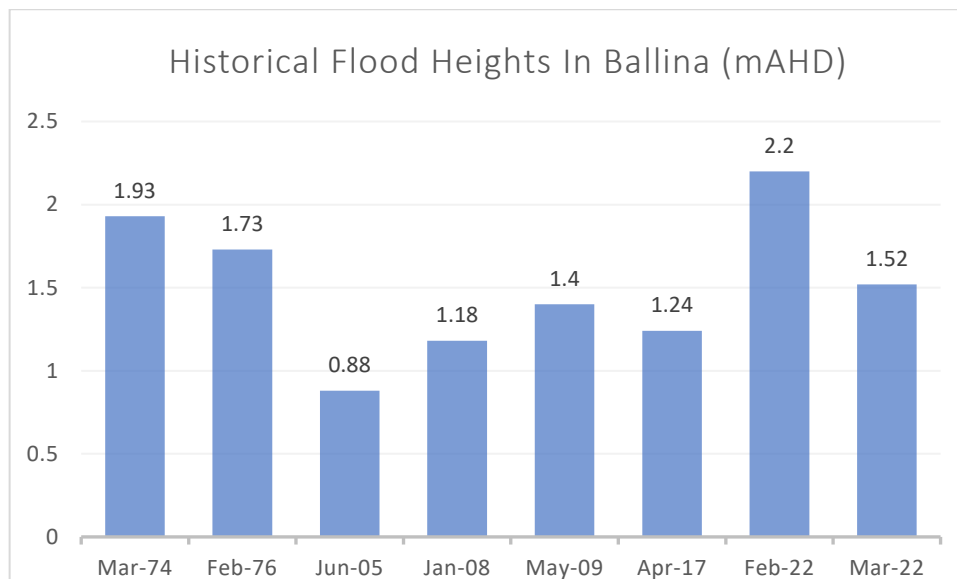
Overland Flooding

- h. Low lying areas in the Ballina Shire, including Ballina Island and West Ballina, are vulnerable to overland flooding from local rainfall-runoff and tidal backflow surcharge of the stormwater network during high-tide events (9). Overland flooding

has been observed following continuous rainfall bursts of greater than 2 hours combined with a high tide event, or during twice annual seasonal high astronomical tide conditions.

- i. Chart 1 below shows the estimated peak heights for significant flooding events in the Ballina LGA. It is important to note that peak heights shown before 2005 are estimates only based on data reported in the most recent Ballina Flood Study, and are not gauge readings that can be compared between events.

Chart 1: Peak Heights for Historical Flooding in the Ballina LGA (10), (11), (12)



1.5 CHARACTERISTICS OF FLOODING

- a. The nature of flooding around Ballina is complicated. Flood inundation occurs because of overtopping of the Richmond River, overtopping of local creeks (Maguires, Emigrant and North Creeks), heavy localised rainfall, or from elevated ocean levels and large ocean swells caused by low or cyclonic depressions. The ocean tidal conditions during flood events add another level of complexity because higher levels result if the flood peak coincides with the top of the tide (4).
- b. Though there are numerous sources which can cause flooding at Ballina, the chances of all sources peaking together is very improbable.
- c. The most widespread source of flooding in the Ballina Shire is due to Richmond River flooding. Flood water travels north-easterly, and spills into the floodplain to the south and west of Ballina (6). These floodwaters also have an effect on local catchment creeks.
- d. Richmond River flooding is generally dominant across the floodplain to Ballina Island, North Creek and lower Emigrant Creek due to the catchment being relatively flat (6).

- e. Local catchment flooding is often caused by local storms and intense rainfall over short periods. This has the potential to overwhelm local drainage systems and lead to faster flowing water, with a rapid onset (5).
- f. Local catchment flooding is dominant in the upper Emigrant and Maguires Creek valleys, with Richmond River flooding becoming equally dominant as the creeks flatten towards their confluences to the river (6).
- g. The lower reaches of the Richmond River and North Creek are dominated by ocean storm flooding, affecting parts of West Ballina, Ballina Island, Shaws Bay, East Ballina and North Ballina (6).
- h. To the south, Wardell and Cabbage Tree Island are affected by Richmond River flooding due to their topography and close proximity to the river (13), (14).
- i. On the Ballina Shire floodplains the duration of inundation varies significantly depending on the type of flood (Richmond River, local catchment or storm tide) and in lower lying areas, on post flood tidal conditions. Typically, the duration of inundation would vary from a few hours to several days. Where poor drainage conditions exist and/or tide levels restrict drainage, longer periods of inundation may occur (4).
- j. Refer to Annex 1: Richmond River Basin Schematic.
- k. Table 2 outlines indicative peak height flow travel times between locations upstream of Ballina in the Richmond River catchment. Predicted travel time in a Richmond River dominated flood from upstream gauges such as Kyogle, Casino and Coraki to Ballina is estimated at 24-48 hours (5). Travel times of flood peaks can vary significantly between floods, and therefore the times listed below should be regarded as approximations only.

Table 2: Indicative Flow Travel Time for the Richmond River (4)

Locations	Travel Time
Casino to Coraki	12 to 24 hours
Lismore to Coraki	10 to 20 hours
Coraki to Bungawalbyn Junction	3 hours
Coraki to Woodburn	5 to 10 hours
Coraki to Broadwater	10 to 20 hours
Coraki to Ballina	Approx 16-24 hours*

**flow times are based on historical data and may vary in subsequent floods.*

- i. Ocean storm dominated flooding has a faster response than Richmond River flooding. Peak levels may be able to be predicted 12 hours in advance on the high tide preceding the peak surge tide, triggered by anomalies in measured tidal data compared to predicted tide levels (5).

Flood design heights

- m. Design heights along the Richmond River are shown for a range of design flood levels in Table 3.

Table 3: Richmond River design flood levels (10)

Location	1% AEP Design Flood Level (m AHD)	5% AEP Design Flood Level (m AHD)
Broadwater	3.86	2.53
D/S Wardell Bridge	3.07	2.07
U/S Pimlico Island	2.47	1.76
Confluence Emigrant Creek & Richmond River	1.94	1.71
Pacific Ocean	2.20	2.00
Emigrant Creek at Deadmans Creek Rd	2.07	1.77
Confluence Emigrant Creek & Maguires Creek	2.02	1.74
Emigrant Creek (U/S Pacific Highway – west of Ballina)	1.98	1.69
West Ballina	1.92	1.73
North Creek (airport)	1.59	1.48
Confluence North Creek & Canal	1.95	1.82
Missingham Bridge	2.04	1.89

1.6 FLOOD HISTORY

- a. Records indicate one of the greatest floods on the Richmond River in Ballina Shire took place around 1858 or 1860. A new straight deep channel was cut by the floodwaters through the South Ballina Beach. Large seas and gale force winds came in through this opening causing flooding (4).

- b. The next heavy flood came in 1864 when there were eight inundations rapidly following each other in one year. This flood resulted in great losses of buildings and stock within the Richmond River system (4).
- c. In 1892 a storm surge caused water at high tide to surround the old Ballina Post Office in River Street (4).
- d. Other major floods occurred during 1945, 1948, 1950, 1954, 1956, 1962, 1974, 1976, 1978, 1985, 1987 and 1989, 2005, and 2022.
- e. The March 1974 flood occurred after heavy rainfall in several bursts over the Richmond River catchment from March 9 to 12. It is one of the largest floods recorded at Broadwater and the largest with some calibration data. There was also significant flooding in the local creeks. There were reports of elevated ocean levels along the NSW coastline. The flood was the result of a cyclonic depression which crossed the coast (4).
- f. The 1976 event is referred to as the Teven Valley Flood, due to its dominance in the Maguires Creek catchment.
- g. The June 2005 flood occurred after heavy rainfall across the catchment, from a deep trough on the East Coast caused by slow moving upper low in Western NSW coupled with strong high feeding moist NE winds (10).
- h. Some of the largest recorded floods in the Ballina LGA occurred in February/March and again in March/April of 2022. In February, a high-pressure system in the Tasman Sea combined with a slow-moving trough, produced prolonged and significant rainfall over the Northern Rivers region (11). A second event then occurred in late March following an East Coast Low (15). The March event in Ballina saw significant local catchment flooding combined with major Richmond River flooding.

Table 4: Flood Level History in the Richmond River Catchment selected locations (4) (11; 12)

Flood Event	Coraki Peak Level (mAHD)	Woodburn Peak Level (mAHD)	Ballina (Burns Point) Peak Level (mAHD)
February 1954	6.1	4.4	-
March 1974	6.2	4.2	-
April 1988	5.8	3.9	-
January 2008	(5.8)#	3.1	1.18
May 2009	(5.8)#	3.2	1.4
April 2017	6.0	3.2	1.24
February/March 2022	6.83	6.36	2.2
March/April 2022	5.99	3.65	1.52

#simulated results due to gauge failure

1.7 FLOOD MITIGATION SYSTEMS

- a. There are no levees servicing urban areas of Ballina, however there are four rural flood mitigation levees situated in the boundaries of the Ballina Shire LGA. These levees primarily service agricultural land in minor and some moderate floods but may also service any nearby rural residential dwellings and local roads. These include;
 - i. Back Channel levee – a 2.7km earth levee located upstream of Wardell on the western bank from Bingal Creek to Cabbage Tree Island.
 - ii. Saltwater Creek levee – a 2.7km earth levee located downstream of Wardell on the western bank, below and above Saltwater Creek.
 - iii. The Lower Emigrant Creek levee network which includes 12km of earth levee. The levee has two sections, one on the western bank of the Richmond River from Emigrant Creek Rd at Pimlico, downstream around the Duck Creek Research Station to Duck Creek. Then commencing again to the north of the new Pacific Motorway upstream on the western bank of Emigrant Creek, around Chilcotts Drain and upstream to Maguires Creek at Teven Road.
 - iv. Scanlons levee – a 6.2km earth levee that runs on the western side of Scanlons Drain in the Newrybar floodplain.
- b. There are no prescribed detention basins within the Ballina Shire LGA.
- c. The Pacific Highway upgrade completed in 2020 includes culverts and small bridges to preserve cross flow, as it crosses significant portions of the Richmond River floodplain. In Ballina, the Ballina Bypass crosses Emigrant Creek and includes flood relief bridges and culverts in the Maguires and Emigrant Creek floodplains designed to withstand a 1 in 20 year flood (5% AEP) (16).
- d. The lower Richmond River floodplain in the Ballina LGA is intensively drained and floodgated with many of the major systems the responsibility of Rous County Council. These drainage networks can be geographically identified as located in:
 - i. The Tuckean Swamp including the Bagotville Barrage.
 - ii. Back Channel
 - iii. East Wardell including Swampy Creek, Walsh's drain, Wilson's drain and Carney's Lane drain.
 - iv. Empire Vale including Sneebys Lane drain and Empire Vale Creek.
 - v. Keith Hall and South Ballina including the Keith Hall Drainage System.
 - vi. Pimlico including Rodgers Canal, Duck Creek East and West drains, Emigrant Creek Canal.

- vii. Lower Emigrant and Maguires Creek including Chilcotts drain and Humbug Creek.
- viii. Newrybar Swamp including Newrybar Union drain, Scanlons drain and Nature Reserve one drain.
- e. The Bagotville Barrage is located on the border between Ballina and Lismore Local Government Areas, near the Tuckean Broadwater. It provides a physical barrier between the upstream Tuckean Floodplain and tidal inflows from the Tuckean Broadwater, with a series of one-way floodgates to allow drainage from the Tuckean Swamp. However, during large flood events it would have little control or effect on the overland floodplain flows travelling downstream (4).
- f. The Newrybar floodplain is drained by the Newrybar drain and Scanlons drain, both drain water downstream to Ross Lane and through to North Creek. There are many other smaller drains that service the area around and above Ross Lane. In this area, inundation, even after small rainfall events, can close Ross Lane, as well as affect 5 residential dwellings. The area receives runoff from land upstream and to the west (17). There are some floodgates located along the drainage network (10).

1.8 EXTREME FLOODING

- a. On rare occasions, flooding of extreme proportions can occur. Extreme floods can reach far greater heights than previously recorded, flooding areas without any previous flood history. In addition, such floods are generally both faster to rise and more dangerous in terms of depth and velocity than previous floods (4).

1.9 COASTAL EROSION

- a. Lennox Head has been defined by the NSW Government as a coastal erosion hot spot (18). More detailed information on affected properties and areas can be found in section 2.7.
- b. The most severe problems of coastal erosion and inundation occur as a result of oceanic storm conditions associated with the passage of cyclones and temperate-zone low-pressure systems. These storms may cause temporary sea level rises with large associated waves. The worst erosion is likely when severe weather conditions occur in conjunction with onshore winds and high spring tides (19).
- c. Severe coastal inundation is an infrequent event and is normally of short duration (peak flooding usually persists for several hours around high tide). The extent is dependent on the height of the barrier and the land behind (19).

2 EFFECTS ON THE COMMUNITY

1.1 COMMUNITY PROFILE

- a. Ballina Shire LGA is made up of a number of communities that can be affected in a flood. For planning purposes, these can be categorised into sectors, which include;
- b. Ballina Central Sector- includes Ballina, Cumbalum (Ballina Heights), West Ballina, North Ballina.
- c. Teven-Tintenbar Sector- includes Tintenbar, Teven, Fernleigh, Newrybar, Brooklet.
- d. East Ballina Sector- includes East Ballina, Lennox Head and Skennars Head
- e. Alstonville Sector - includes Alstonville, Tuckombil, Wollongbar, Uralba, Lynwood, Dalwood, Rous.
- f. Wardell Sector - includes Wardell, East Wardell, South Ballina, Keith Hall, Empire Vale, Patchs Beach, Pimlico, Cabbage Tree Island and Meerschaum Vale.
- g. Table 5 shows the 2021 Census 'usual resident' counts for key statistics for the Ballina Shire Local Government Area. Note these vary slightly from the sector areas due to census availability.

Table 5: Census of Housing and Population data (3)

Census Description	Ballina LGA (A)	Central Ballina	East Ballina	Teven/Tintenbar	Alstonville	Wardell
Total Persons	46, 296	15, 176	14, 872	2386	9861	2334
Aged 0-4 yrs	2,205	661	797	92	474	110
Aged 5-14 yrs	5,336	1433	1887	305	1237	284
Aged 65 + yrs	12,524	5191	3230	544	2741	408
Of Indigenous Origin	1,804	823	341	25	323	227
Who do not speak English well	107	60	12	4	20	0
Have a need for assistance (profound/severe disability)	3,117	1516	585	86	722	118
Living alone (Total)	5155	2356	1303	145	1075	165
Living alone (Aged 65+)	2987	1427	696	78	644	65
Residing in caravans, cabins or houseboats or improvised dwellings	521	364	61	5	9	67
Occupied Private Dwellings (Households)	18, 281	6463	5658	820	3908	852
No Motor Vehicle	878	580	99	0	163	18
Caravan, cabin, houseboat or improvised dwell	371	280	31	0	0	46
Rented via State or Housing Authority	531	450	30	0	54	0
Rented via Housing Co-Op or Community Church Group	140	105	11	0	11	15
Unoccupied Private Dwellings	1421	481	517	84	231	66
Average persons per occupied dwelling	2.4	2.3	2.5	2.6	2.7	2.6
Average vehicles per occupied dwelling	1.9	1.8	2	2.5	2.3	2.1

SPECIFIC RISK AREAS - FLOOD

Richmond River Valley

2.2 WARDELL

a. Community Overview

- a. **Wardell** is the main settlement within the Wardell sector, and is located on the banks of the lower reaches of the Richmond River, approximately 15km upstream from Ballina.
- b. There is an estimated population of 1142 in Wardell and East Wardell (3) and development has occurred along both sides of the river (13).
- c. **South Ballina, Keith Hall, Empire Vale and Patches Beach** are located on the Southern side of the Richmond River mouth, with Ballina to the north. They have estimated populations of 27, 156, 185 and 45 respectively (3).
- d. **Cabbage Tree Island** is situated on the southern end of the Ballina Shire LGA. Is located on the lower reaches of the Richmond River and has a predominantly Indigenous community. It has an Indigenous population of approximately 200 people. It contains a number of residential dwellings as well as a range of buildings used for recreation, administration and health services (14). Currently, as a result of damages from the 2022 flood, the Cabbage Tree Island Community are situated at Bath St, Wardell, and are not living on the Island.
- e. **Meerschaum Vale and Bagotville** are located to the East of the Tuckean Nature Reserve and to the West of Wardell Rd. They have estimated populations of 372 and 60 respectively (3).
- f. **Pimlico** is located north of the suburb of Wardell, it has an estimated population of 358 (3).

b. Characteristics of Flooding

- a. **Wardell:** Due to their close proximity to the river, communities within the Wardell sector are vulnerable to Richmond River dominated riverine flooding (13).
- b. **South Ballina:** Areas in South Ballina experience ocean storm tide dominated floods (10).
- c. **Pimlico:** Areas around Pimlico are vulnerable to equal dominance Richmond River flooding and local catchment flooding (10).
- d. **Cabbage Tree Island:** Cabbage Tree Island is located on the lower reaches of the Richmond River and would be affected by riverine flooding once flooding in the river

reached an elevation corresponding to design height of 20% AEP (14). Cabbage Tree Island flooding is typically dominated by Richmond River flooding (5).

c. Flood Behaviour

- a. Floods in the vicinity of Cabbage Tree Island and Wardell are typically caused by large flows through the Richmond River through Broadwater in combination with elevated levels caused by ocean storm conditions.
- b. Wardell: Flooding in Wardell has typically been influenced by the old Pacific Highway bridge crossing at the Richmond River (Blackwall Drive). In small to medium floods, no overtopping of the western banks of the Richmond River occur upstream of the bridge. Downstream of the bridge floodwaters inundate low-lying areas of the township. Floodwaters are forced through the bridge openings resulting in an increase of upstream flood levels by 150-300mm.
- c. Water will eventually overtop the southern approaches to the bridge and will inundate East Wardell and the Eastern section of the floodplain (20).
- d. The Eastern floodplain in this area acts as flood storage, and floodwaters have the tendency to back up along Reedy Creek.
- e. Cabbage Tree Island: Cabbage Tree Island is located in a high hazard floodway. In a 1% AEP flood it is expected that approximately 1 metre of water flowing at 1 m/s will be experienced across the island (4).

d. Classification of Floodplain

- a. Wardell can be further broken down into subsectors for floodplain classification, these classifications are as follows;
- b. Wardell A (GEMS Object ID 41611) is a High Flood Island.
- c. Wardell B (GEMS Object ID 196) is a Low Flood Island.
- d. Wardell C (GEMS Object ID 41640) has rising road access to a high flood island.
- e. Wardell D (GEMS Object ID 44813) has rising road access.
- f. Wardell E (GEMS Object ID 45205) has an overland escape route.
- g. Wardell F (GEMS Object ID 45614) is an indirectly affected area.
- h. Wardell H (GEMS Object ID 44808) is a Low Flood Island.
- i. Wardell I (GEMS Object ID 44809) is a Low Flood Island.
- j. Empire Vale (GEMS Object ID 44806) is a Low Flood Island.
- k. Pimlico (GEMS Object ID 44815) has an overland escape route to the west.
- l. South Ballina A (GEMS Object ID 45219) is a Low Flood Island.

- m. South Ballina B (GEMS Object ID 45211) is a Low Flood Island.
- n. Patches Beach (GEMS Object ID 44802) is a Low Flood Island.
- o. Goat Island (GEMS Object ID 44810) is a Low Flood Island.
- p. East Wardell A (GEMS Object ID 44801) is a Low Flood Island.
- q. Wardell East A (GEMS Object ID 44805) is a Low Flood Island.
- r. Wardell East B (GEMS Object ID 41639) is a Low Flood Island.
- s. Broadwater-Wardell (GEMS Object ID 45207) has an overland escape route.
- t. Cabbage Tree Island (GEMS Object ID 44807) is a Low Flood Island.

e. **Inundation**

- a. Once flood levels reach a height equivalent to a 10% AEP at Coraki, there will be at least 10 hours warning time before the 10% AEP level is reached at Wardell (13).
- b. There is no formalised flood warning system at Wardell (20).
- c. Networks of drainage and floodgates will affect flood behaviour in smaller flood events within this sector. These are described in section 1.7.
- d. **Wardell and East Wardell:** Some areas along Richmond St and Wilson St may experience inundation at levels equivalent to a 5% AEP flood event, or approximately 2.05-2.08m AHD (13).
- e. Areas of Wardell located to the east of Blackwall Drive are expected to be almost completely inundated during heights corresponding to a 1% AEP and 2% AEP flood event. East Wardell would be completely inundated during a 1% AEP flood and a significant portion would be inundated during a 10% AEP flood (13).
- f. **South Ballina:** In South Ballina, South Ballina Beach Holiday Park may be isolated from events equivalent to a 20%AEP, with Parts of Seabreeze Holiday Park inundated at events equivalent to a 1% AEP, and most properties experiencing inundation during events equivalent to a 0.2%AEP.
- g. The majority of properties in South Ballina, Keith Hall, Pimlico and Empire Vale do not experience above floor inundation until a flood event corresponding to at least a 2% AEP. There are a small number of properties which experience above floor inundation from a 5%AEP, however the range of over floor depths is low, of less than 0.5m over floor, even in a 1% AEP event (6).
- h. **Pimlico:** In Pimlico, patterns of inundation will be affected by a network of rural canals and drains.
- i. Table 6 below shows the estimated number of properties with over floor flooding in Wardell and East Wardell based on select design flood events, as well as properties which may experience inundation on the dwelling site (over-ground flooding).

- j. **Cabbage Tree Island:** There is no specific gauge associated with Cabbage Tree Island. For evacuation purposes, Woodburn and Coraki gauges may be utilised to determine when to evacuate (4) (14).
- k. Evacuation for the Jali Aboriginal Community on Cabbage Tree Island will be considered when a prediction is received from the Bureau of Meteorology for a flood height exceeding 4.2 m at the Woodburn gauge or and there is a possibility of further river rises. This is the height that water is expected to close the evacuation route to light traffic (4).
- l. Assessment of historical and design flood data suggests if a flood warning is issued once flood levels reach a height corresponding with a 10% AEP event at Coraki, then there will be at least 10 hours warning time before height corresponding to a 10% AEP are experienced at Cabbage Tree Island (14).
- m. The majority of Cabbage Tree Island will be inundated once flood levels reach heights corresponding to a 20% AEP (14).
- n. Most buildings are raised to above the 1% AEP flood level, however the expected high velocity of water and the early loss of the single evacuation route means the complete evacuation is essential prior to the loss of the evacuation route (4).

Table 6: Estimated number of properties inundated above floor level and over ground in Wardell related to selected design flood events (13)

Design Flood Event (% AEP)	No. Properties with Over floor Flooding	No. Properties with Over-ground Flooding
20% AEP	0	3
10% AEP	0	18
5% AEP	3	33
2% AEP	12	64
1% AEP	33	95
PMF	110	110

Table 7: Estimated number of properties inundated above floor level and over ground in Cabbage Tree Island related to selected flood design events (14).

Design Event (% AEP)	No. Properties with Over floor Flooding	No. Properties with Over-ground Flooding
20% AEP	0	10
10% AEP	0	19
5% AEP	0	26
2% AEP	1	26
1% AEP	3	26
PMF	21	26

f. Isolation

- a. **Wardell:** During the 2022 floods, road access to Wardell was cut off, with many residents not able to evacuate (15).
- b. Closure can occur at multiple points along Blackwall Drive, cutting off access from East Wardell into Wardell over the Wardell Bridge.
- c. **South Ballina:** River Drive is also vulnerable to closure in multiple locations during Richmond River dominated flooding, affecting evacuation routes for residents in the South Ballina, Empire Vale and Patch Beach subsectors (5). This may be affected by depths ranging from 0.2m in a 20% AEP to 0.9m in a 1% AEP (21)
- d. Direct access from West Ballina to South Ballina in the Wardell sector is possible via the Burns Point Car Ferry between West Ballina and South Ballina, operated by Ballina Shire Council. This point of access will be closed during a flood event at the discretion of the ferry operator, based on the velocity of the water and amount of debris present.
- e. **Meerschaum Vale:** Areas of Meerschaum Vale can be vulnerable to isolation due to flooding over the access roads such as Marom Creek Rd and Wardell Rd from Yellow and Gum Creeks.
- f. **Pimlico:** Pimlico Road is vulnerable to closure from both local catchment and creek flooding near its junction with the Pacific Motorway and Richmond River dominated flooding along its length down to Pimlico Island causing isolation to the area (5).
- g. The Bruxner Highway and Pacific Highways are both vulnerable to closure in the vicinity of Emigrant Creek, cutting off access between Ballina and the Wardell sector.
- h. **Cabbage Tree Island:** The Back Channel Road accesses the community on the Western Bank of the Richmond River with a single lane bridge across to the island and a bridge across Bingal Creek (4). Light traffic to the evacuation route over Back Channel Road is expected to be cut at levels corresponding with 4.2m on the Woodburn gauge (4).

g. Flood Mitigation Systems

- a. Flood mitigation measures in Wardell are focused on planning measures.
- b. The existing minimum Council requirement for habitable floor levels is set at the 100 year recurrence flood level (1% AEP), plus a specified freeboard of 500mm (13).
- c. There are drainage networks located within the Wardell sectors, which are described in section 1.7.

h. Dams

- a. There are no direct consequences of dam failure in Wardell.

i. At Risk Facilities

- a. The facilities that are at risk of flooding and/or isolation within the Ballina Shire LGA including schools, childcare centres, hospitals, aged and infirm, infrastructure and caravan parks are shown in Annex 2.

j. Other Considerations

- a. It should be noted that the Cabbage Tree Island community have not returned to the island following the 2022 floods and extensive damage to property and infrastructure still exists, with 26 of the 27 homes having extensive damage (17).
- b. The Cabbage Tree Island community are currently residing in temporary housing at Bath Street, Wardell.

2.3 TEVEN/TINTENBAR

a. Community Overview

- a. **Teven** lies within the Maguires Creek catchment (10). It has a population of approximately 306 people. 16% of the population is aged 15 and under, and 17.6% aged 65 and older (3).
- b. **Tintenbar** lies between the Maguires creek and Emigrant Creek catchments (10). It has a population of approximately 618 people. 18.3% of the population is aged 15 and under, and 23.8% aged 65 and older (3).
- c. **Fernleigh** has a population of approximately 618 people. 17.4% of the population is aged 15 and under, and 18% aged 65 and older (3).
- d. **Brooklet** has a population of approximately 253 people. 16.6% of the population is aged 15 and under, and 23.3% aged 65 and older (3).
- e. **Newrybar** has a population of approximately 532 people. 19.7% of the population is aged 15 and under, and 11% aged 65 and older (3).

b. Characteristics of Flooding

- a. Flooding in the Teven and Tintenbar sector is characterised by local catchment dominated flooding (5).
- b. Flooding in the Teven and Tintenbar Valleys are bounded by steep hill slopes, thereby confining the flood extents, causing hazardous flow conditions in larger events (5)

c. Flood Behaviour

- a. Flooding in the Tintenbar area on Emigrant Creek is essentially flash flooding in nature. Severe flooding could occur after 150mm of rainfall in one hour in the upper catchment and can be affected by tidal movements upstream as far as the Tintenbar Road bridge. Friday Hut Road is cut by fast flowing water at Kirklands Crossing even during minor levels of flooding (4).
- b. Flooding in Maguires Creek and the Teven Valley is characterised by deep, high velocity flow within the banks of Maguires Creek, and then slower moving shallower waters across the floodplain. The presence of sugarcane plantations slow down the velocity of flow. The Maguires Creek floodplain is a High Hazard category in a 1% AEP, predominantly due to depths in excess of 1.2m (10).
- c. Flooding in the Tintenbar area on Emigrant Creek is essentially flash flooding in nature. Flooding may occur after 70mm of rainfall in one hour or 175mm in 2-3 hours in the upper catchment, and can be affected by tidal movements upstream as far as the Tintenbar road bridge.

- d. Generally flooding in the Emigrant Creek Valley has slightly higher velocities across the floodplain than in Maguires Creek. This is partly due to the floodplain being narrower than that of Maguires Creek. Additionally, there are various controls for flow within Emigrant Creek, such as the Pacific Highway, Deadmans Creek Road and the Cumbalum Road bridge (4).
- e. Sandy Flat Creek, which joins Emigrant Creek in the vicinity of the Tamarind Drive and Old Bangalow Rd intersection, is a tidally influenced tributary. During large flood events, if the Richmond River is in flood and Emigrant Creek is backwater affected, floodwaters from Emigrant Creek break out across Sandy flat, flowing into North Creek, with Sandy Flat acting as a flood storage area (10).

d. Classification of Floodplain

- a. Teven and Tintenbar are High Flood Islands. However, flooded low lying areas are considered high hazard flood areas due to depth and velocity of flooding (10) and road closures may cause isolation.
- b. West Ballina D (GEMS Object ID 45239) has Rising Road Access.

e. Inundation

- a. Teven Flash flood warning system exists to alert the NSW SES Ballina and local residents of impending flash flooding in the Teven Valley. Contact details for residents affected are updated at least annually by the NSW SES Ballina Local Unit Commander (1).
- b. The flash flood warning system exists for approximately 14 homes and an old school in the Teven Valley. The automated system utilises three rainfall and one water level gauge, with the Bureau of Meteorology's Flash Flood Warning manager being alerted once a pre-determined threshold is reached (20).
- c. In Teven, the majority of properties that would experience inundation are located along Maguires Creek. These properties may experience inundation from a 5%AEP event, however, over-floor depths are generally low up to a 1%AEP event, with the majority below 0.5m over floor (6). It is important to note these depths are only modelled to a 1% AEP event, and more extreme flooding may incur greater depths.

f. Isolation

- a. Whilst Teven and Tintenbar are High Flood Islands, some access roads can be cut off causing temporary periods of isolation (see Table 10).
- b. Friday Hut Rd at Kirklands Crossing is a common closure point due to local catchment flash flooding from Emigrant Creek. Other common closure points in the Emigrant Creek catchment include Watsons Lane and Friday Hut Rd at the Emigrant Creek Crossing.

- c. Other roads commonly affected by flooding include Maguires Creek causeway (near Teven golf course), Houghlahans Creek Rd causeways, Old Bangalow Rd downstream from Tintenbar Rd to Tamarind Drive, Nashua Rd near Skinners Creek, Fernleigh Rd near the junction with Tintenbar Rd and other locations along Old Bangalow Rd, which is often cut off from extreme tides.

g. Flood Mitigation Systems

- a. Floodgates exist throughout the Newrybar drainage system, and are described in section 1.7.

h. Dams

- a. The Emigrant Creek Dam is located in the Tintenbar Valley, and houses downstream in the Tintenbar community which may be affected in a dam failure are located along Friday Hut Rd, Fernleigh Rd, Crosbys Lane, Tintenbar Store, George St, Foresters Way, Old Bangalow Rd and Cumbalum Rd (7).
- b. Refer to section 1.3

i. At Risk Facilities

- a. The facilities that are at risk of flooding and/or isolation within the Ballina Shire LGA including schools, childcare centres, hospitals, aged and infirm, infrastructure and caravan parks are shown in Annex 2.

j. Other Considerations

- a. No additional considerations have been identified.

2.4 CENTRAL BALLINA

a. Community Overview

- a. **Ballina** is a coastal town located at the mouth of the Richmond River, the suburb of Ballina is also referred to as Ballina Island as it is bounded by the Richmond River on its southern end, North Creek on its eastern end and the North Creek canal on its north-western side. It has a population of approximately 9735. 11.9% of the population is aged 15 and under, and 38.4% aged 65 and older. It has a 5% Indigenous population. A high proportion of the Ballina population is elderly, and 11.9% of the population identify as having a need for assistance, or activity limitation (3).
- b. **West Ballina** is located to the west of the North Creek Canal. It has a population of approximately 3230 people. 13.5% of the population is aged 15 and under, and 35.8% aged 65 and older. It has a 7.7% Indigenous population (3).
- c. **Cumalum** is located to the north-west of Ballina. It has a population of approximately 2211 people. 22.7% of the population is aged 15 and under, and 13.2% aged 65 and older. It has a 4% Indigenous population (3).

b. Characteristics of Flooding

- a. The nature of flooding around Ballina is complicated. Flood inundation occurs because of the overtopping of the Richmond River, overtopping of local creeks (Maguires, Emigrant and North Creeks), heavy localised rainfall or from elevated ocean levels and large ocean swells caused by a low or cyclonic depression (4).
- b. Overland flooding due to capacity of the drainage and pipe systems can cause localised flooding during significant localised rainfall events, during astronomical tides and during riverine flooding (8).

c. Flood Behaviour

- a. Flooding on Ballina Island can occur from each of the three dominant sources of flooding (10).
- b. West Ballina is the main flood risk area of Ballina. Flood waters from Emigrant and Maguires Creeks cross the flood plain from the north-west. It is affected from events with a frequency of 2% AEP (5).
- c. Parts of West Ballina experience equal dominance from Richmond River and Local Catchment flooding from Maguires and Emigrant Creeks, whilst areas around River St experience Richmond River dominated Riverine Flooding (5).
- d. Areas of West Ballina and Ballina Island may experience coastal inundation flooding during a major ocean storm tide of the magnitude of 1% AEP (storm tide level of 2.0mAHD), even without local rainfall events. The area of inundation increases if

there is significant rainfall over the town coinciding with the peak of significant flows in the lower Richmond River (9).

- e. In the Emigrant Creek catchment, to the south of Cumbalum, flow across the Emigrant Creek floodplain is slow moving with depths generally exceeding 1.2mAHD in a 1% AEP event. Pattern of flow across the floodplain are determined by event type and direction of flow may vary depending on whether floodwaters are rising or receding, and due to source dominance (10).
- f. In the North Creek Catchment, the Ballina Nature Reserve area, to the North of the airport, is a large basin serving as a flood storage zone for both North Creek and the Richmond River. Flow velocities in most of the area apart from the main channels are low, however depths exceed 1.2m across the majority of the floodplain in a modelled 1% AEP event (10).

d. Classification of Floodplain

- a. Ballina can be further broken down into subsectors for floodplain classification, these classifications are as follows;
- b. Ballina CBD A (GEMS Object ID 45231) is a Low Flood Island.
- c. Ballina CBD B (GEMS Object ID 46006) is a Low flood Island.
- d. Ballina CBD C (GEMS Object ID 45232) is a Low Flood Island.
- e. North Ballina (GEMS Object ID 45233) is a Low Flood Island.
- f. Ballina Heights (GEMS Object ID 45217) is a High Flood Island.
- g. West Ballina A (GEMS Object ID 45216) is a Low Flood Island.
- h. West Ballina B (GEMS Object ID 46015) is a Low Flood Island.
- i. West Ballina C (GEMS Object ID 45214) is a Low Flood Island.

e. Inundation

- a. There is currently no formal flood forecasting system that covers the Ballina Shire (20). However, river level gauges within the sector exist at Burns Point in West Ballina (203461) and Ballina RSL (203421) as well as at Missingham Bridge (203465).
- b. In a 20% AEP, flooding in West Ballina may occur in the vicinity of the Ballina Waterfront Village & Tourist Park on River St near Emigrant Creek, along with some shallow flooding of properties in Central Ballina adjacent to flooded roads (21).
- c. In the sector, some properties would experience above floor inundation from a 5% AEP event, these properties are mostly located in the vicinity of Riverside Drive in West Ballina and Waverley Place in West Ballina, and around Skinner and Martin Streets in Central Ballina. However, over-floor depths are generally low up to a 1%AEP event, with the majority below 0.5m over floor (6). It is important to note

these depths are only modelled to a 1% AEP event, and more extreme flooding may incur greater depths. A 5% AEP may correspond with peak flood levels of approximately 1.69-1.73mAHD in West Ballina, and 1.89mAHD at Missingham Bridge, between Central and East Ballina (11).

- d. Some properties in the following streets may experience inundation during a 1% AEP flood: Pacific Hwy (West Ballina), Riverview Ave, Riverside Dr, Henry Philip Ave, Bolding St, Richmond Ave, Tweed St, Camoola Av, River St, Tamar St, Grant St, Moon St, Fox St, Martin St, Skinner St, Marine St and Cawarra St. In floods larger than the 1% AEP, substantial parts of Central Ballina would be inundated. Similar areas of West Ballina would also be flooded but to a greater severity (4). A 1% AEP may correspond with peak flood levels of approximately 1.92-1.98 mAHD in West Ballina, and 2.04mAHD at Missingham Bridge, between Central and East Ballina (11).
- e. In a 0.2% AEP a significant proportion of properties in West Ballina and Central Ballina would experience inundation (21).
- f. Flooding in the Ballina Sector can also be affected by tides, with modelling showing some inundation of Tamar St, Grant St, Cherry St, Skinner St, Martin St, Riverside Drive and River St due to backwater effects during a King Tide, even with no local rainfall event (8).

Table 8: Estimated number of properties inundated above floor level and over ground in Ballina, North Ballina and West Ballina related to selected design flood heights (6).

Design Flood Event (% AEP)	No. Properties with Over floor Flooding
20% AEP	158
5% AEP	380
1% AEP	1466
0.2% AEP	5050

f. Isolation

- a. In Ballina and West Ballina, flood affected roads which are characterised a flood hazard category 3 or above, which is considered unsafe for vehicles, children and the elderly, begin to be cut off once flooding reaches an AEP event of 5%. These roads include Westland Place and some internal roads in Riverbend Village (9).
- b. The majority of land in Cumbalum (Ballina Heights Subsector) is above the PMF but may be isolated as a High Flood Island.
- c. During the 2022 floods, Ballina was isolated for three to four days, affecting the ability of support services to access the region (15).
- d. The following paragraphs outline expected road closures during design events (21); however these scenarios may differ depending on the source of flooding, and should be used as a guide only.

- e. During a 20% AEP flood event, in West Ballina parts of Burns Point Ferry Rd and Riverside Drive between Quays Drive and Riverside Ave in West Ballina may be inundated up to depths of 0.5m. In Central Ballina parts of Brunswick St, Grant St, Tamar St between Kerr and Owen St's and Skinner St may be inundated at depths ranging from 0.3-0.7m.
 - f. During a 1%AEP event, in West Ballina Burns Point Ferry Rd and Riverside Drive may experience inundation at depths of 0.5-1m, as well as many other local roads. In Central Ballina Brunswick St, Grant St, Tamar St, Skinner St as well as other local roads may experience inundation at depths of 0.5-1m.
 - g. During a 0.2% AEP event most roads in West and Central Ballina would be inundated, and in East Ballina George Pearse Pl, Lakeview Crescent and Parts of Chickiba Drive may experience flooding.
 - h. Some local roads are frequently cut off due to local catchment flooding during short bursts of intense rainfall over the catchments. These include Ross Lane at Deadmans Creek, the Tamarind Drive roundabout at the Cumbalum interchange and between North Creek Rd and the interchange.
 - i. Areas where overland flooding may frequently cause inundation of roads occurs throughout the Ballina Central Sector. This occurs at Kalinga St, Kerr St, Waterview Crescent, Moon St and Acacia Place, Russel St, TAFE campus, Newland St and Westland Place. Additional overland flooding which is also influenced by tide levels occurs at Grant St, Swift St and Burnet St, Tamar St, Brunswick St, River St between Sunset Ave and Ronan Place, Skinner St, Martin St, Riverside Drive and Burns Point Ferry Rd (8).
- g. Flood Mitigation Systems**
- a. Floodgates exist throughout the Newrybar drainage system, and are described in section 1.7.
 - b. The flow path of Deadmans Creek to the south of Ross Lane has been altered via a series of manmade drains due to infrastructure in the area.
- h. Dams**
- a. There are no direct dam failure consequences in Ballina.
- i. At Risk Facilities**
- a. The facilities that are at risk of flooding and/or isolation within the Ballina LGA including schools, childcare centres, hospitals, aged and infirm, infrastructure and caravan parks are shown in Annex 2.
- j. Other Considerations**

- a. As Ballina is a coastal town, caravan and holiday parks may be at capacity during summer school holiday period of December-January and the population in the Shire may be temporarily increased due to tourism.
- b. Increased visitors may also be expected during major festivals and events held in the nearby Byron Shire, such as Splendour in the Grass in July, and the Bluesfest on the Easter long weekend.

2.5 EAST BALLINA

a. Community Overview

- a. **East Ballina** is located at the mouth of the Richmond River. The suburb of East Ballina has a population of approximately 5882. 15.6% of the population is aged 15 and under, and 27% aged 65 and older. It has a 2.6% Indigenous population (3).
- b. **Lennox Head** is located at the northern border of the boundary of the Ballina Shire LGA. It has a population of approximately 7687 people. 19.9% of the population is aged 15 and under, and 17% aged 65 and older. It has a 2.1% Indigenous population (3).
- c. **Skennars Head** has East Ballina to its south and Lennox Head to its north. It has a population of approximately 1303 people. 18.3% of the population is aged 15 and under, and 24.4% aged 65 and older. It has a 1.8% Indigenous population (3).

b. Characteristics of Flooding

- a. The nature of flooding around Ballina is complicated. Flood inundation occurs because of the overtopping of the Richmond River, overtopping of local creeks (Maguires, Emigrant and North Creeks), heavy localised rainfall or from elevated ocean levels and large ocean swells caused by a low or cyclonic weather system (4).
- b. The areas of East Ballina and Lennox Head are dominated by ocean storm flooding (6).
- c. Local catchment flooding may also cause some inundation of surrounding roads and properties.
- d. Properties surrounding Shaws Bay in East Ballina may experience inundation due to floodwater entering through the porous northern headwall, however there is high ground directly adjacent to this area (5).

c. Flood Behaviour

- a. Flooding in East Ballina is heavily influenced by tides.
- b. Refer to section 1.5.

d. Classification of Floodplain

- a. East Ballina can be further broken down into subsectors in GEMS for floodplain classification, these classifications are as follows;
- b. East Ballina A (GEMS Object ID 53242) has Rising Road Access.
- c. Lennox Head A (GEMS Object ID 53240) has Rising Road Access.
- d. Lennox Head B (GEMS Object ID 53241) is a High Flood Island

e. Inundation

- a. There is currently no formal flood forecasting system that covers the Ballina Shire (20).

Table 9: Estimated number of properties inundated above floor level and over ground in East Ballina* related to selected design flood heights (6)

Design Flood Event (% AEP)	No. Properties with Over floor Flooding
20% AEP	9
5% AEP	14
1% AEP	53
0.2% AEP	165

**Note: Data is for East Ballina only, Lennox Head and Skennars Head data not available.*

f. Isolation

- a. The majority of land in East Ballina is above the PMF, however some access roads may be cut leading to short term periods of isolation, see table 9.
- b. Lennox Head and East Ballina may experience periods of isolation due to access roads being cut off by floodwater. Tidal effects will also influence the timing and location of isolation.

g. Flood Mitigation Systems

- a. No known flood mitigation systems.

h. Dams

- a. There are no direct dam failure consequences in East Ballina.

i. At Risk Facilities

- a. The facilities that are at risk of flooding and/or isolation within the Ballina LGA including schools, childcare centres, hospitals, aged and infirm, infrastructure and caravan parks are shown in Annex 2.

j. Other Considerations

- a. As East Ballina and Lennox Head are popular coastal holiday destinations, caravan and holiday parks may be at capacity during summer school holiday period of December-January and the population in the Shire may be temporarily increased due to tourism.
- b. Increased visitors may also be expected during major festivals and events held in the nearby Byron Shire, such as Splendour in the Grass in July, and the Bluesfest on the Easter long weekend.

2.6 ALSTONVILLE

a. Community Overview

- a. Alstonville is located on the western border of the Ballina Shire LGA. Most of the settlement in the sector is in the suburb of Alstonville and Wollongbar.,
- b. **Alstonville** has a population of approximately 5182 people, with 33.5% aged over 64, and a 2.7% Indigenous population. 9.9% of the population have identified as needing assistance due to a profound or severe disability.
- c. **Wollongbar** has a population of approximately 3261 people, with 20% ages over 65 years old.
- d. Smaller settlements within the Alstonville sector include Tuckombil, Uralba, Lynwood, Dalwood, Rous.
- e. **Tuckombil** has a population of 285, with 22.5% over 65, 22.1% under 14 and a 1% Indigenous population.
- f. **Uralba** has a population of 266 people, with 27% aged 65 and over.
- g. **Lynwood** has a population of 215, with 30% of the population 65 and over, and 16% under 14 years old.
- h. **Dalwood** has a population of 218, with 25% of the population 65 and over, and 13.8% under 14. 2.8% of the population are Indigenous.
- i. **Rous and Rous Mill** have a combined population of 434, 22% of the population are 65 and over, and 16.4% are under 14 years old. 1.2% of the population are Indigenous (3).

b. Characteristics of Flooding

- a. The majority of land in the Alstonville sector is above the PMF, and is not directly affected by flooding.
- b. Flooding of local creeks within the rural areas of the sector, such as Gum Creek and Youngmans Creek, may cause localised flooding.

c. Flood Behaviour

- a. Refer to section 1.5.

d. Classification of Floodplain

- a. Alstonville can be further broken down into subsectors in GEMS for floodplain classification, these classifications are as follows;
- b. Alstonville (Object ID 46410) is an indirectly affected area.
- c. Wollongbar (Object ID 46411) is an indirectly affected area.

e. Inundation

- a. There is currently no formal flood forecasting system that covers the Ballina Shire (20).
- b. The majority of land in the Alstonville sector is above the PMF, and is not directly affected by flooding.

f. Isolation

- a. The majority of land in the Alstonville sector is above the PMF, and is not directly affected by flooding, however access roads into Ballina or Lismore may be cut in a flood event. Refer to Table 10.
- b. Local roads may also experience inundation due to local creek flooding, particularly in the rural areas of the sector.

g. Flood Mitigation Systems

- a. No known flood mitigation systems.

h. Dams

- a. There are no direct dam failure consequences in Alstonville.

i. At Risk Facilities

- a. The facilities that are at risk of flooding and/or isolation within the Ballina LGA including schools, childcare centres, hospitals, aged and infirm, infrastructure and caravan parks are shown in Annex 2.

j. Other Considerations

- a. None identified.

SPECIFIC RISK AREAS – COASTAL EROSION

2.7 LENNOX HEAD

- a. Lennox Head is located on the north-eastern aspect of the Ballina Shire LGA. The only significant built assets at risk in the immediate beach erosion hazard area includes some road infrastructure in Lennox Head Village. However, coastal erosion events may cause damage to beach access tracks, walking paths and beach access points. This may present a risk to the general public and residents of this coastal area (21).
- b. Lennox Head Southern Section: In a storm event, failure of existing seawalls may lead to erosion threat to approx. 15 properties, however this is considered a very low probability risk (19), (21).
- c. Lennox Head Southern Section: Wave runup and overtopping of wall causing limited overwash and inundation of low floors, affecting 15 properties, is also considered very low probability (19), (21).
- d. Lennox Head Southern Section: Erosion and overtopping of the constructed dune in a storm event, affecting approx. 14 properties, is considered to be a low probability risk (19), (21).
- e. Lennox Head Central– North of Byron Street: In an extreme storm event or prolonged erosive conditions, direct erosion of the dune system and/or erosion of the seawalls could affect approx. 12 properties across Pacific Parade and into Foster and Byron Streets, however this risk is considered very low (19), (21).
- f. Lennox Head Northern Section: Erosion and failure of the old seawall during a storm event poses a very low erosion threat to the Surf Club building and carpark (19), (21).

ROAD CLOSURES AND ISOLATED COMMUNITIES

2.8 ROAD CLOSURES

- a. Table 10 lists major roads liable to flooding in the Ballina Shire LGA, [these locations are shown on Maps 2-9 ; Town Maps.
- b. The timing and location of road closures may be dependent on the source of flooding; Richmond River, ocean storm surge or local catchment flooding (5).
- c. Many local roads may also be liable to flooding, and are described in sections 2.2-2.7: Specific risk areas.

Table 10: Roads liable to flooding in Ballina Shire LGA (4).

Road	Closure location	Consequence of closure	Alternate Route	Indicative height
Wardell Sector				
Pimlico Road (Local catchment or Richmond flood)	Between Emigrant Creek Canal and Rogers Canal	May affect access onto the Pacific Highway to the north or south for South Ballina A and Pimlico Subsectors	N/A	Closure may occur from 1.3mAHD
Pimlico Road	Near Duck Creek Canal, Pacific Hwy	May affect access onto the Pacific Highway and in and out of Pimlico	N/A	Closure may occur from 1.37mAHD
River Drive (Richmond River or storm surge flooding)	Between Empire Vale Rd and Purdies Lane	May affect access routes in and out for the South Ballina/ Empire Vale area	N/A	Closure may occur from 1.7mAHD
River Drive (Richmond River flooding)	Multiple closure points between Keith Hall Lane and Floods Lane	May affect access routes in and out for the South Ballina/ Empire Vale area	N/A	Closure may occur from 1.4mAHD
River Drive	Between Sneebys Lane and Byron St	May affect access routes in and out for the South Ballina/ Empire Vale area	N/A	Closure may occur from 2mAHD
Blackwall Drive	Blackwell Drive before the Wardell Bridge	May affect access into Wardell for East Wardell A, Wardell East A and Wardell East B Subsectors	N/A	Closure may occur from 3.5mAHD
Cabbage Tree Rd	On Cabbage Tree Island, Before Richmond River Crossing	May affect access for Cabbage Tree Island	N/A	Closure may occur from 2.1mAHD

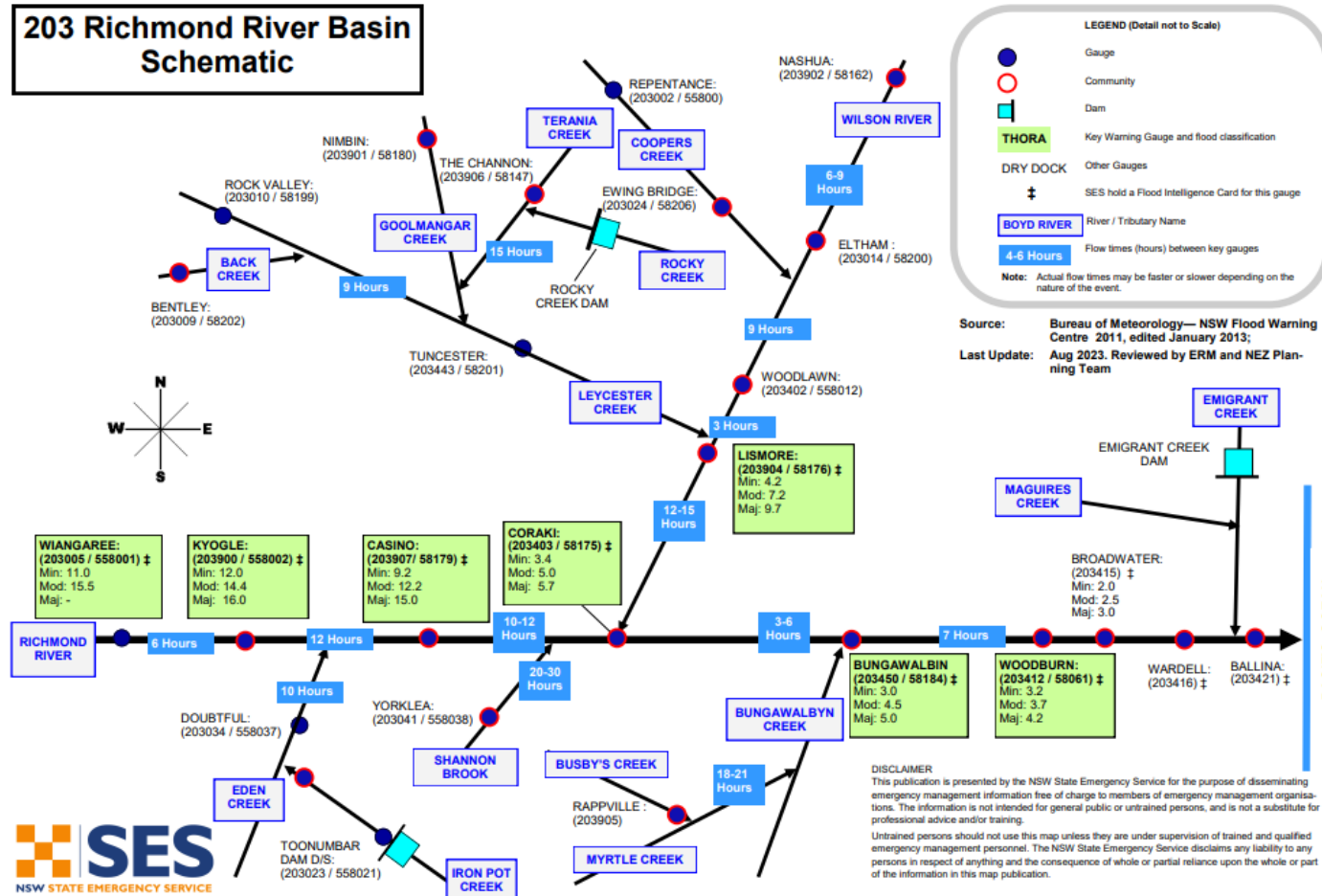
Back Channel Rd	Multiple closure points	May affect access for Cabbage Tree Island	N/A	Closure may occur from 4.2m at the Woodburn Gauge
Teven-Tintenbar Sector				
Ross Lane	Near Deadmans creek crossing.	Loss of access to Pacific Highway coming from the East.	Access to the North may be possible via Byron Bay Road/The Coast Road depending on flood levels.	Closure often occurs due to local catchment flooding.
Tintenbar/Teven Road	Between Fernleigh Road and Teven Bridge, and Maquires Creek Bridge (to Alstonville)	Access from Alstonville to the East is cut off.	None. Bruxner Highway is alternate route which is also vulnerable to closure at West Ballina.	Road closure is susceptible to flash flooding
Bruxner Highway	Bottom of Ballina cutting near the Pacific Highway junction	West Ballina is cut off from access to the west.	N/A	Closure occurs from 1m AHD
Central Ballina				
Pacific Highway, Bruxner Highway Intersection	Roundabout Near BP Travel Centre	Access out of West Ballina, to the South and West is lost.	N/A	River St approach to roundabout closes from 1.99m AHD, roundabout may be inundated earlier.
Wardell Rd	Meerscham Vale Bridge	Access to Wardell is cut off from the north.	Other access via the Pacific Highway	From 5%AEP, Closure often occurs

			is also vulnerable to closure.	due to local catchment flooding.
River St	Exit on to the Pacific Highway/ Bruxner Highway roundabout at River St, West Ballina	Access between Ballina and Alstonville/Lismore is cut off	N/A	Closure occurs from 1.99m AHD
River St	River St, – between Keppel St and Brampton Ave West Ballina	Access out of West Ballina C into Ballina is cut off	N/A	Closure occurs from 1.56m AHD
Southern Cross Drive	Southern Cross Drive, just before the Airport	Access to airport via this route may be affected	Alternate route via Boeing Ave	Closure occurs from 1.5m AHD
Bentinck St	Grant St/ Bentinck St intersection	Access to Ballina Hospital may be affected	Alternate route via Cherry St	Closure occurs from 1.57m AHD

2.9 SUMMARY OF ISOLATED COMMUNITIES AND PROPERTIES

- a. Areas in the Ballina Shire LGA may be susceptible to isolation as a consequence of road closures.
- b. **Cabbage Tree Island:** Cabbage Tree Island is expected to become completely isolated by road, with the evacuation route via Back Channel Rd towards Wardell being cut off at levels equivalent to 4.2m on the Woodburn gauge. See section 2.2 for additional details.
- c. **Wardell:** Areas of East Wardell can become isolated due to closure of Blackwell Drive towards the west. Isolation may last for up to 7 days. See section 2.2 for further details.
- d. **South Ballina:** Closures on River Drive, Blackwall Drive and the ceasing of operations of the Burns Point Ferry can leave residents in South Ballina, Empire Vale and Patchs Beach vulnerable to isolation. See section 2.2 for further details.
- e. **Pimlico:** Road closures of the main access routes for Pimlico along Pimlico Rd can cause isolation. See section 2.2 for further details.
- f. **Meerschaum Vale:** Flooding over main access routes from Meerschaum Vale may cause isolation. See section 2.2 for further details.
- g. **Ballina:** Closures along River St, the Bruxner Highway and Pacific Highway can leave residents in West Ballina vulnerable to isolation. Affected roads in Ballina and West Ballina can be further influenced by tidal conditions, more detail can be found in section 2.4.
- h. **Teven/Tintenbar:** Local catchment flooding can cause isolation for communities in Teven and Tintenbar. However this is usually of a shorter duration, and water rises and falls more quickly.

ANNEX 1: RICHMOND RIVER BASIN SCHEMATIC



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

Richmond River Valley

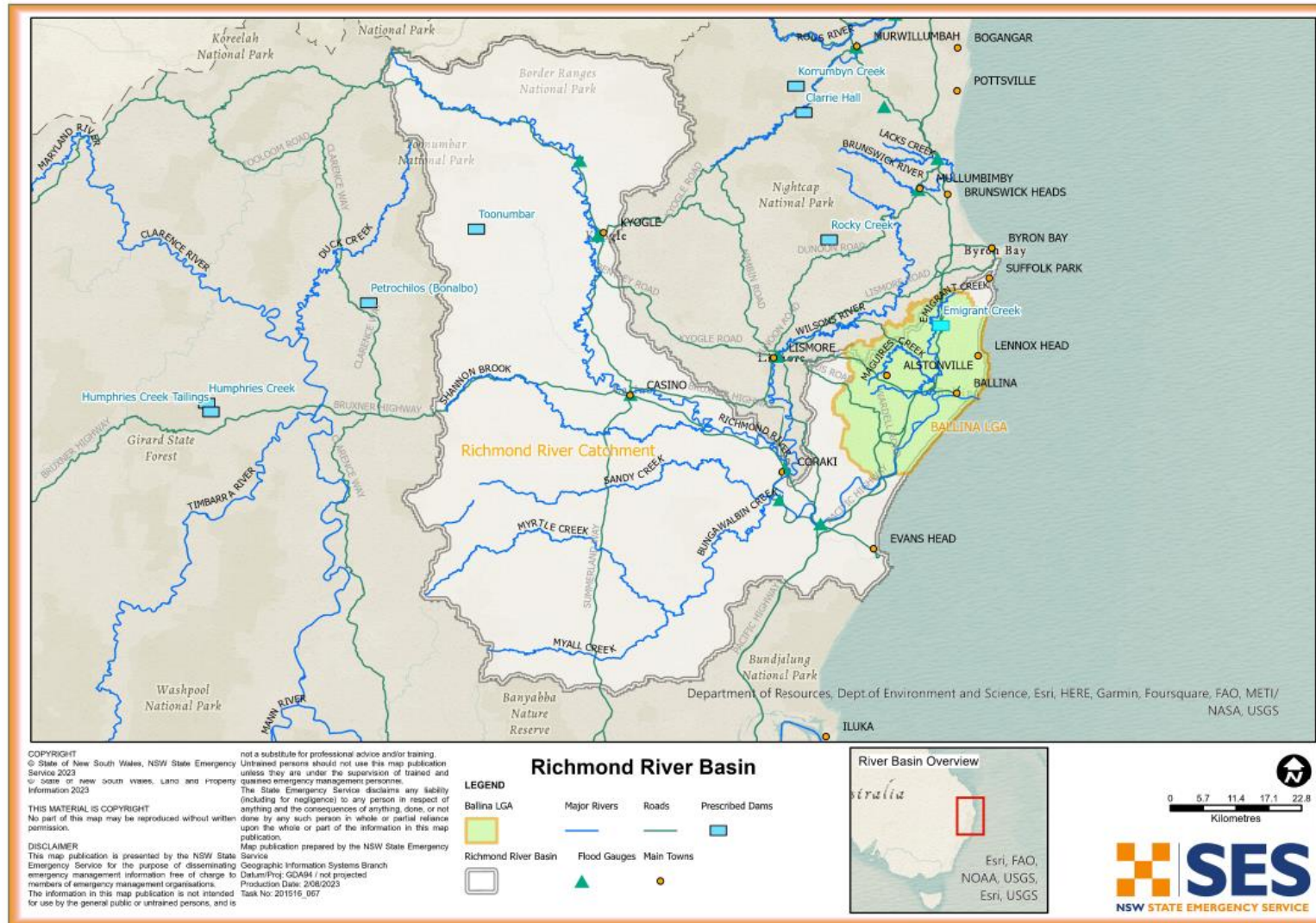
Facility Name	Street	Suburb	Comment
Schools			
Ballina Coast High School	57 Cherry St	Ballina	Approx 859 students, 118 staff. Becomes a Low Flood Island, may experience inundation.
Ballina Public School	48 Crane St	Ballina	Approx 280 students, 35 staff Becomes a Low Flood Island, may experience inundation.
Biala Support Services Inc	78 Fox St	Ballina	Approx 28 students, 14 staff Becomes a Low Flood Island, may experience inundation.
Biala Support Services Disability Services	62 Tamar St	Ballina	Approx 9 clients, 3 staff - Becomes a Low Flood Island, may experience inundation.
Cabbage Tree Island Public School*	Cabbage Tree Island Road	Cabbage Tree Island	Approx 30 students, 10 staff- Cabbage Tree Island becomes isolated and requires evacuation before Back Channel Rd is cut off a floods predicted to exceed 4.2 m at the Woodburn gauge. Becomes a Low Flood Island, may experience inundation.
Emmanuel Anglican College	62 Horizon Drive	Ballina	Approx 680 students, 80 staff Becomes a Low Flood Island, may experience inundation.
Empire Vale Public School*	632 River Drive	Empire Vale	Approx 27 students, 5 staff. Becomes a Low Flood Island, may experience inundation.*School is currently relocated due to damage sustained in 2022 floods.
Richmond Christian College	7 Gallans Rd	Ballina	Approx 234 students, 34 staff. Becomes a Low Flood Island, may experience inundation.
St Francis Xavier Primary School	38-50 Swift St	Ballina	Approx 368 students, 45 staff - Becomes a Low Flood Island, may experience inundation.
Southern Cross Public School	2-40 Chickiba Drive	East Ballina	Approx 385 students, 30 staff –Has rising road access, May experience some inundation in a PMF

Southern Cross School of Distance Education	2-40 Chickiba Drive	East Ballina	Approx 100 students, 150 staff – Has rising road access, may experience some inundation in a PMF
Wardell Public School	20 Richmond St	Wardell	Approx 40 students, 7 staff – May experience inundation, has rising road access to a high flood island.
Child Care Centres			
Ballina Before & After School & Vacation Care	48 Crane St	Ballina	Approx 45 children, 5 staff Begins to be inundated at levels equivalent to a 20% AEP. Becomes a Low Flood Island, may experience inundation.
Ballina Fox Street Preschool	84 Fox Street	Ballina	Approx 40 children, 8 staff. Becomes a Low Flood Island, may experience inundation.
East Ballina Before & After School & Vacation Care	2-40 Chickiba Drive	East Ballina	Approx 45 children, 5 staff – May experience some inundation in a PMF.
Emmanuel Anglican College Early Learning Centre	62 Horizon Drive	Ballina	Approx 80 children, 10 staff - Becomes a Low Flood Island, may experience inundation.
Goodstart Learning & Daycare Centre	38 Links Ave	East Ballina	Approx 90 children, 20 staff – Has rising road access, may experience inundation in a PMF
Imagine Early Learning	27-37 Kalinga St	West Ballina	Isolated at a 20% AEP, Becomes a Low Flood Island, may experience inundation.
Rainbow Children’s Centre	4 John Sharpe St	East Ballina	Approx 70 children, 33 staff. Has rising road access, may experience inundation in a PMF
River Street Preschool	12 River St	Ballina	Approx 59 children, 14 staff. Becomes a Low Flood Island, may experience inundation.
Seeds early Learning Centre	58-62 Westland Drive	West Ballina	Approx 83 children, 24 staff – Becomes a Low Flood Island, may experience inundation.
Facilities for the aged and/or infirm			
Ballina Community Health	50 Fox St	Ballina	30 patients, 90 staff. Becomes a Low Flood Island, may experience inundation.
Ballina Day Surgery	Suite 6, 46 Tamar St	Ballina	80 patients, 25 staff – Becomes a Low Flood Island, may experience inundation.

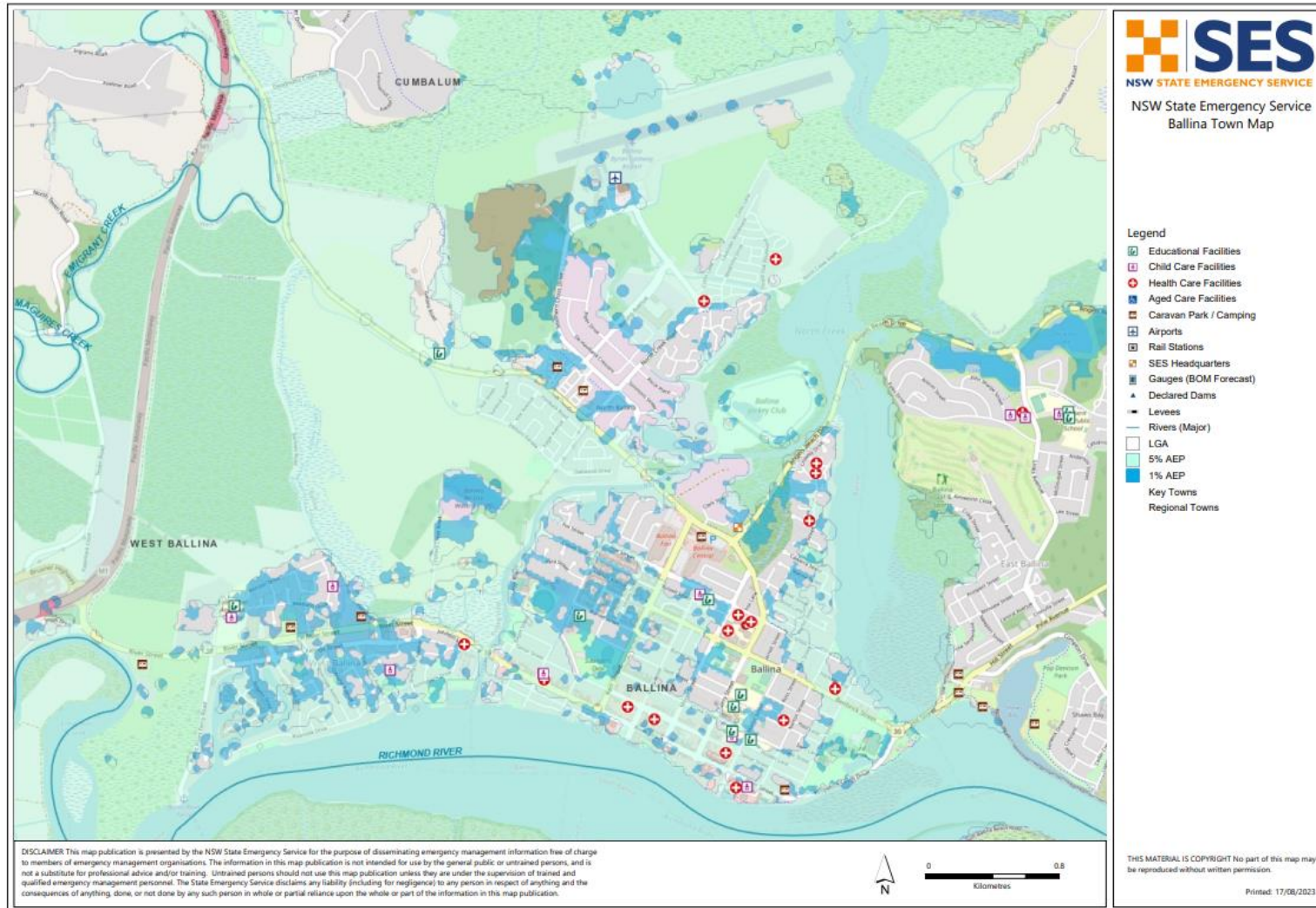
Ballina District Hospital	78-92 Cherry St	Ballina	90 beds, 180 staff - Becomes a Low Flood Island, may experience inundation.
BUPA Aged Care	148 North Creek Rd	Ballina	123 residents, 60 staff- Becomes a Low Flood Island, may experience inundation.
Crowley Mercy Centre	154 Cherry St	Ballina	315 residents, 251 staff. Becomes a Low Flood Island, may experience inundation.
Florence Price Gardens	11 Hackett Lane	Ballina	120 rooms, 75 staff. Becomes a Low Flood Island, may experience inundation.
Kokoda Village	Units 1-23 Owen St Units 24-29 Namitjira Place Units 30-35 71-71 Norton Units 36-54 Bentinck St Units 54-74 1 Hackett Lane	Ballina	74 units, 111 residents, 2 staff – all locations become a Low Flood Island, may experience inundation.
RSL Life Care	7 Bentinck St	Ballina	120+ residents, 6 staff – Becomes a Low Flood Island, may experience inundation.
St Andrews Village	59 Bentinck St	Ballina	123 beds, 150 staff - Becomes a Low Flood Island, may experience inundation.
Utilities and infrastructure			
Ballina Byron Gateway Airport	210 Southern Cross Drive	Ballina	Becomes a Low Flood Island, may experience inundation.
Ballina Wastewater Treatment Plant	Fishery Creek Rd	Ballina	Becomes a Low Flood Island, may experience inundation.
Ballina Complex Zone Substation, Depot and Pole Dump	34 Temple St	Ballina	May experience inundation within its vicinity in a PMF, with access becoming difficult.
Wardell Wastewater Treatment Plant	Coolgardie Rd	Wardell	May experience inundation in a PMF.
Camping Ground / Caravan Parks			
Ballina Central Caravan Park	1 River St	Ballina	Becomes a Low Flood Island, may experience inundation.
Ballina Gardens Caravan Park	126 Tamarind Drive	Ballina	Becomes a Low Flood Island, may experience inundation.

Ballina Pacific Palms Village	59-61 Southern Cross Drive	Ballina	May become isolated or experience inundation.
Ballina Sea Breeze Caravan Park	344 South Ballina Beach Rd	South Ballina	Becomes a Low Flood Island, may experience inundation.
Camp Drewe	117 Camp Drewe Rd	Lennox Head	May experience isolation
Cedars Caravan Park*	449 River St	Ballina	*Currently closed due to damage from 2022 floods
Hibiscus Gardens Caravan Park	491 River St	Ballina	Becomes a Low Flood Island, may experience inundation.
Lake Ainsworth Sport & Recreation Centre	164 Camp Drewe Rd	Lennox Head	May experience isolation
Sanctuary Village	502 Ross Lane	Lennox Head	May experience inundation and/or isolation.
Sandalwood Leisure Village	978 Pimlico Rd	Wardell	May experience inundation or isolation in a PMF.
Shaws Bay Caravan park	1 Brighton St	East Ballina	May experience some inundation in a PMF
South Ballina Beach Holiday Park	440 South Ballina Beach Rd	South Ballina	Becomes a Low Flood Island, may experience inundation.
Ballina Waterfront Village and Tourist Park	Cnr Pacific Hwy & Emigrant Creek Rd	Ballina	Becomes a Low Flood Island, may experience inundation.
Riverbend Retirement Village	1 Riverbend Drive	West Ballina	Becomes a Low Flood Island, may experience inundation.

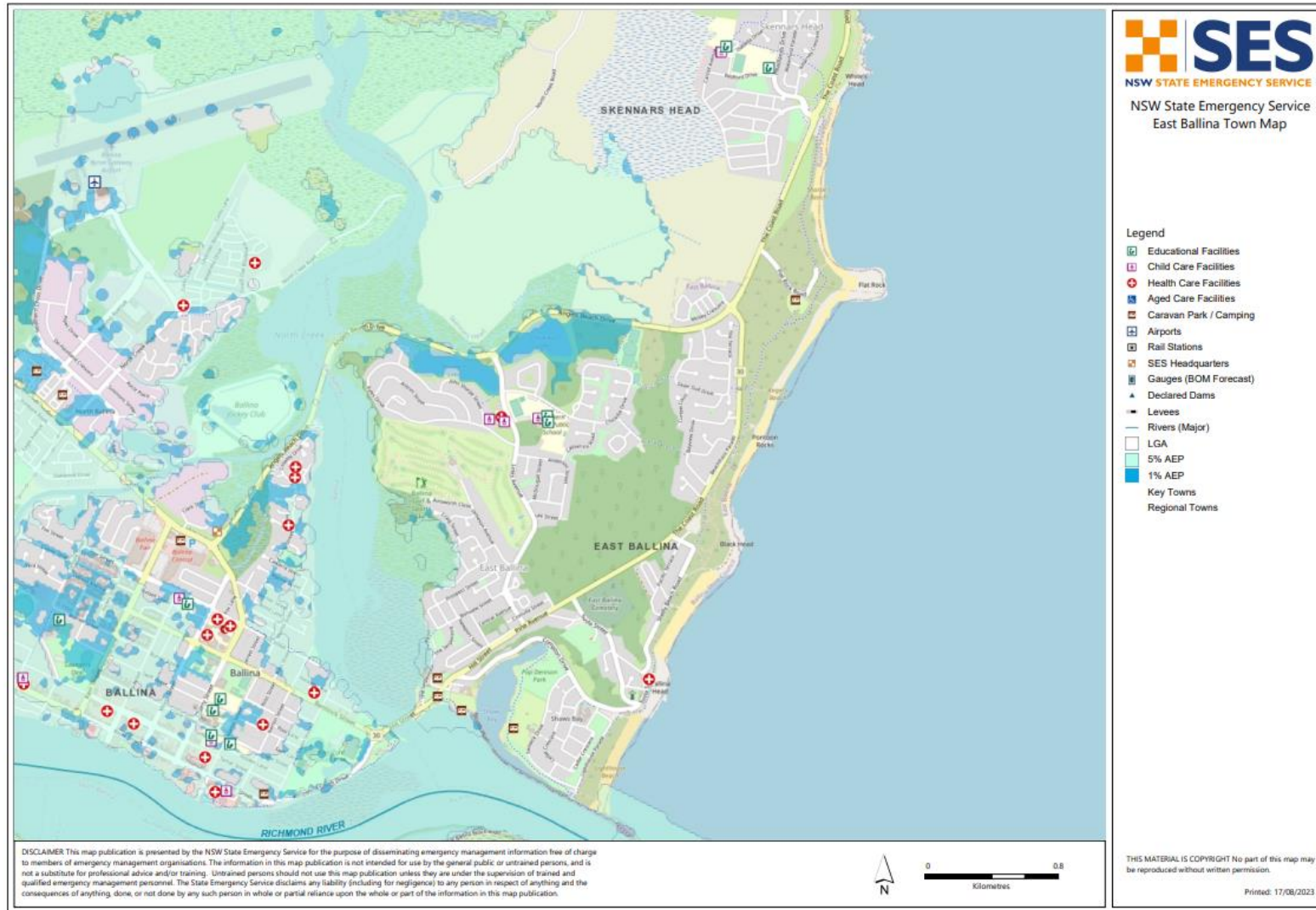
MAP 1: RICHMOND RIVERBASIN



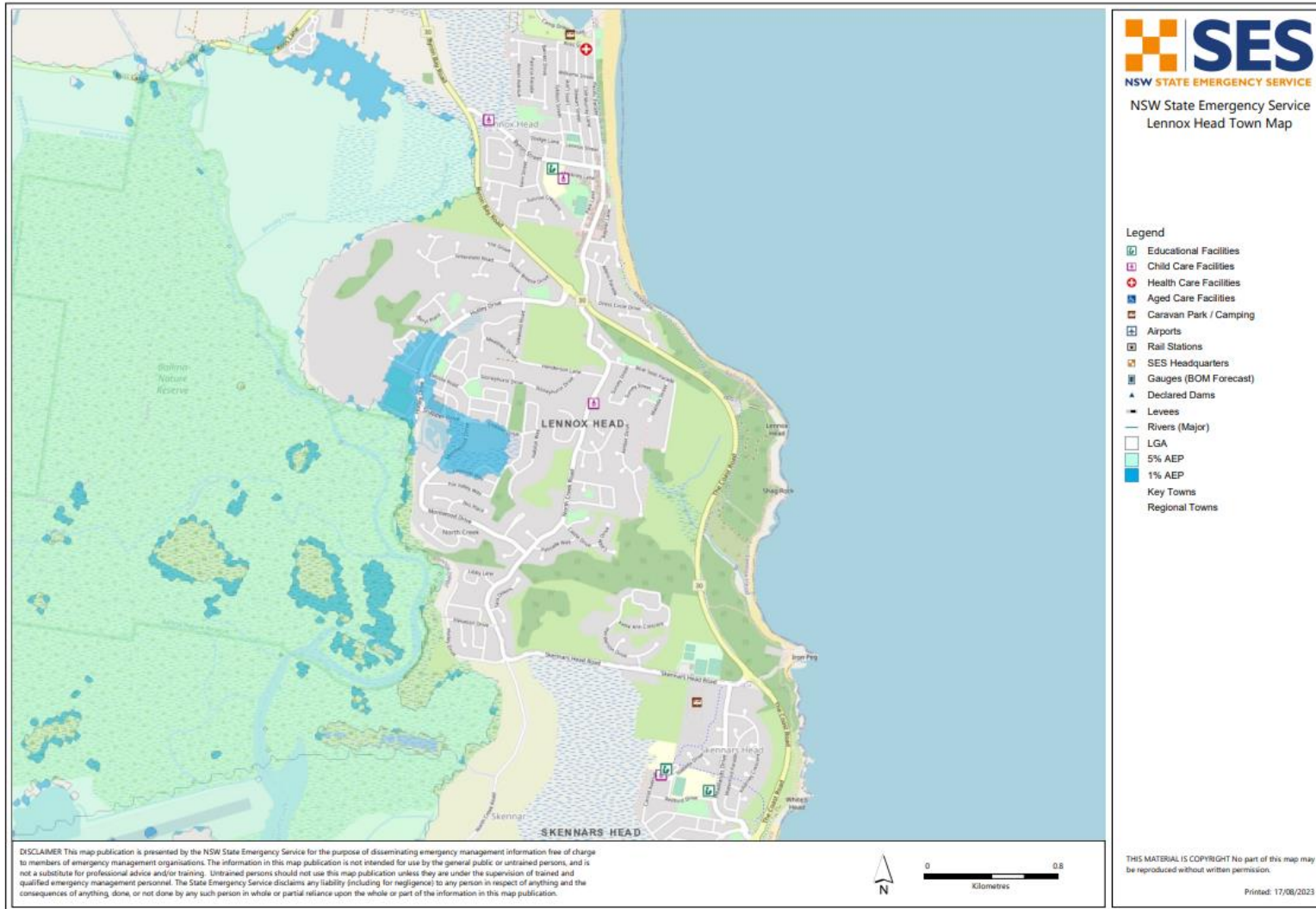
MAP 2: BALLINA TOWN MAP



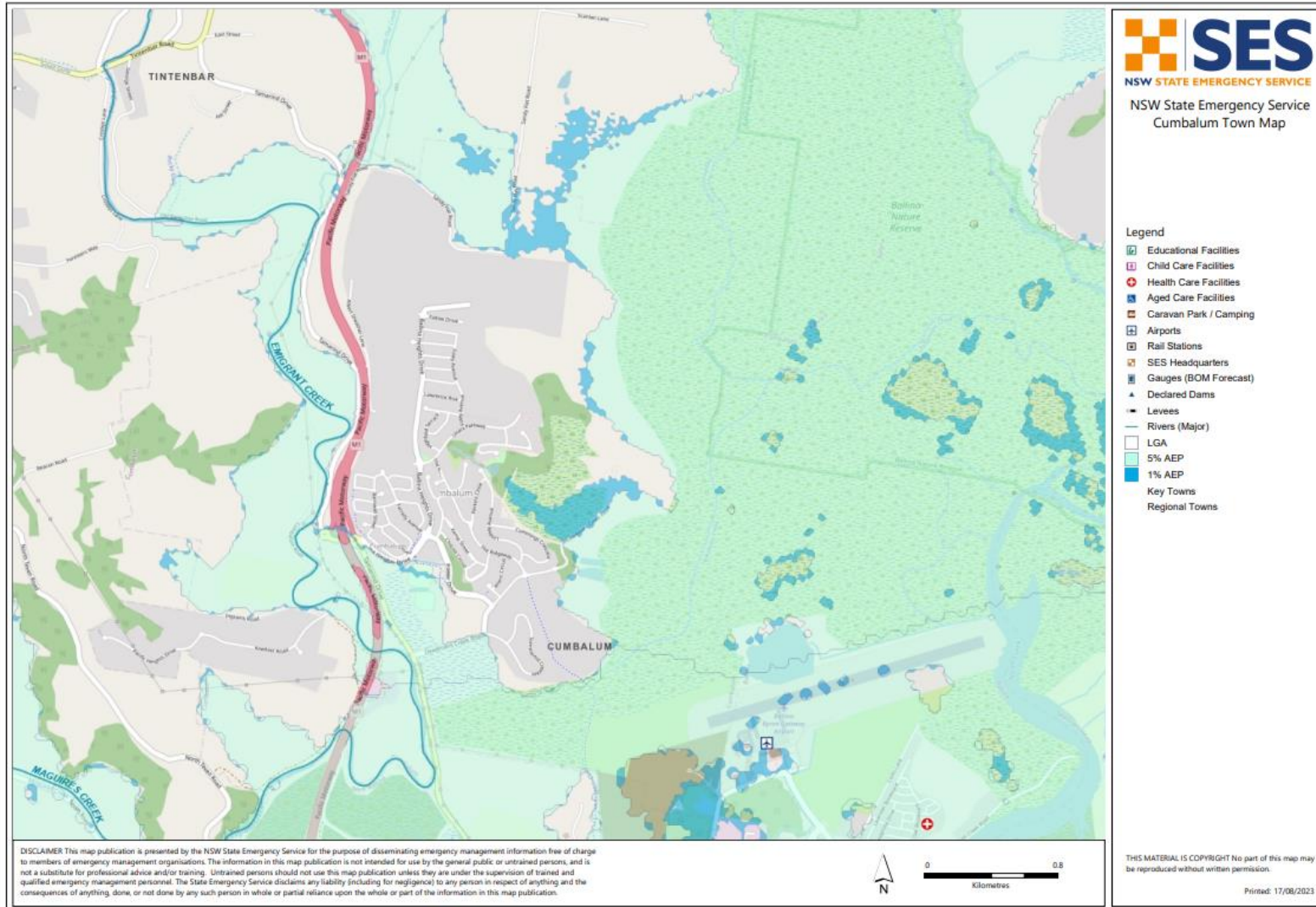
MAP 3: EAST BALLINA TOWN MAP



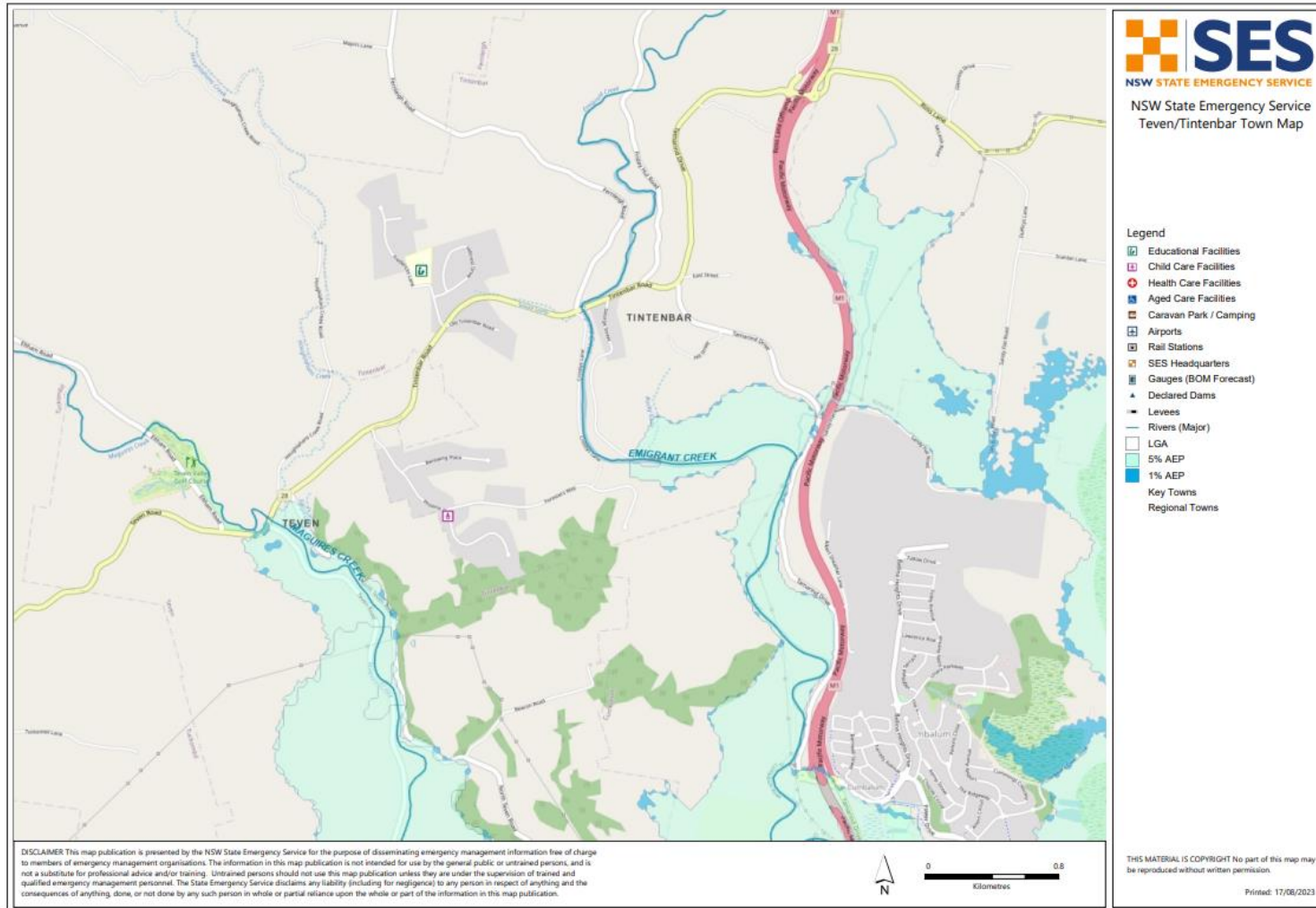
MAP 4: LENNOX HEAD TOWN MAP



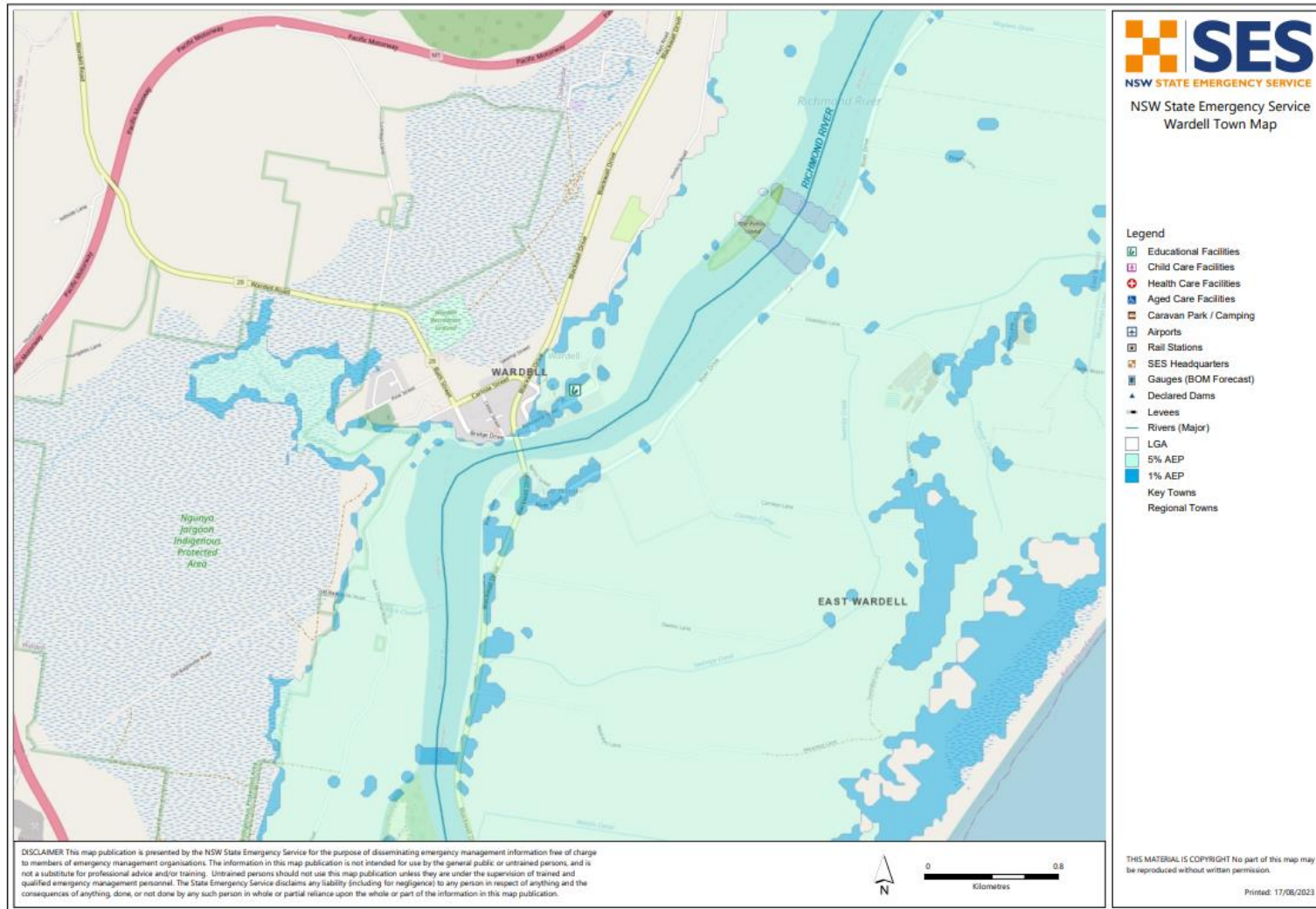
MAP 5: CUMBALUM TOWN MAP



MAP 6: TEVEN-TINTENBAR TOWN MAP



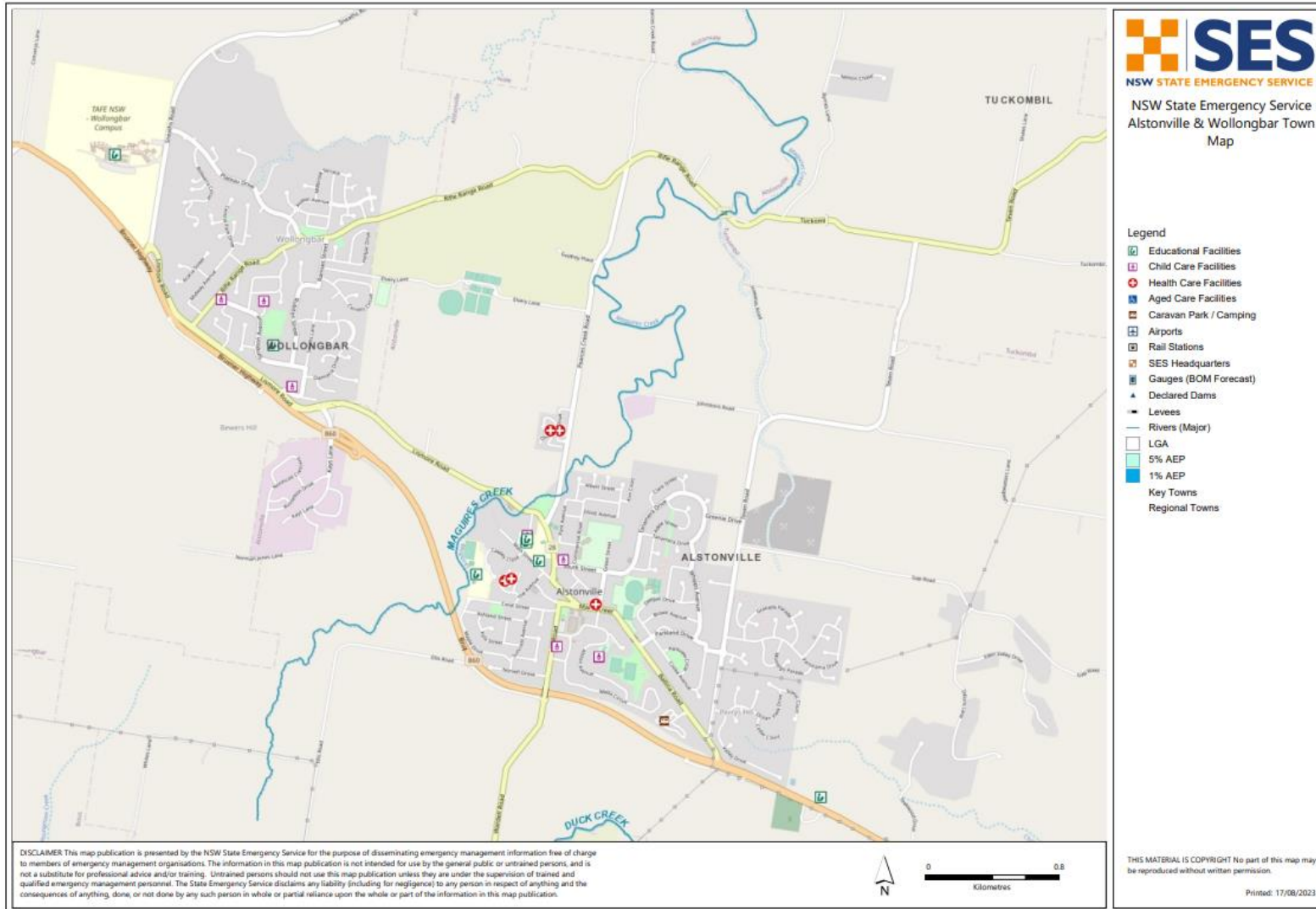
MAP 7: WARDELL TOWN MAP



MAP 8: SOUTH BALLINA TOWN MAP



MAP 9: ALSTONVILLE TOWN MAP



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BALLINA SHIRE FLOOD WARNING SYSTEMS AND ARRANGEMENTS

**Chapter 1 of Volume 3 (NSW SES Response Arrangements for Ballina) of
the Ballina Shire Flood Emergency Sub Plan**

Last Update: February 2024

AUTHORISATION

NSW SES Locality Response Arrangements in Ballina Shire has been prepared by the NSW State Emergency Service (NSW SES) as part of a comprehensive planning process.

Approved	Michael Stubbs 
	<hr/> <i>NSW SES North Eastern Zone Coordinator Planning</i> Date: 06/02/2024
Approved	
	<hr/> <i>Joanna Jones</i> <i>NSW SES North Eastern Zone Commander</i> Date: 06 /02 / 2024
Tabled at LEMC	<hr/> Date: 07/02/2024

Document Issue: V3.2-07042014

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1. GAUGES MONITORED BY THE NSW SES BALLINA LOCAL HEADQUARTERS

Table 1: Gauges monitored by the NSW SES Ballina Local Headquarters

Gauge Name	Type	AWRC No.	Bureau Gauge No.	Stream	Flood level classification in metres			Special Reading Arrangements	Owner
					MIN	MOD	MAJ		
Ballina Breakwall (Tide)	Automatic	203425	558097	Richmond River	-	-	-	-	DPE
Lake Ainsworth	Automatic	203455	558052	Lake Ainsworth	-	-	-	-	DPE
Teven	Automatic	-	558070	Maguires Creek	-	-	-	-	Ballina Shire Council/ Water NSW
Wardell†	Automatic	203468	-	Richmond River	-	-	-	-	DPE
Wardell (Wharf) ‡	Manual	203416	-	Richmond River	-	-	-	-	Ballina Shire Council
Byrnes Point (Burns Point) †	Automatic	203461	558044	Richmond River	-	-	-	-	DPE
Missingham Bridge	Automatic	203465	-	Richmond River	-	-	-	-	DPE
Ballina RSL†‡	Manual	203421	-	Richmond River	-	-	-	-	Ballina Shire Council
Woodburn*†‡	Automatic	203412	58061	Richmond River	3.2	3.7	4.2	-	DPE
Coraki*†‡	Automatic	203403	58175	Richmond River	3.4	5.0	5.7	-	DPE

Notes: The Bureau of Meteorology provides flood warnings for the gauges marked with an asterisk (*).

NSW SES Local Flood Advices are provided for the gauges marked with a single cross (†).

The NSW SES holds a Flood Intelligence Card for the gauges marked with a double cross (‡)

2. DISSEMINATION OPTIONS FOR NSW SES FLOOD INFORMATION AND WARNING PRODUCTS

As the combat agency for flood, storm and tsunami NSW SES has a statutory responsibility to issue warnings and public information to affected communities (NSW SES Act s 8). Warnings include advice about options and likely impacts of an event. The Incident Controller is accountable for preparing and disseminating accurate warning products during an incident.

2.1 DISSEMINATION OF WARNINGS:

NSW SES disseminates warnings through the following platforms: (Please note that this is not an exhaustive list and not all the following may be used during any or all events)

- NSW SES Website
 - www.ses.nsw.gov.au
- HazardWatch
 - HazardWatch is currently online at www.hazardwatch.gov.au .
 - Warnings are automatically updated/removed and managed through this platform.
- Hazards Near Me NSW App
- Doorknocking
- Emergency Alert
- Social Media
 - The following are some social media accounts:
 - Facebook (@NSWSESBallina)
 - Facebook (Local community pages, Local business pages)
 - Twitter (@NSWSES)
 - Instagram (@NSWSES)
- Community Meetings

Television Stations:

Station	Location
ABC TV (Channel 2, 20 & 21)	Northern NSW
ABC NEWS, (Channel 24)	Northern NSW
NBN (Channel 8, 81)	Northern NSW
SBS (Channel 3)	Northern NSW
WIN/10 (Channel 5)	Northern NSW
Seven West (Channel 6, 61)	Northern NSW
SkyNews (Channel 53)	Northern NSW

Radio Stations:

Station	Location	Frequency	Modulation
ABC Radio	North Coast	738 AM 94.5 FM	
Paradise FM	Ballina	101.9 FM	

Digital/On-Line Services

- Streaming Services
- Podcasts
- YouTube Channels

Other Agencies:

Stakeholders include:

- Chamber of Commerce
- Business Owners
- NFP's
- NDIS and Community Care Providers
- Aged Care Providers
- Emergency Services
- Schools and Child Care
- Ballina Shire Council
- Rous County Council
- NSW Health
- Media Outlets
- Others where appropriate

BALLINA SHIRE NSW SES LOCALITY RESPONSE ARRANGEMENTS

**Chapter 2 of Volume 3 (NSW SES Response Arrangements for Ballina
Shire) of the Ballina Shire Flood Emergency Sub Plan**

Last Update: February 2024

AUTHORISATION

NSW SES Locality Response Arrangements in Ballina Shire has been prepared by the NSW State Emergency Service (NSW SES) as part of a comprehensive planning process.

Michael Stubbs



Approved

NSW SES North Eastern Zone Coordinator Planning

Date: 06/02/2024



Approved

Joanna Jones

NSW SES North Eastern Zone Commander

Date: 06/02/2024

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SECTOR OVERVIEW

Table 1: Overview of Sectors in the Ballina Shire LGA.

Sector Name	Community	Sector Basis	Total properties	Properties potentially at risk
Central Ballina	Ballina (Ballina Island), West Ballina, Cumbalum.	Ballina and West Ballina are Low Flood Islands. Cumbalum is a High Flood Island.	7966	Approx 4987 at risk of over floor flooding in Ballina, North Ballina and West Ballina in a PMF. Properties within these areas are also at risk of isolation. Approximately 958 dwellings at risk of isolation in Cumbalum.
East Ballina	East Ballina, Skennars Head, Lennox Head.	The East Ballina sector has rising road access to flood free land.	7757	Approx 165 at risk of over floor flooding in East Ballina in a PMF. Approx 181 within the flood extent in Lennox Head There are 28 properties in Lennox Head at risk from Coastal Erosion
Wardell	Wardell, East Wardell, South Ballina, Keith Hall, Empire Vale, Patches Beach, Pimlico, Cabbage Tree Island, Meerschaum Vale.	East Wardell, South Ballina, Empire Vale, Keith Hall, Goat & Cabbage Tree Islands are Low Flood Islands. Wardell has Rising Road Access. Pimlico has an overland escape route. Meerschaum Vale has an overland escape route.	734	Approx 110 at risk of over floor flooding in Wardell. Approx 26 at risk of over floor flooding in in Cabbage Tree Island. No over floor inundation data is available however there are 21 dwellings South Ballina, 60 in Keith

				<p>Hall, 72 in Empire Vale and 26 in Patches Beach which may be at risk of inundation and/or isolation.</p> <p>There are 128 properties in Pimlico, which may be vulnerable to inundation or isolation.</p> <p>There are 26 properties in Meerschaum Vale and Bagotville which may be vulnerable to inundation or isolation.</p>
Alstonville	Alstonville, Alstonvale, Tuckombil, Wollongbar, Coolgardie, Tuckombil, Uralba, Lynwood, Dalwood, Rous, Rous Mill.	Alstonville and Wollongbar are Indirectly Affected Areas. Uralba has Rising Road Access	4955	There are approximately 6 properties in Uralba which may be at risk of either isolation and/or inundation.
Teven/ Tintenbar	Teven, Tintenbar, Kinvara, Fernleigh, Pearces Creek, Brooklet, Newrybar.	Teven and Tintenbar have Rising Road Access.	943	14 in Teven, 1 in Tintenbar, 8 in Kinvara which may be at risk of inundation.

1. CENTRAL BALLINA SECTOR

1.1. CENTRAL BALLINA RESPONSE ARRANGEMENTS					
Refer to Volume 2: Hazard and Risk in Ballina Shire for more information about this Sector/Community.					
Sector Description	This sector covers the suburbs of Ballina (Ballina Island), West Ballina and Cumbalum.				
Hazard	Richmond River Riverine Flooding Overland Flow Storm Surge/ Coastal Inundation Local catchment flooding from North Creek, Emigrant Creek, Maguires Creek.				
Flood Affect Classification	Ballina is a Low Flood Island West Ballina is a Low Flood Island Cumbalum is a High Flood Island				
At risk properties	Ballina: 3669 West Ballina: 1318	Total number of properties within Sector/Community	Ballina: 5036 West Ballina: 1530 Cumbalum: 958		
Sector Control	The Ballina Unit Commander/ SES Incident Controller will control evacuations in this sector. The NSW SES will conduct evacuations in this sector with assistance from NSW Police, Fire and Rescue NSW, and NSW Rural Fire Service (RFS) volunteers.				
Key Warning Gauge Name	Name	AWRC No.	Min (m)	Mod (m)	Maj (m)
	Byrnes Point *	203461	-	-	-
	*There is no Bureau of Meteorology key warning gauge in this sector. Upstream gauges may give an indication of flood severity.				
General Strategy	<ul style="list-style-type: none"> ▪ Evacuation of at-risk population. ▪ Self-evacuation to friends/family outside of the impact area. ▪ Establishment of an Assembly Area/Evacuation Centre at Southern Cross Public School or other nominated centre where evacuees are able to gather while flood situation is monitored. 				
Key Risks / Consequences	<ul style="list-style-type: none"> ▪ Closure of evacuation routes, the inundation of many of which will be influenced by tides. ▪ Inundation of a large number of dwellings. ▪ Potential of isolation to supplies for thousands of people in a large flood event for a number of days. ▪ Potential loss of life from rapid and potentially high velocity flooding inundation. 				
Information and Warnings	<ul style="list-style-type: none"> ▪ Flood Watch (BoM) ▪ Flood Warnings (BoM) ▪ AWS Advice ▪ AWS Watch and Act ▪ AWS Emergency Warning ▪ Sequenced door knocking of evacuation sector ▪ Media announcements (including social media) 				

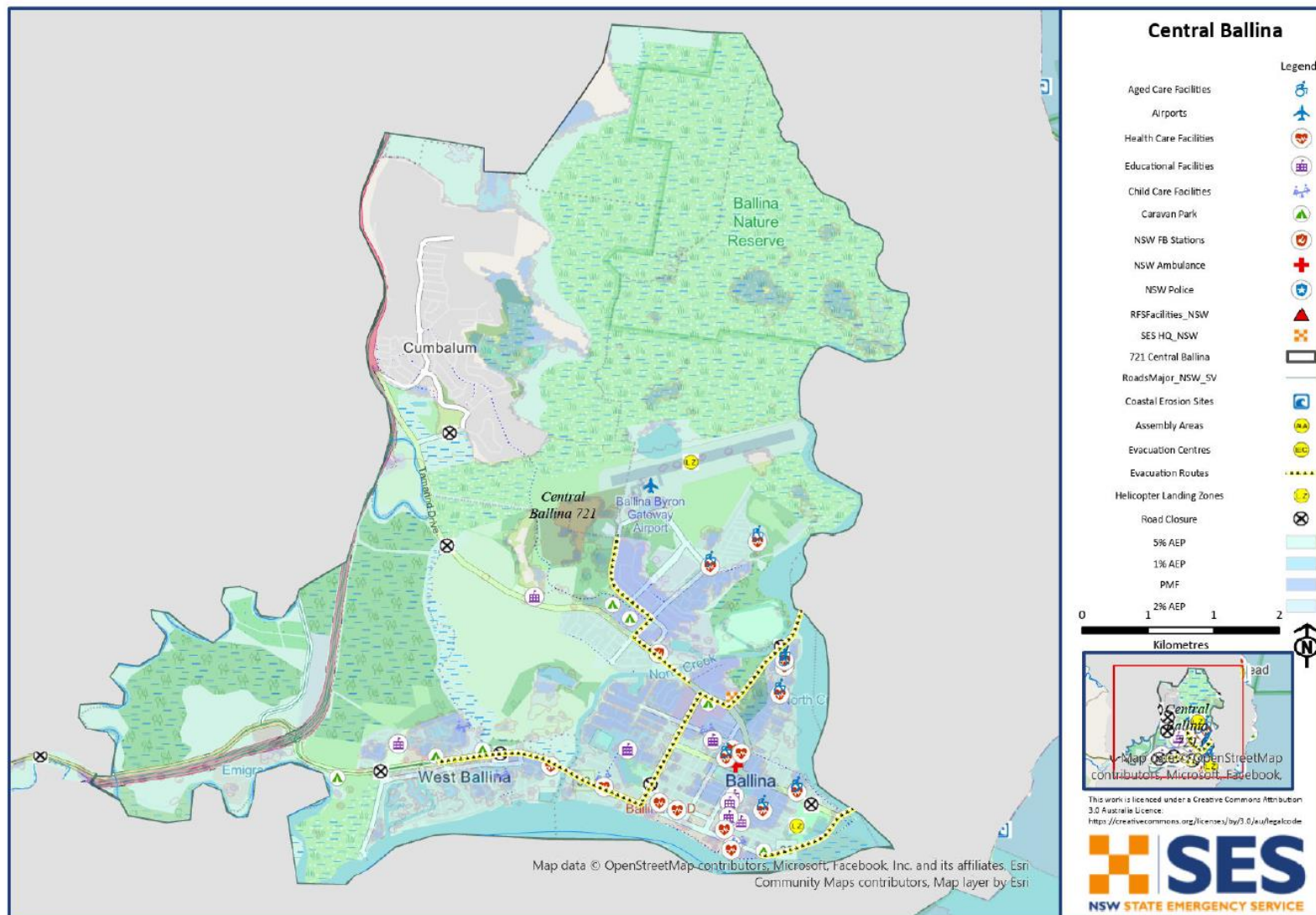
	<ul style="list-style-type: none"> ▪ Emergency Alerts (SMS, landlines) ▪ Standard Emergency Warning Signal
<p>Property Protection</p>	<p><i>Specific property protection measures:</i></p> <ul style="list-style-type: none"> ▪ Relocation of livestock. ▪ Relocation of farm machinery and valuable goods ▪ Control of surface water through sandbagging measures. ▪ Assist in the lifting of furniture to residents in need. ▪ Monitoring integrity of dwellings surrounded by flood waters. <p><i>Assistance with property protection:</i></p> <ul style="list-style-type: none"> ▪ Refer to Chapter 4: Caravan Park Arrangements ▪ Self-serve sandbag stations may be set up at nominated locations to assist with property protection. <p><i>Protection of essential infrastructure:</i></p> <p>No identified essential infrastructure requires protection below a 1% Annual exceedance Probability (AEP) flood height, equivalent to approximately 2.0mAHD/2.86mRRVD at Burns Point Gauge.</p> <ul style="list-style-type: none"> ▪ Ballina District Hospital may experience inundation and/or isolation between a 1%-0.2% AEP. ▪ Ballina Wastewater Treatment Plant (Fishery Creek Rd) is built to withstand a 1%AEP, with switchboards above flood level.
<p>Evacuation and/or Isolation Triggers</p>	<p>There is no Bureau of Meteorology flood forecasting in the Ballina Shire, however evacuation may be considered due to flood conditions that are expected to cause;</p> <ul style="list-style-type: none"> ▪ Inundation of property. ▪ Closure of primary evacuation routes. ▪ Failure of essential services
<p>Evacuation Triggers</p>	<p>The effects of flooding within this sector are very much dependant on tidal influences. Tidal levels will need to be identified at the onset of main Richmond River flooding.</p> <p>All effects listed below associated with gauge heights will need to be monitored and verified via reconnaissance wherever possible, and should not be considered as absolute. Different sources of flooding within the Ballina Shire may affect consequences.</p> <p>Note: The Byrnes Point Gauge datum is Richmond River Valley Datum. mAHD can be obtained by RRVD-0.857=mAHD.</p> <p>Evacuation or warning may be considered when:</p>

	<p>1.) From 2.4mRRVD at the Byrnes Point Gauge (1.57mAHD / 20% AEP): Low lying parts of West Ballina including Ballina Waterfront Village Tourist Park may experience inundation. West Ballina A1 may experience inundation of low-lying areas of roads including along Burns Point Ferry Rd, Riverside Drive and Riverside Ave and along Smith Drive. Ballina Nature reserve area may become inundated.</p> <p>2.) From 2.56mRRVD at the Byrnes Point Gauge (1.7mAHD / 5% AEP): Further properties may experience over-floor inundation in parts of West Ballina (West Ballina A1 subsector), and Central Ballina (Ballina CBD A and A2 subsectors).</p> <p>3.) From 2.86mRRVD at the Byrnes Point Gauge (2mAHD / 1% AEP): Most of Ballina is experiencing some level of inundation, with increased number of properties with over-floor inundation in both West and Central Ballina. (Low-lying properties in North Ballina, CBD B and B2). Subsectors which may be outside the flood extent may require messaging not to enter flood affected areas (Subsectors Ballina CBD C, Ballina Heights)</p>
<p>Sequencing of evacuation/messaging</p>	<ul style="list-style-type: none"> ▪ Evacuation of vulnerable facilities such as the hospital, aged care facilities, schools, and child-care facilities will require a higher priority. ▪ For Prediction 1: Evacuation of Low-lying areas in West Ballina A1 and Ballina Nature Reserve, watch and act messaging for other properties in these areas for floods predicted to reach and/or exceed 2.56m. ▪ For Prediction 2: West Ballina A1, and low-lying areas in West Ballina B, Ballina CBD A, Ballina CBD A2 and North Ballina. Road closures along West Ballina evacuation route should be assessed to monitor for potential isolation of West Ballina subsectors. ▪ For Prediction 3: Further evacuations may need to be carried out in West Ballina A1 and B, and Ballina CBD A and A2 as flood levels rise. Consider messaging for Ballina CBD B and B2 and Ballina Heights based on reconnaissance of local conditions. Further over floor inundation may be expected if heights are predicted to rise and evacuation routes may close isolating residents in these subsectors.
<p>Evacuation Routes</p>	<ul style="list-style-type: none"> ▪ Route 1 from Ballina CBD: Kerr St to Bangalow Rd, Angels Beach Drive, Links Ave ▪ Route 2 from Ballina CDB: Kingsford Smith Drive to Hill St, Links Ave ▪ North Ballina: Tamarind Drive to Angels Beach Rd ▪ Route from West Ballina: River St to Kerr St to Angels Beach Drive to Southern Cross PS. ▪ Route from North Ballina: North Creek Rd to Tamarind Drive, Angels Beach Rd to East Ballina.
<p>Evacuation Route Closure</p>	<p>Road closures to gauge height are not known, however the following closures would be expected to occur in a 1% AEP event:</p> <ul style="list-style-type: none"> • River St near Burns Point Ferry Rd (Road low point 1.78mAHD) • Bentinck St: (Road low points near Grant St 1.57mAHD, near Kingsford Smith Park 1.79mAHD). • Kerr St near Crane St: (Road low point 1.8mAHD) <p>Other closures not listed may occur along evacuation routes and need to be monitored.</p>

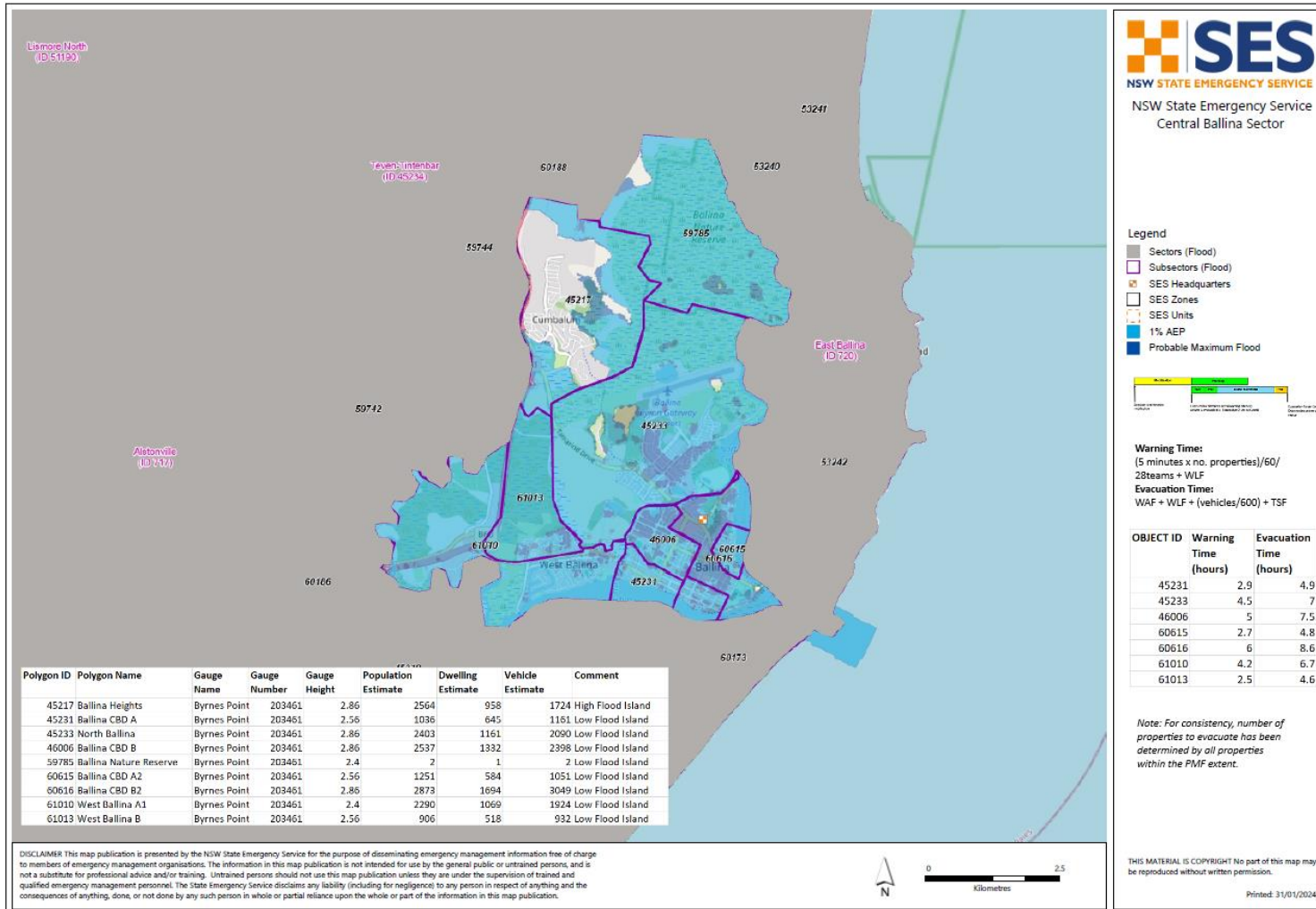
	<p>Many roads in the area may close due to local rainfall and tidal conditions, independent of riverine flooding. These include the following;</p> <ul style="list-style-type: none"> ▪ Stormwater hotspots: Tamar and Moon, Kerr St near Ballina fair ▪ Roads where closure is highly dependent on tidal conditions: Grant St, Swift St and Burnett St, Tamar St, Brunswick St, River St between Sunset Ave and Ronan Place, Skinner St, Martin St, Riverside Drive and Burns Point Ferry Rd.
<p>Method of Evacuation</p>	<ul style="list-style-type: none"> ▪ Primarily self-evacuation by private transport to higher ground within East Ballina or Lennox Head. ▪ Primarily self-evacuation by private transport to nominated evacuation centres/assembly areas (Southern Cross Public School, Lennox Head Community Centre, Ballina RSL) ▪ In large events, buses may be organised to transport people from assembly areas to nominated evacuation centres.
<p>Evacuation Centre/Assembly Point</p>	<ul style="list-style-type: none"> ▪ Primary Centre: Southern Cross Public School- Chickiba Drive, East Ballina. Short term Capacity 7580, long term 5050. Additional capacity if sports fields are utilised. ▪ Lennox Head Community Centre- 1 Mackney lane, Lennox Head. Short Term Capacity 510, Long Term 290. Additional capacity if Williams Reserve is utilised. ▪ Ballina RSL- 1 Grant St Ballina. Large capacity with second story and high ground, however the lower carpark is liable to flooding causing disruption to power. Streets around the RSL are also likely to have low level inundation in events over a 20% AEP. ▪ Other nominated evacuation centres in the Ballina Central Sector are within the flood extent and may not be suitable in larger events.
<p>Large scale evacuations</p>	<ul style="list-style-type: none"> ▪ When large-scale evacuations are likely, the NSW SES Incident Controller will liaise with the LEOCON and request support of the EOC as required. Large scale evacuations would be unlikely in this sector but if required additional locations will be identified. ▪ Additional locations may be identified in large scale evacuations, or if existing evacuation centres are flood affected or isolated. ▪ Assembly areas may be utilised on higher ground.
<p>Rescue</p>	<ul style="list-style-type: none"> ▪ The Ballina NSW SES Unit will undertake all Flood Rescue Operations as per the State Rescue Policy and NSW SES Flood Rescue Field Procedure. ▪ In larger events, A Flood Rescue Area of Operations may be stood up to coordinate and support rescue resources.
<p>Resupply</p>	<ul style="list-style-type: none"> ▪ Resupply is unlikely to be required in this sector in events more frequent than a 1% AEP ▪ If resupply is required, it will be provided by the NSW SES through the 132500 call out system. <p>Section 2.9, in Volume 2 of the Ballina Shire Flood Emergency Sub Plan provides information about isolated communities in the Ballina Shire area.</p>

<p>Aircraft Management</p>	<p><i>Helicopter Landing Points:</i></p> <p>Suitable landing points are located at:</p> <ul style="list-style-type: none"> ▪ Ballina-Byron Gateway Airport 28.8339°S 153.5597°E ▪ Kingsford Smith Park 28.8703°S 153.5706°E <hr/> <p><i>Airports:</i></p> <ul style="list-style-type: none"> ▪ Ballina Byron Gateway Airport is located within the sector at 210 Southern Cross Drive, Ballina. It is a large Regional Jet Airport, with one sealed runway (designated as 06/24) and an Aerodrome Rescue and Fire Fighting (ARFF) service. The current main runway was adopted to cater for Code 4 aircraft, such as Boeing 737-800 and Airbus A320 type aircraft. ▪ Local road closures may occur which may affect access by road. These include Southern Cross Drive. ▪ The Airport will be closed in flood conditions once the water levels reach a point that makes the infrastructure unserviceable by the regulations of the Civil Aviation Safety Authority. This would be excessive pooling within the runway strip or other movement areas. ▪ Some rotary wing emergency operations may still take place on the aerodrome, but a pavement assessment and other conditional factors would need to be considered before heavy fixed wing operations returned to the airport
<p>Other</p>	<p>Special considerations relating to evacuation:</p> <ul style="list-style-type: none"> ▪ Closure of schools - coordinated through the Department of Education and Training. ▪ Closure of licensed premises. All hotels and licensed clubs will be closed if required. ▪ Security. Police patrols to be established to maintain law and order after evacuation has occurred. ▪ The NSW SES will use flood boats and helicopters to monitor safety of individuals, where feasible. ▪ These arrangements will stay in place until the “Return with Caution” is provided by the NSW SES to residents to return to their premises. <p>There may be increased numbers of visitors to the Ballina Shire in peak periods, including school holidays and festivals such as Bluesfest over the Easter Long Weekend, and Splendour in the Grass in July.</p>

1.2. CENTRAL BALLINA SECTOR MAP



1.3. EVACUATION PLANNING



2. EAST BALLINA SECTOR

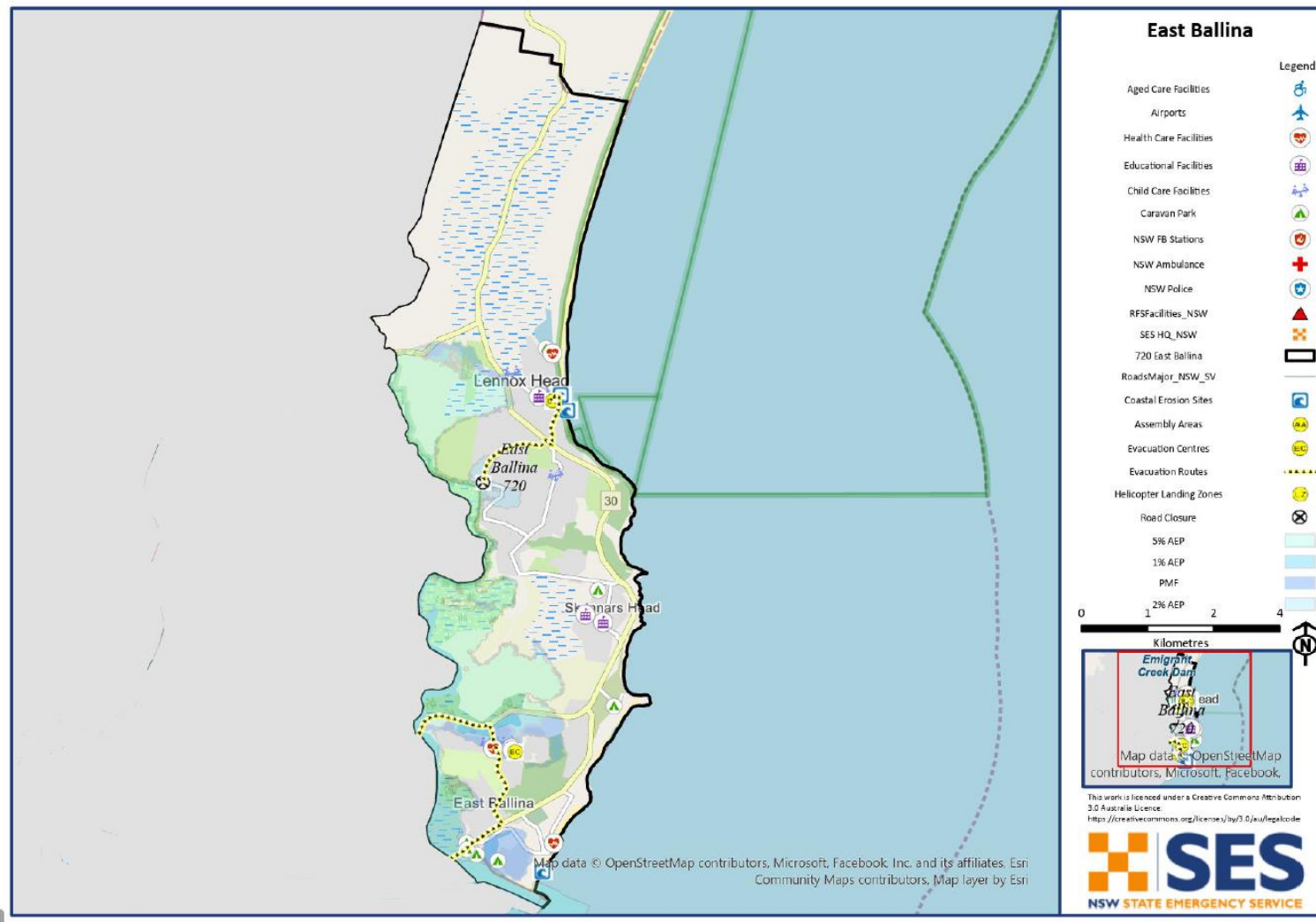
2.1. EAST BALLINA RESPONSE ARRANGEMENTS					
Refer to Volume 2: Hazard and Risk in Ballina Shire for more information about this Sector.					
Sector Description	This sector covers the suburbs of East Ballina, Skennars Head and Lennox Head.				
Hazard	Storm surge, coastal erosion, Richmond River riverine flooding, local catchment flooding from North Creek.				
Flood Affect Classification	The East Ballina Sector has Rising Road Access to the North and East.				
At risk properties	East Ballina: 165 at risk of over-floor inundation Lennox Head: *181 in area of impact. Over floor inundation data not available	Total number of properties within Sector/Community	7748		
Sector Control	The Ballina Unit Commander/ SES Incident Controller will control evacuations in this sector. The NSW SES will conduct evacuations in this sector with assistance from NSW Police, Fire and Rescue NSW, and NSW Rural Fire Service (RFS) volunteers and other agencies.				
Key Warning Gauge Name	Name	AWRC No.	Min (m)	Mod (m)	Maj (m)
	Byrnes Point* <i>*There is no Bureau of Meteorology key warning gauge in this sector. Upstream gauges may give an indication of flood severity.</i>	203461	-	-	-
General Strategy	<ul style="list-style-type: none"> ▪ Evacuation of at-risk population. ▪ Self-evacuation to friends/family outside of the impact area. ▪ Establishment of an Assembly Area/Evacuation Centre at the nominated evacuation centre (Lennox Head Community Centre) where evacuees are able to gather while the flood situation is monitored. 				
Key Risks / Consequences	<ul style="list-style-type: none"> ▪ Closure of evacuation routes, the inundation of many of which will be influenced by tides. ▪ Inundation of a number of dwellings. ▪ Potential of isolation to supplies for thousands of people in a large flood event for a number of days. ▪ There is a small, low probability risk of damage to property in an extreme storm event due to coastal erosion in Lennox Head. 				

<p>Information and Warnings</p>	<ul style="list-style-type: none"> ▪ Flood Watch (BoM) ▪ Flood Warnings (BoM) ▪ AWS Advice ▪ AWS Watch and Act ▪ AWS Emergency Warning ▪ Sequenced door knocking of evacuation sector ▪ Media announcements (including social media) ▪ Emergency Alerts (SMS, landlines) ▪ Standard Emergency Warning Signal <p>Door knocking would be appropriate first line warning due to relatively smaller number of affected properties in this sector.</p>
<p>Property Protection</p>	<p><i>Specific property protection measures:</i></p> <ul style="list-style-type: none"> • Monitoring rising flood waters. • Relocation of livestock. • Relocation of farm machinery and valuable goods • Control of surface water through sandbagging measures. • Assist in the lifting of furniture to residents in need. • Monitoring integrity of dwellings surrounded by flood waters. <p><i>Note: Property protection measures for the threat of coastal erosion involves the relocation of readily moveable household goods and commercial stock and equipment. The SES is not responsible for planning or conduct of emergency beach protection works or other physical mitigation works. The Ballina Shire Council is responsible for the activation of the Ballina Shire Coastal Zone Management Plan – Emergency Action Plan.</i></p> <p><i>Assistance with property protection:</i></p> <ul style="list-style-type: none"> • Refer to Chapter 4: Caravan Park Arrangements • Self-serve sandbagging stations may be set up at nominated locations. <p><i>Protection of essential infrastructure:</i></p> <p>There is no identified essential infrastructure at risk in this sector.</p>
<p>Evacuation and/or Isolation Triggers</p>	<ul style="list-style-type: none"> ▪ Closure of main evacuation routes prior to Inundation ▪ Property Inundation
<p>Evacuation Triggers</p>	<p>Evacuation may be considered when:</p> <ul style="list-style-type: none"> ▪ There is a prediction to reach and/or exceed a 2% AEP event in the Ballina Sector, where inundation of low-lying parts of the Lennox Head A subsector may occur. ▪ This <i>may</i> be equivalent to levels between approximately 2.6m- 2.8m RRVD at the Burns Point Gauge, however due to other influences on flooding in the area this <i>needs to be monitored</i> and checked via reconnaissance, as over floor inundation data is currently not available.

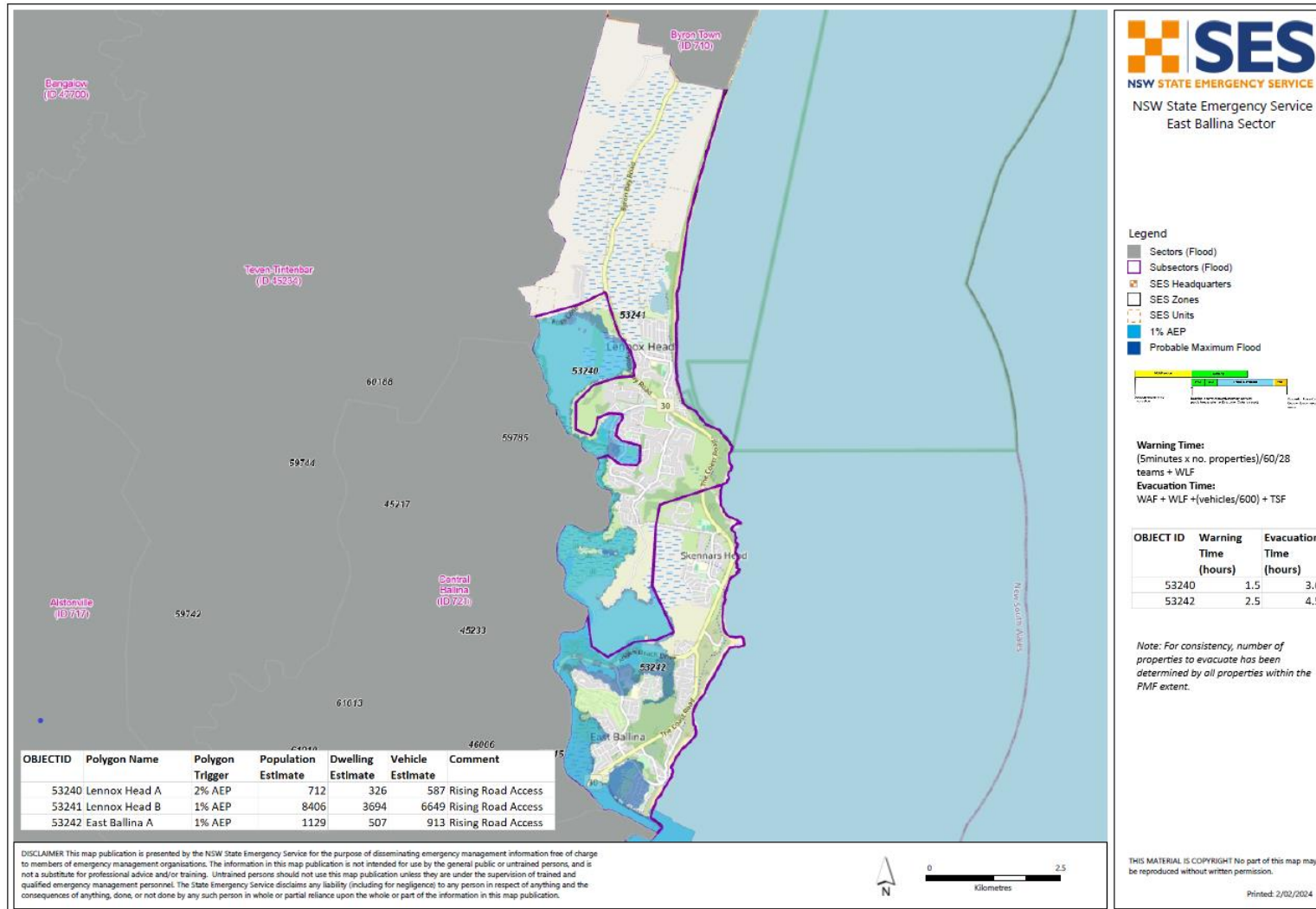
	<ul style="list-style-type: none"> ▪ Flood levels/inundation in Ballina Nature Reserve and North Creek will have significant impact on inundation in this area. ▪ Some properties along in Lennox Head may be at risk during an extreme storm surge event.
Sequencing of evacuation	<ul style="list-style-type: none"> ▪ 2% AEP event: Watch and Act messaging for Lennox Head A and Low-lying areas in East Ballina. ▪ 1% AEP: Some evacuations may be required in Lennox Head A subsector. No other evacuations are likely to be required unless heights approach modelled the PMF, however advice or watch and act level warnings may be needed regarding the flood situation in other sectors of Ballina. ▪ PMF: Further properties in the Lennox Head A and East Ballina subsectors may be within the flood extent.
Evacuation Routes	Lennox Head A: Hutley Drive towards The Coast Rd, Ballina St to Lennox Head Community Centre.
Evacuation Route Closure	Lennox Head A: In the vicinity of the intersection of Snapper and Hutley Drive, its low point has a road height of approximately 1.2m AHD and may be at risk of closure depending on local conditions. Other local roads can be taken to the Coast Rd.
Method of Evacuation	<ul style="list-style-type: none"> ▪ Primarily self-evacuation by private transport to higher ground within East Ballina or Lennox Head. ▪ Primarily self-evacuation by private transport to evacuation centres/assembly area at Lennox Head Community Centre.
Evacuation Centre/Assembly Point	<ul style="list-style-type: none"> ▪ Lennox Head Community Centre- 1 Mackney lane, Lennox Head. Short Term Capacity 510, Long Term 290.
Large scale evacuations	<ul style="list-style-type: none"> ▪ When large-scale evacuations are likely, the NSW SES Incident Controller will liaise with the LEOCON and request support of the EOC as required. Large scale evacuations would be unlikely in this sector but if required additional locations will be identified. ▪ Additional locations may be identified in large scale evacuations, or if existing evacuation centres are flood affected or isolated. ▪ Assembly areas may be utilised on higher ground
Rescue	<ul style="list-style-type: none"> ▪ The Ballina NSW SES Unit will undertake all Flood Rescue Operations as per the State Rescue Policy and NSW SES Flood Rescue Field Procedure. ▪ In larger events, A Flood Rescue Area of Operations may be stood up to coordinate and support rescue resources.
Resupply	<ul style="list-style-type: none"> ▪ Resupply is unlikely to be required in this sector until floods exceeding the 1%-0.2% AEP level. ▪ If resupply is required, it will be provided by the NSW SES through the 132500 call out system. <p>Section 2.9, in Volume 2 of the Ballina Shire Flood Emergency Sub Plan provides information about isolated communities in the Ballina Shire area.</p>
Aircraft Management	<p><i>Helicopter Landing Points:</i></p> <ul style="list-style-type: none"> ▪ There are no designated landing points in the East Ballina Sector, the closest landing points can be found in the Ballina Central Sector. <p><i>Airports:</i></p>

	<ul style="list-style-type: none"> ▪ See Ballina Central sector for more information about the Ballina Byron gateway Airport.
<p>Other</p>	<p>Special considerations relating to evacuation:</p> <ul style="list-style-type: none"> ▪ Closure of schools - coordinated through the Department of Education and Training. ▪ Closure of licensed premises. All hotels and licensed clubs will be closed if required. ▪ Security. Police patrols to be established to maintain law and order after evacuation has occurred. ▪ The NSW SES will use flood boats and helicopters to monitor safety of individuals, where feasible. ▪ These arrangements will stay in place until the “Return with Caution” is provided by the NSW SES to residents to return to their premises. <p>The Lennox Head and East Ballina area may see an increased number of visitors in peak tourist seasons, such as during summer and school holiday periods.</p>

2.2. EAST BALLINA SECTOR MAP



2.3. EVACUATION PLANNING



3. WARDELL SECTOR

3.1. WARDELL RESPONSE ARRANGEMENTS					
Refer to Volume 2: Hazard and Risk in Ballina Shire for more information about this Sector/Community.					
Sector Description	This sector covers Wardell, South Ballina, Keith Hall, Empire Vale, Patchs Beach, Cabbage Tree Island, Meerschaum Vale, Bagotville, Pimlico and Goat Island.				
Hazard	Richmond River riverine flooding Ocean Storm Surge floods in South Ballina Emigrant Creek local catchment flooding				
Flood Affect Classification	The majority of Wardell has Rising Road Access East Wardell becomes a Low Flood Island. Pimlico has an overland escape route to the west South Ballina, Empire Vale, Keith Hall, Patchs Beach, Goat Island and East Wardell are Low Flood Islands				
At risk properties	Wardell: 110 Cabbage Tree Island: 26 South Ballina, Empire Vale, Keith Hall & Patchs Beach: 179 Pimlico: 128 Meerschaum Vale: 12	Total number of properties within Sector/Community	734		
Sector Control	The Ballina Unit Commander/SES Incident Controller will control evacuations in this sector. The NSW SES will conduct evacuations in this sector with assistance from NSW Police, Fire and Rescue NSW, and NSW Rural Fire Service (RFS) volunteers and other agencies as needed.				
Key Warning Gauge Name	Name	AWRC No.	Min (m)	Mod (m)	Maj (m)
	Wardell (MHL Gauge) Woodburn	203468 203403	- 3.2	- 3.7	- 4.2
General Strategy	<ul style="list-style-type: none"> ▪ Evacuation of at-risk population. ▪ Self-evacuation to friends/family outside of the impact area. ▪ Establishment of an Assembly Area/Evacuation Centre at Alstonville Leisure and Entertainment Centre where evacuees are able to gather while flood situation is monitored. ▪ Deployment of flood rescue assets to Wardell if heights are predicted to reach levels whereby road access between Wardell and Ballina is cut off. 				
Key Risks / Consequences	<ul style="list-style-type: none"> ▪ Potential loss of life from rapid and potentially high velocity inundation. ▪ Potential isolation of hundreds of people for a number of days. ▪ Closure of access routes between Wardell and Ballina affects ability of Ballina SES and other local Units to perform flood rescues in the area. 				
Information and Warnings	<ul style="list-style-type: none"> ▪ Flood Watch (BoM) ▪ Flood Warnings (BoM) ▪ AWS Advice 				

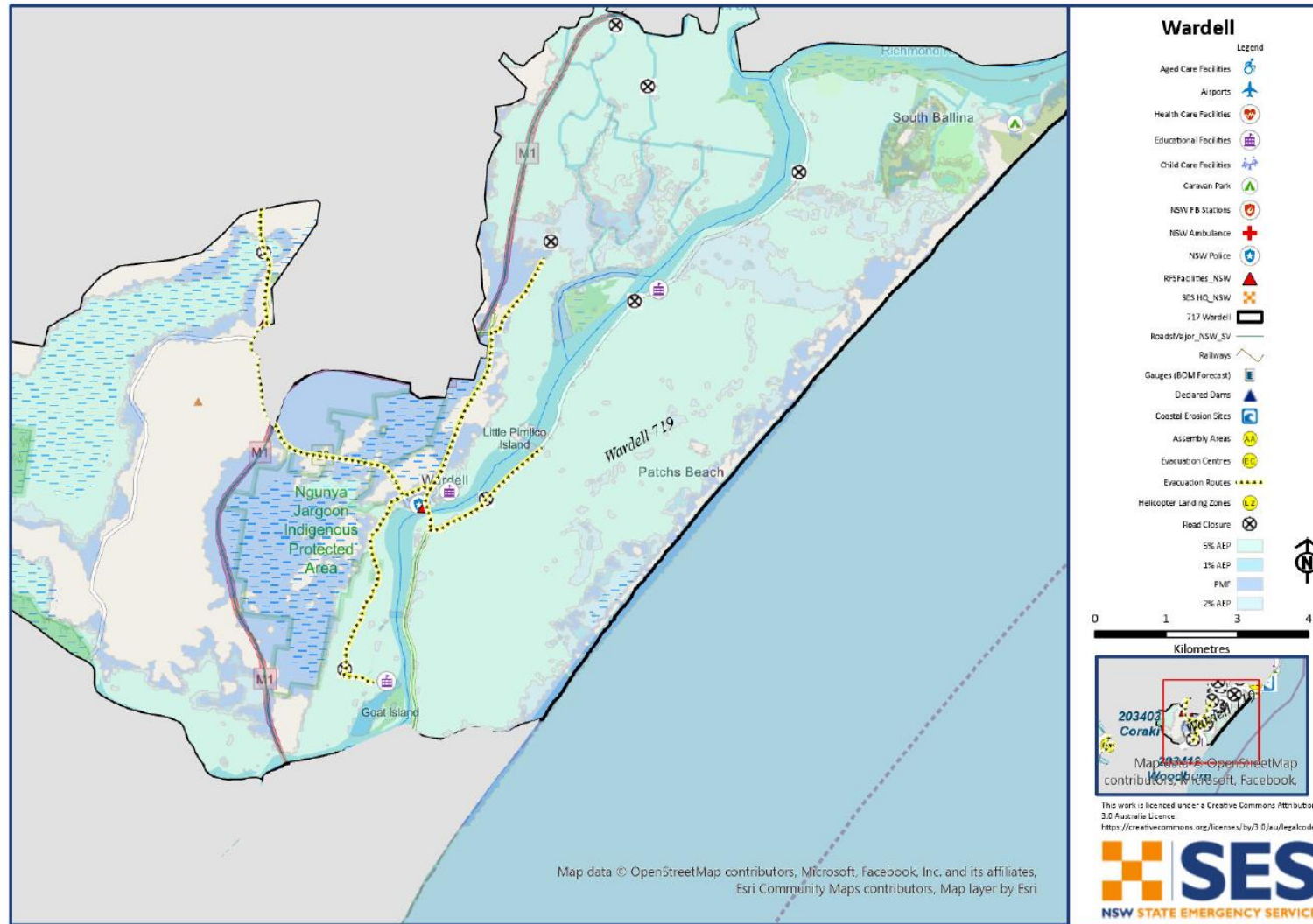
	<ul style="list-style-type: none"> ▪ AWS Watch and Act ▪ AWS Emergency Warning ▪ Sequenced door knocking of evacuation sector ▪ Media announcements (including social media) ▪ Emergency Alerts (SMS, landlines) ▪ Standard Emergency Warning Signal
<p>Property Protection</p>	<p><i>Specific property protection measures:</i></p> <ul style="list-style-type: none"> ▪ Monitoring rising flood waters. ▪ Relocation of livestock. ▪ Relocation of farm machinery and valuable goods ▪ Control of surface water through sandbagging measures. ▪ Assist in the lifting of furniture to residents in need. ▪ Monitoring integrity of dwellings surrounded by flood waters <p><i>Assistance with property protection:</i></p> <ul style="list-style-type: none"> ▪ Refer to Chapter 4 for details regarding the arrangements for Caravan Parks. ▪ Self-serve sandbagging station may be set up at a nominated location to assist with property protection. <p><i>Protection of essential infrastructure:</i></p> <ul style="list-style-type: none"> ▪ Wardell Wastewater Treatment Plant services Wardell and Cabbage Tree Island. It may experience inundation in an extreme flood event in order of a PMF. ▪ Wardell Water Reservoir is outside the PMF extent.
<p>Evacuation and/or Isolation Triggers</p>	<p>Evacuation may be considered due to;</p> <ul style="list-style-type: none"> ▪ Inundation of property ▪ Closure of main access routes ▪ Failure of essential services
<p>Evacuation Triggers</p>	<p>Evacuation will be considered when:</p> <p>1.) Prediction to reach and/or exceed 4-4.2m at the Woodburn Gauge (203412) Cabbage Tree Island sewerage system may fail, with the only evacuation route via Back Channel Rd cut by 4.2m and progressive inundation occurring. Activate Cabbage Tree Island and Goat Island Subsectors.</p> <p>Note: The Wardell Gauge datum is Richmond River Valley Datum. mAHD can be obtained by RRVD-0.824=mAHD.</p> <p>The effects of flooding within this sector are dependent on tidal influences. Tidal levels will need to be identified at the onset of main Richmond River flooding.</p> <p>All effects listed below associated with gauge heights will need to be monitored and verified via reconnaissance wherever possible and should not be considered as absolute. Different sources of flooding within the Ballina Shire may affect consequences.</p>

	<p>2.) 20% AEP event- approximately 2.4mRRVD at Wardell gauge (203468) South Ballina Beach Village (Ballina Beach Nature Resort) may become isolated at this height. Road closures may begin to occur along River Drive isolating communities in South Ballina, Empire Vale and Patches Beach (South Ballina/Empire Vale Subsector), however the majority of over floor inundation is not expected to occur until a 1% AEP.</p> <p>3.) 10% AEP event- approximately 2.79mRRVD at Wardell gauge (203468) : East Wardell experiences inundation from this level, however over-floor inundation is not expected to occur until a 2% AEP. Wardell subsector C may experience inundation from this height. (Subsector Wardell East)</p> <p>4.) 5% AEP event- approximately 2.99mRRVD at Wardell gauge (203468) a Some property over floor inundation in South Ballina, Keith Hall, Pimlico and Empire Vale. Richmond and Wilson St in Wardell may experience inundation (Wardell B subsector). The Wardell Rural subsector may experience isolation and/or inundation from this level, however the majority of properties are outside the flood extent and have Rising Road or Overland Escape to higher ground.</p> <p>5.) 2%AEP event - 3.44mRRVD at Wardell gauge (203468): Increased over floor inundation in South Ballina area. Areas of Wardell to the east of Blackwall Drive inundated (Wardell B Subsector).</p> <p>6.) 1% AEP event 3.83mRRVD at Wardell gauge (203468).</p> <p><i>Approximate levels at Wardell MHL Gauge for each modelled event:</i></p> <ul style="list-style-type: none"> - 20% AEP (5 year ARI) = 1.58mAHD / 2.4m RRVD - 10% AEP (10 year ARI)= 1.97mAHD / 2.79m RRVD - 5% AEP (20 year ARI)= 2.17mAHD/ 2.99m RRVD - 2% AEP (50 year ARI) = 2.62mAHD/ 3.44m RRVD - 1% AEP (100 year ARI)= 3.01mAHD/ 3.83m RRVD
<p>Sequencing of evacuation/ messaging</p>	<p>Woodburn Gauge</p> <p>For Prediction 1: Emergency Warning Evacuation messaging for Cabbage Tree Island and Goat Island Subsectors.</p> <p>Wardell MHL Gauge</p> <p>For Prediction 2: Watch and act level warning prepare to isolate and/or move to higher ground for South Ballina-Empire Vale subsector if heights not predicted to exceed a 5% event.</p> <p>For Prediction 3: Watch and Act level warning for Wardell C, East Wardell A, Wardell East Outer, Wardell B subsectors.</p> <p>For Prediction 4: Evacuation of low-lying areas in Wardell B subsector (over floor inundation), East Wardell A subsector, South Ballina-Empire Vale subsector (Over-floor inundation of low-lying properties), Pimlico and Wardell D subsector (isolation and inundation). Watch and Act warning for Wardell Rural Subsector.</p> <p>For Prediction 5: Further evacuations in low lying parts of Wardell B2 (over floor inundation).</p> <p>For Prediction 6: Warning for Wardell A1 subsector, inundation may occur if flood levels are expected to exceed this level.</p>
<p>Evacuation Routes</p>	<p>Cabbage Tree Island: Blackwall Drive to Wardell Recreation Grounds or Alstonville</p> <p>South Ballina: River drive to Blackwall Drive ,Wardell then Wardell Rd to Alstonville</p> <p>East Wardell: Across Blackwall Drive into Wardell, then Wardell Rd to Alstonville</p> <p>Wardell: Local roads to Wardell Road into Alstonville</p>

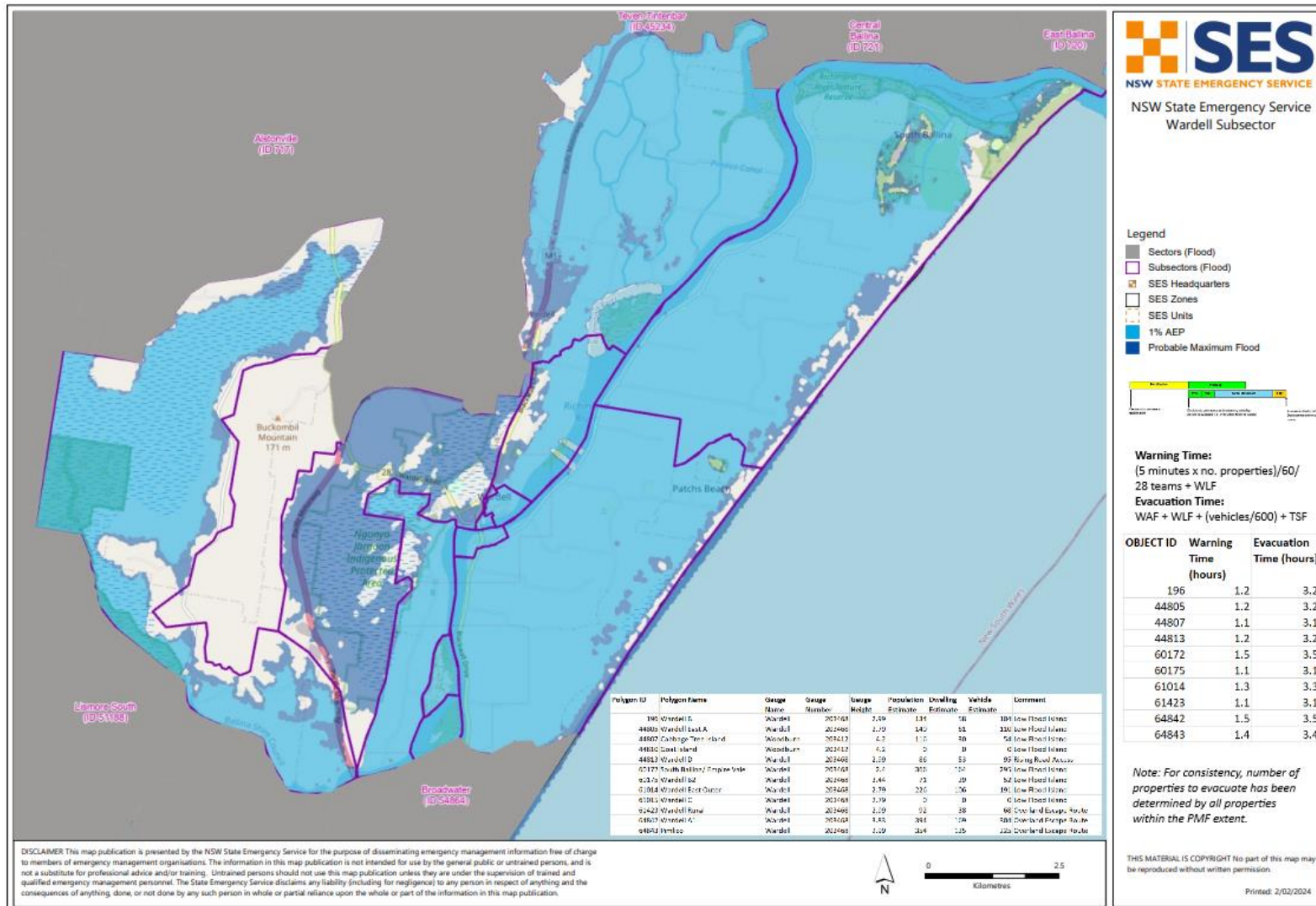
	<p>Pimlico: Pimlico Rd towards Blackwell Drive, to Wardell Rd.</p> <p>NB: Alternate access to Alstonville is possible via Pacific Motorway and Bruxner Highway. Closures along the Bruxner Highway will affect this route.</p> <p>If Northbound Access via Pacific Motorway is available, routes towards Bangalow evacuation centres may also be open.</p>
Evacuation Route Closure	<p>Cabbage Tree Island: Back Channel Rd at approx. 4.2m at Woodburn Gauge</p> <p>South Ballina: River Drive may start to become inundated at various points from a 20% AEP event.</p> <p>All subsectors: Evacuation into Alstonville may be affected by the closure of Wardell Rd near Yellow Creek. Alternative access to Alstonville via Pacific Motorway and Bruxner Highway may be affected by closure of Bruxner Highway near Duck Creek.</p>
Method of Evacuation	<ul style="list-style-type: none"> ▪ Primarily self-evacuation by private transport to higher ground within Wardell in smaller flood event. ▪ Primarily self-evacuation by private transport to evacuation centres/assembly areas at Alstonville Leisure and Entertainment Centre in larger flood events.
Evacuation Centre/Assembly Point	<ul style="list-style-type: none"> ▪ There are no nominated evacuation centres in Wardell outside of the flood extent. The preferred option is for evacuees to travel to Alstonville, to the Alstonville Leisure and Entertainment Centre, 42-46 Commercial Rd, Alstonville. ▪ Assembly Areas may be set up in Wardell at nominated areas of high ground and would need to be determined via reconnaissance.
Large scale evacuations	<ul style="list-style-type: none"> ▪ In a larger flood event, the preferred option is evacuation to the Alstonville Leisure and Entertainment Centre. ▪ Where this is not possible, due to road closures, high ground within Wardell area in a PMF is located in the vicinity of Bath St and Pine St and the area near the Wardell Recreation Ground. This area is primarily residential, so if it is likely to be required, a prepositioning of supplies may be required. ▪ In events up to and including a 0.2% AEP, high ground may also be found in the vicinity of St Patricks Catholic Church, Cnr Richmond and Sinclair St, Wardell, however this becomes within the flood extent for a PMF.
	<p>In larger flood events Ballina SES Unit may be unable to access the sector for flood rescue purposes.</p>
Resupply	<p>Resupply may be required by helicopter or boat if this sector becomes cut off from Ballina and Alstonville by road.</p> <p>Communities in the Wardell sector may all be at risk of isolation in a large flood event.</p> <p>Section 2.9, in Volume 2 of the Ballina Shire Flood Emergency Sub Plan provides information about isolated communities in the Ballina Shire area.</p>
Aircraft Management	<p>Helicopter Landing Points:</p> <ul style="list-style-type: none"> ▪ There are no designated landing zones in this sector.

	<p>Airports:</p> <ul style="list-style-type: none"> ▪ The closest airport is located in the Ballina Central Sector.
<p>Other</p>	<p>Cabbage Tree Island</p> <p>At time of plan writing, the Cabbage Tree Island Community are currently located at the Wardell Recreation Grounds, due to damage sustained in the 2022 flooding. There are currently no known residents on Cabbage Tree Island, however evacuation planning has been conducted for this area, and monitoring needs to occur for anyone on the island in flood events.</p> <p>Special considerations relating to evacuation:</p> <ul style="list-style-type: none"> ▪ Closure of schools - coordinated through the Department of Education and Training. ▪ Closure of licensed premises. All hotels and licensed clubs will be closed if required. ▪ Security. Police patrols to be established to maintain law and order after evacuation has occurred. ▪ The NSW SES will use flood boats and helicopters to monitor safety of individuals, where feasible. ▪ These arrangements will stay in place until the “Return with Caution” is provided by the NSW SES to residents to return to their premises.

3.2. WARDELL SECTOR MAP



3.3. EVACUATION PLANNING



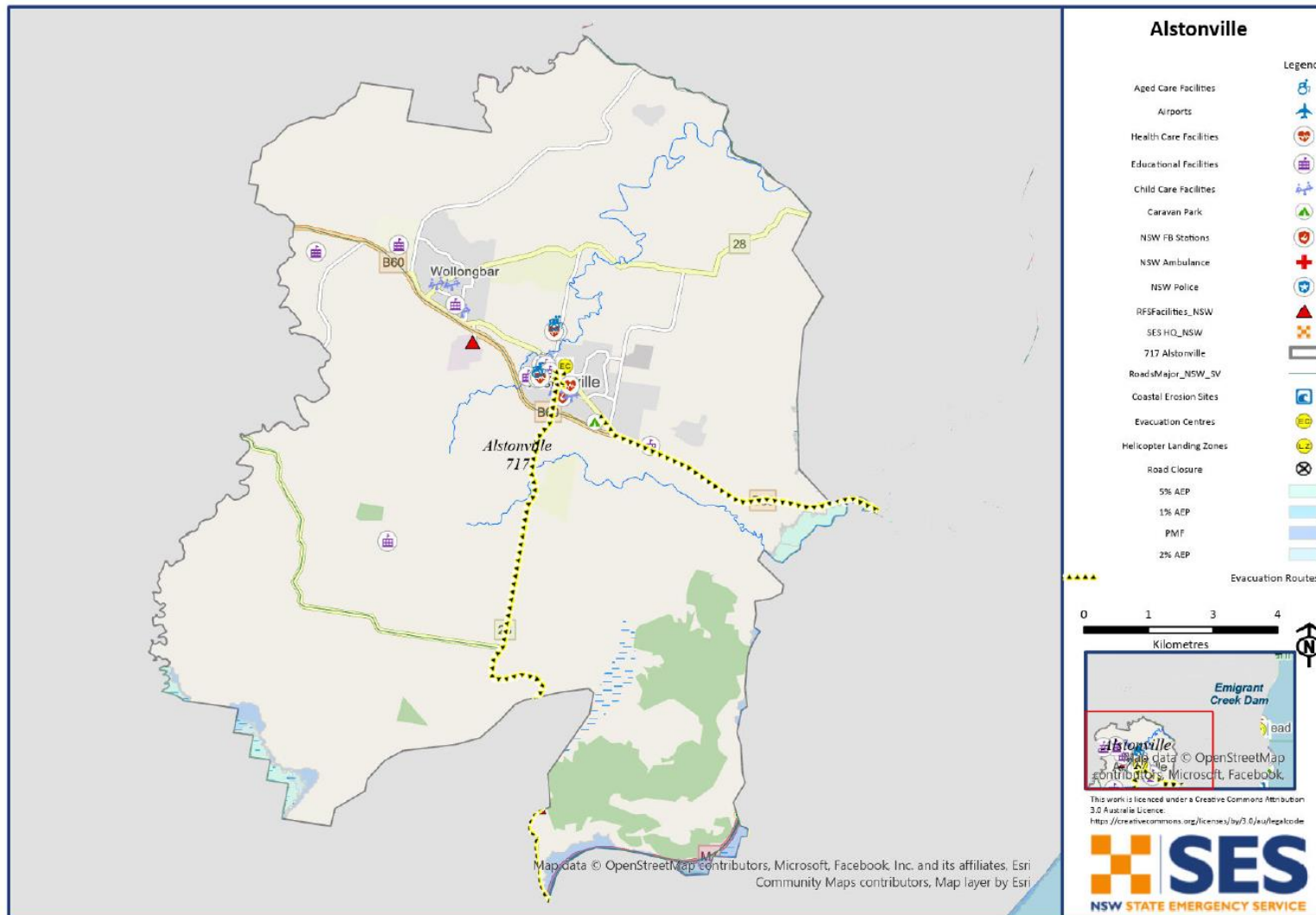
4. ALSTONVILLE SECTOR

4.1. ALSTONVILLE RESPONSE ARRANGEMENTS					
Refer to Volume 2: Hazard and Risk in Ballina Shire for more information about this Sector.					
Sector Description	This sector includes the suburbs of Alstonville, Alstonvale, Tuckombil, Wollongbar, Coolgardie, Tuckombil, Uralba, Lynwood, Dalwood, Rous, Rous Mill.				
Hazard	The majority of Alstonville is outside the flood extent, however areas within the sector may be affected by Richmond River Riverine flooding, or flooding from local creeks.				
Flood Affect Classification	Alstonville is a High Flood Island				
At risk properties	6* <i>*dwellings within PMF flood extent. Over-floor inundation data not available</i>	Total number of properties within Sector/Community	4855		
Sector Control	The Ballina Unit Commander/SES Incident Controller will control evacuations in this sector. The NSW SES will conduct evacuations in this sector with assistance from NSW Police, Fire and Rescue NSW, and NSW Rural Fire Service (RFS) volunteers.				
Key Warning Gauge Name	Name	AWRC No.	Min (m)	Mod (m)	Maj (m)
	<i>*There is no Bureau of Meteorology key warning gauge in this sector. Upstream gauges may give an indication of flood severity.</i>				
General Strategy	<ul style="list-style-type: none"> • Evacuation of at-risk population. • Self-evacuation to friends/family outside of the impact area. • Establishment of an Assembly Area/Evacuation Centre at Alstonville Leisure & Entertainment Centre where evacuees are able to gather while flood situation is monitored. 				
Key Risks / Consequences	<ul style="list-style-type: none"> • Closure of key access roads • Inundation of a small number of dwellings. • Rapid velocity water rises over local creek crossings • Potential of isolation to supplies for thousands of people in a large flood event for a number of days. 				
Information and Warnings	<ul style="list-style-type: none"> • Flood Watch (BoM) • Flood Warnings (BoM) • AWS Advice • AWS Watch and Act • AWS Emergency Warning 				

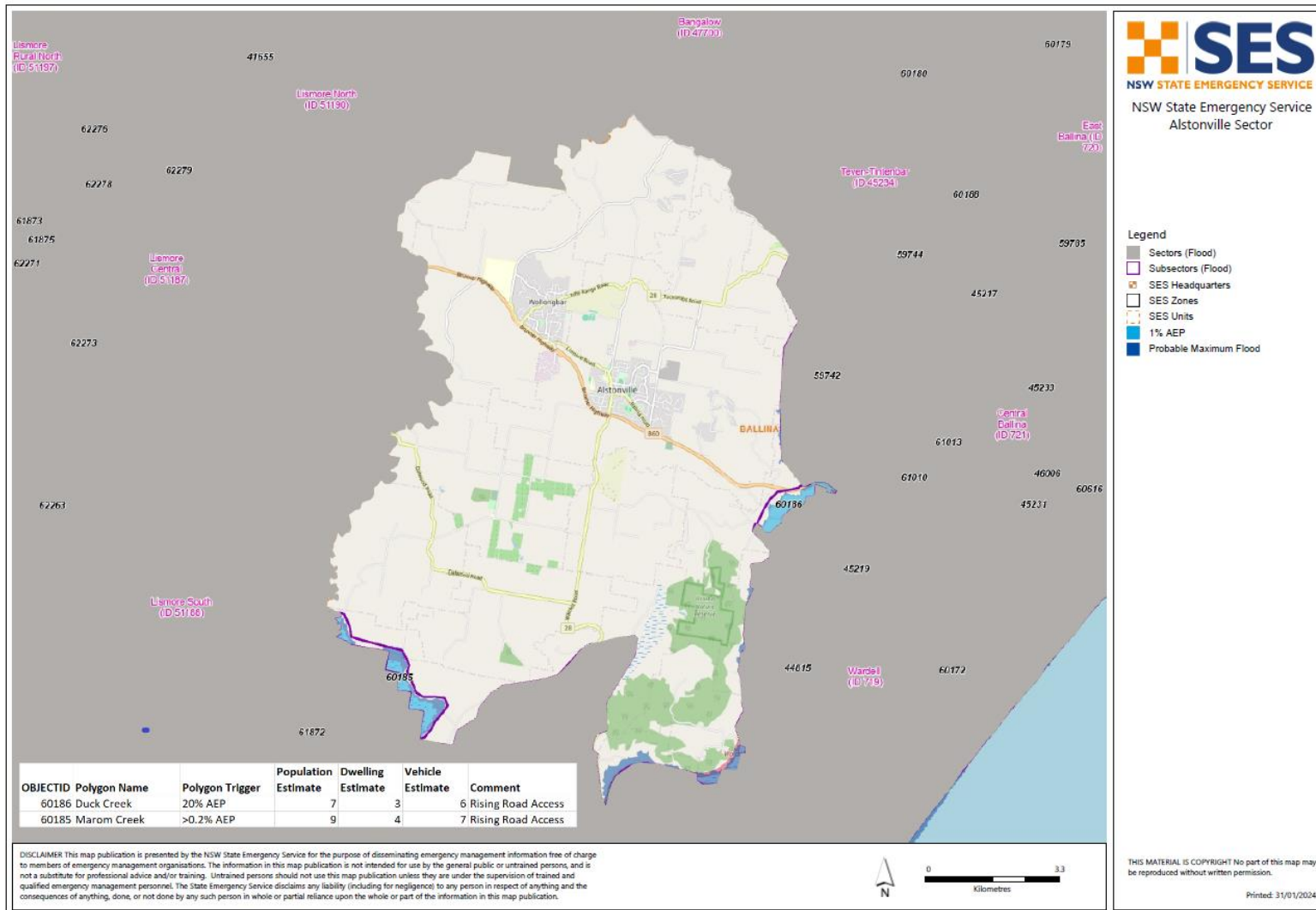
	<ul style="list-style-type: none"> • Sequenced door knocking of evacuation sector • Media announcements (including social media) • Emergency Alerts (SMS, landlines) • Standard Emergency Warning Signal
	<ul style="list-style-type: none"> ▪ Due to the relatively small number of affected properties in this sector, door knocking would be the most appropriate method of warning.
Property Protection	<p><i>Specific property protection measures:</i></p> <ul style="list-style-type: none"> ▪ Monitoring rising flood waters. ▪ Relocation of livestock. ▪ Relocation of farm machinery and valuable goods ▪ Control of surface water through sandbagging measures. ▪ Assist in the lifting of furniture to residents in need. ▪ Monitoring integrity of dwellings surrounded by flood waters
	<p><i>Assistance with property protection:</i></p> <ul style="list-style-type: none"> ▪ Refer to Chapter 4: Caravan Park Arrangements ▪ Self-serve sandbagging stations may be set up at nominated locations.
	<p><i>Protection of essential infrastructure:</i></p> <p>No identified essential infrastructure requiring protection in this sector.</p>
Evacuation and/or Isolation Triggers	<p>The Alstonville sector is unlikely to require large scale evacuations. Where necessary, evacuations will be dealt with on a case-by-case basis. Evacuation may be considered due to;</p> <ul style="list-style-type: none"> ▪ Inundation of property ▪ Closure of key evacuation routes.
Evacuation Triggers	<p>Evacuation will be considered when:</p> <ul style="list-style-type: none"> ▪ Prediction to reach a 20%AEP event: (approx. 1.58mAHD / 2.4m RRVD at the Wardell gauge or 1.57mAHD/2.4mRRVD at the Burns Point Gauge). Some inundation may occur and access roads in Duck Creek subsector may become inundated. ▪ Prediction to reach and exceed extreme flood levels at upstream gauges (Coraki, Woodburn): The Marom Creek subsector has approximately 2 properties within the PMF flood extent. These are not modelled to be inundated in events up to and including a 0.2%AEP.
Sequencing of evacuation	<ul style="list-style-type: none"> ▪ Prediction 1: Duck Creek subsector. ▪ Prediction 2: Marom Creek Subsector.
Evacuation Routes	<p>Both the Duck Creek and Marom Creek Subsectors have rising road access to high ground immediately adjacent.</p>
Evacuation Route Closure	<p>Uralba Rd is vulnerable to closure near Duck Creek.</p>
Method of Evacuation	<ul style="list-style-type: none"> ▪ Primarily private transport to adjacent high ground

<p>Evacuation Centre/Assembly Point</p>	<p>If evacuation centres are required, the nominated evacuation centre is Alstonville Community and Entertainment Centre, 42-46 Commercial Rd, Alstonville.</p>
<p>Large scale evacuations</p>	<p>Large scale evacuations would be unlikely in this sector but if required additional locations will be identified.</p>
<p>Rescue</p>	<p>The Ballina NSW SES Unit will undertake all Flood Rescue Operations as per the State Rescue Policy and NSW SES Flood Rescue Field Procedure. In larger events, A Flood Rescue Area of Operations may be stood up to coordinate and support rescue resources.</p>
	<p>Many causeways and road crossings in the area can be susceptible to flash flooding and may require flood rescue, these may include;</p> <ul style="list-style-type: none"> ▪ Dalwood Rd (at Gum Greek and Youngmans Creek) ▪ Rifle range Rd at Maguires Creek ▪ Uralba Rd near Duck Creek
<p>Resupply</p>	<ul style="list-style-type: none"> ▪ Resupply is unlikely to be required in this sector until flood exceeding a 1%-0.2% AEP. ▪ If resupply is required, it will be provided by the NSW SES through the 132500 call out system.
	<p>Section 2.9, in Volume 2 of the Ballina Shire Flood Emergency Sub Plan provides information about isolated communities in the Ballina Shire area.</p>
<p>Aircraft Management</p>	<p><i>Helicopter Landing Points:</i></p> <ul style="list-style-type: none"> ▪ There are no designated landing zones in this area. Suitable sites will be assessed based on local conditions.
	<p><i>Airports:</i></p> <ul style="list-style-type: none"> ▪ The closest airport is located in the Ballina Central Sector.
<p>Other</p>	<p>Special considerations relating to evacuation:</p> <ul style="list-style-type: none"> ▪ Closure of schools - coordinated through the Department of Education and Training. ▪ Closure of licensed premises. All hotels and licensed clubs will be closed if required. ▪ Security. Police patrols to be established to maintain law and order after evacuation has occurred. ▪ The NSW SES will use flood boats and helicopters to monitor safety of individuals, where feasible. ▪ These arrangements will stay in place until the “Return with Caution” is provided by the NSW SES to residents to return to their premises.

4.2. ALSTONVILLE SECTOR MAP



4.3. EVACUATION PLANNING



5. TEVEN/TINTENBAR SECTOR

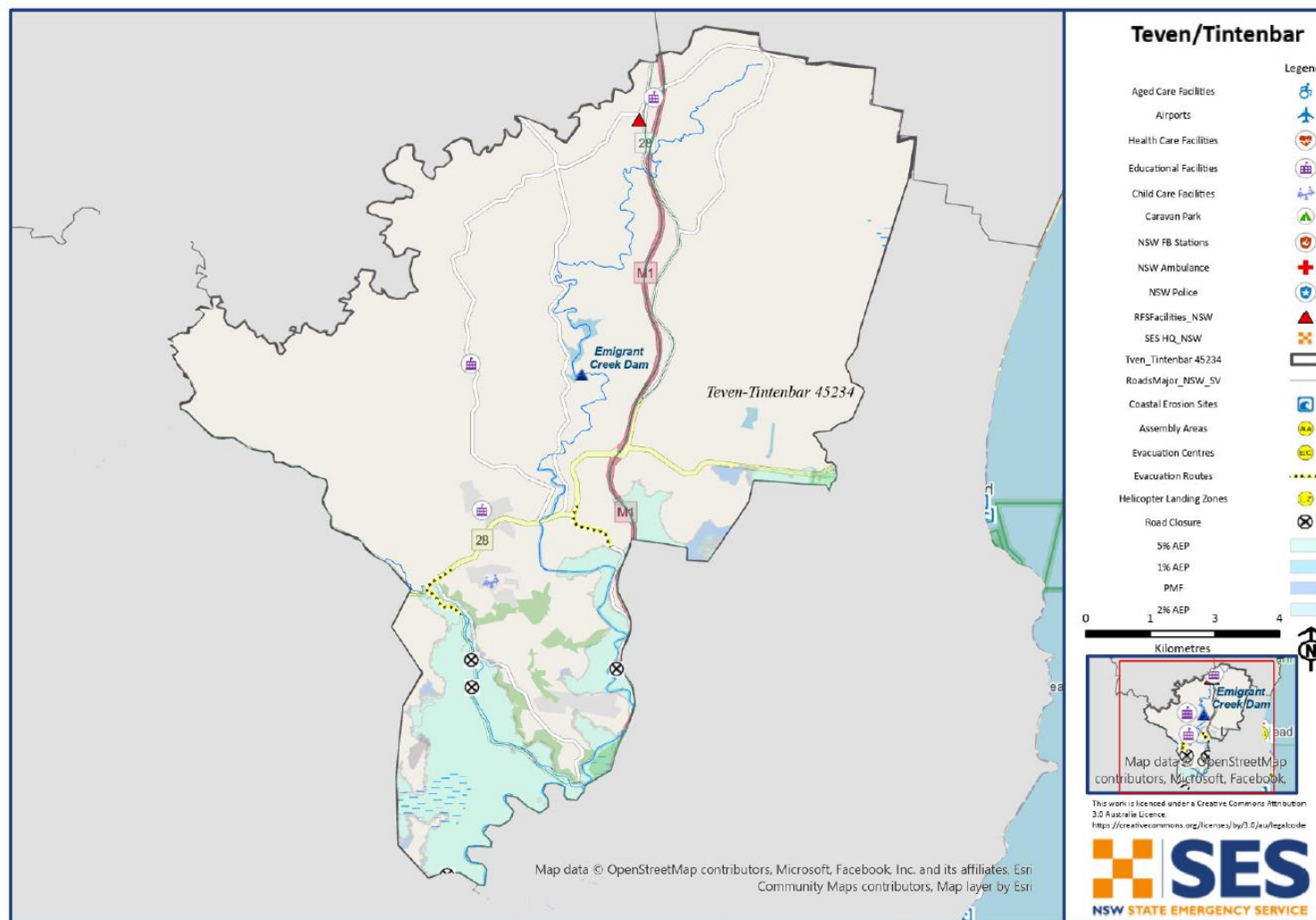
5.1. TEVEN/TINTENBAR RESPONSE ARRANGEMENTS					
Refer to Volume 2: Hazard and Risk in Ballina Shire for more information about this Sector.					
Sector Description	This sector covers the suburbs of Teven, Tintenbar, Kinvara, Knockrow, Brooklet, Fernleigh, Newrybar and Pearces Creek.				
Hazard	The primary hazard is local catchment/ flash flooding from Emigrant and Maguires Creeks and their tributaries including Sandy Flat Creek and Houghlahans Creek. In large events breakout flow from Emigrant Creek may flow over Sandy Flat into North Creek.				
Flood Affect Classification	The Teven/Tintenbar Sector has Rising Road Access.				
At risk properties*	Teven: 14 Tintenbar: 1 Kinvara: 8	Total number of properties within Sector/Community	943		
Sector Control	The Ballina Unit Commander/ NSW SES Incident Controller will control evacuations in this sector. The NSW SES will conduct evacuations in this sector with assistance from NSW Police, Fire and Rescue NSW, and NSW Rural Fire Service (RFS) volunteers and other relevant agencies.				
Key Warning Gauge Name	Name	BOM No.	Min (m)	Mod (m)	Maj (m)
	Teven** (Maguires Creek) *Rainfall gauges in upper catchment area (Alstonville STP, Tuckombil, Houghlahans Creek) **There is no Bureau of Meteorology key warning gauge in this sector. Upstream gauges may give an indication of flood severity.	558070	-	-	-
General Strategy	<ul style="list-style-type: none"> ▪ Evacuation of at-risk population. ▪ Self-evacuation to friends/family outside of the impact area. ▪ Establishment of an Assembly Area/Evacuation Centre in the Bangalow Area where evacuees are able to gather while flood situation is monitored. 				
Key Risks / Consequences	<ul style="list-style-type: none"> ▪ Closure of evacuation routes ▪ Inundation of a number of dwellings. ▪ Potential of isolation to supplies for hundreds of people in a large flood event for a number of days. ▪ Potential loss of life from rapid and potentially high velocity flooding inundation, particularly on roads. 				

<p>Information and Warnings</p>	<ul style="list-style-type: none"> ▪ Flood Watch (BoM) ▪ Flood Warnings (BoM) ▪ AWS Advice ▪ AWS Watch and Act ▪ AWS Emergency Warning ▪ Sequenced door knocking of evacuation sector ▪ Media announcements (including social media) ▪ Emergency Alerts (SMS, landlines) ▪ Standard Emergency Warning Signal <p>Due to the relatively small number of affected dwellings and the rapid onset and velocity of the flood risk in the area, a telephone tree has been established for at risk properties in the Teven Valley.</p> <p>A telephone tree exists for approx. 14 residences in the Teven Valley impacted by Flash Flooding. This is held at the Ballina SES Unit HQ and is updated annually.</p>
<p>Property Protection</p>	<p><i>Specific property protection measures:</i></p> <ul style="list-style-type: none"> ▪ Monitoring rising flood waters. ▪ Relocation of livestock. ▪ Relocation of farm machinery and valuable goods ▪ Control of surface water through sandbagging measures. ▪ Assist in the lifting of furniture to residents in need. ▪ Monitoring integrity of dwellings surrounded by flood waters <p><i>Assistance with property protection:</i></p> <ul style="list-style-type: none"> ▪ Refer to Chapter 4: Caravan Park Arrangements ▪ Self-serve sandbagging stations may be set up at nominated locations. <p><i>Protection of essential infrastructure:</i></p> <p>There is no identified essential infrastructure at risk within this sector. Emigrant Creek Dam arrangements are outlined in the Dam Safety Emergency Plan and are outlined in Chapter 3 of this plan.</p>
<p>Evacuation and/or Isolation Triggers</p>	<ul style="list-style-type: none"> ▪ Inundation of property ▪ High velocity inundation of roads
<p>Evacuation/ Warning Triggers</p>	<p>Given the dominance of rapid onset local catchment flooding in this sector, evacuation or warnings may be considered when:</p> <ul style="list-style-type: none"> ▪ Teven Valley: Rainfall occurs which is expected to generate a level of 3m at the Maguires Creek gauge (558070). Rainfall in the Teven Flash Flood Warning Gauges (Alstonville STP, Houghlahans Creek and Tuckombil) exceeds 60mm in one hour, 80mm in two hours, 95mm in three hours or 100mm in five hours. ▪ Tintenbar: Rainfall in the upper catchments is expected to exceed 70mm in one hour or 175mm in 2-3 hours. <p>Warnings may also be considered when:</p>

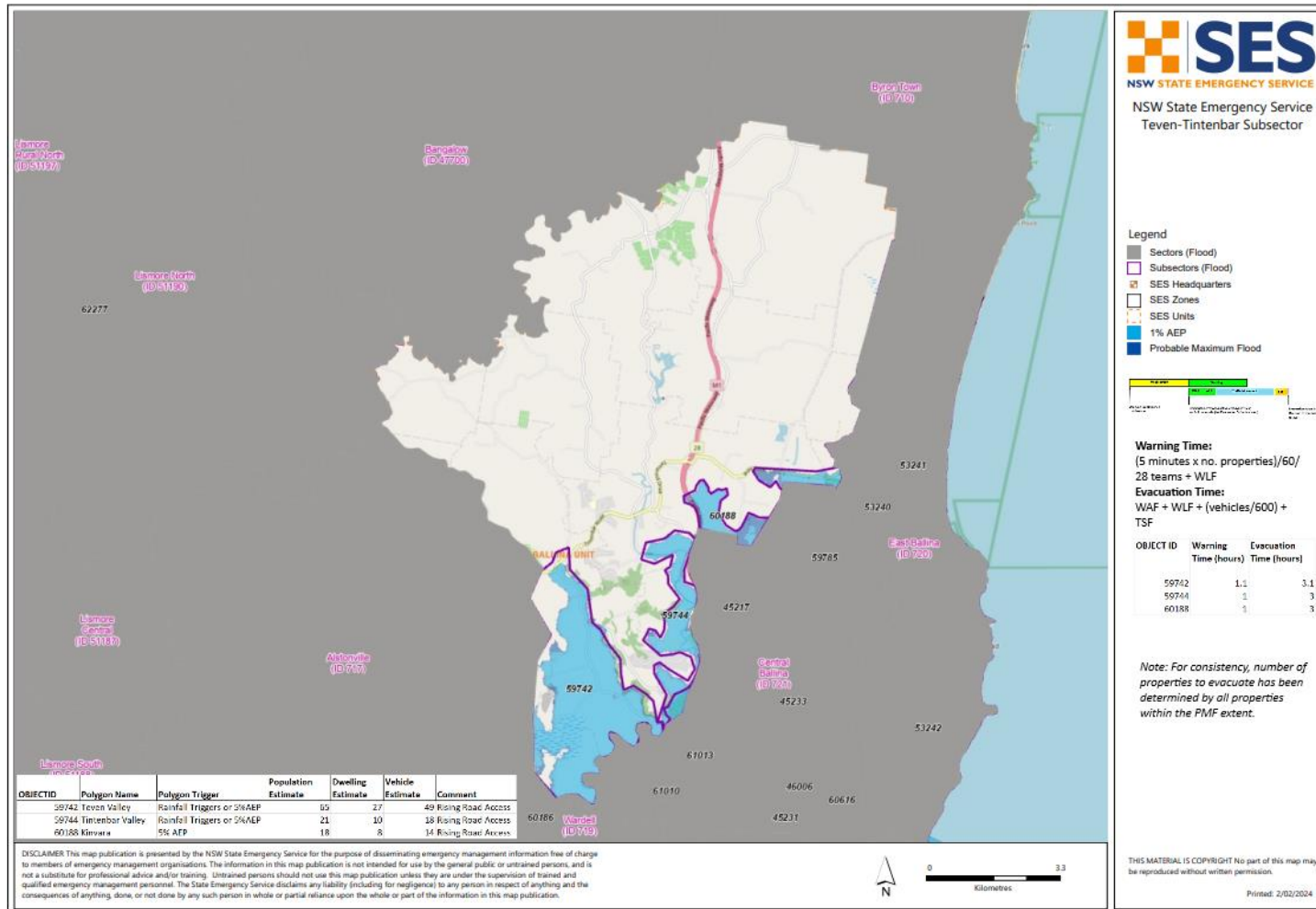
	<ul style="list-style-type: none"> ▪ Prediction to reach and exceed a 5% AEP event: Some over floor inundation of property may occur in the Teven Valley subsector. The Tintenbar and Kinvara subsectors are within the flood extent for this event, however over floor inundation data is currently unknown.
Sequencing of evacuation/messaging	<ul style="list-style-type: none"> • Teven and Tintenbar Valley: Consideration of warning messaging if rainfall is predicted to reach and exceed trigger levels, or there is a prediction to reach and exceed a 5% AEP flood event.
Evacuation Routes	<p>Rising road access is available into higher ground in Tintenbar, however flooding in the area can be of rapid onset and high velocity.</p> <ul style="list-style-type: none"> ▪ Teven Valley Subsector: Teven Rd to Tintenbar Rd towards Bangalow. ▪ Tintenbar Subsector: Tamarind Drive to the Pacific Motorway towards Bangalow.
Evacuation Route Closure	<ul style="list-style-type: none"> ▪ Multiple closures may occur at crossings within this sector. ▪ While gauge to closure height is not known, Teven Rd may close at multiple points along Maguires Creek, and would close in a local catchment, Richmond River and/or Ocean Storm dominated 1% AEP event. Any evacuation via this route needs to occur early in an event.
Method of Evacuation	Primarily private transport to higher ground within the Tintenbar area.
Evacuation Centre/Assembly Point	Rising road access via the Pacific Highway is available towards nominated Bangalow evacuation centres within the Byron Shire LGA.
Large scale evacuations	Large scale evacuations would be unlikely in this sector but if required additional locations will be identified.
Rescue	<p>Due to the flash flood risk in the area, many local roads are high risk areas for flood rescue, some of these include;</p> <ul style="list-style-type: none"> ▪ Kirklands Lane ▪ Eltham Rd at Teven ▪ Ross Lane at Deadmans Creek ▪ Teven Rd at Leadbeatters Lane and Upton Place
Resupply	<ul style="list-style-type: none"> ▪ Resupply is unlikely to be required in this sector until floods exceeding the 1%-0.2% AEP level. ▪ If resupply is required, it will be provided by the NSW SES through the 132500 call out system.
	Section 2.9, in Volume 2 of the Ballina Shire Flood Emergency Sub Plan provides information about isolated communities in the Ballina Shire area.
Aircraft Management	<p>Helicopter Landing Points:</p> <p>There are no known suitable landing points in this sector.</p>
	<p>Airports:</p> <ul style="list-style-type: none"> ▪ The closest airport is located in the Ballina Central Sector.

Other	<p>Special considerations relating to evacuation:</p> <ul style="list-style-type: none">▪ Closure of schools - coordinated through the Department of Education and Training.▪ Closure of licensed premises. All hotels and licensed clubs will be closed if required.▪ Security. Police patrols to be established to maintain law and order after evacuation has occurred.▪ The NSW SES will use flood boats and helicopters to monitor safety of individuals, where feasible.▪ These arrangements will stay in place until the “Return with Caution” is provided by the NSW SES to residents to return to their premises.
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5.2. TEVEN-TINTENBAR SECTOR MAP



5.3. EVACUATION PLANNING



BALLINA SHIRE NSW SES DAM FAILURE ARRANGEMENTS

**Chapter 3 of Volume 3 (NSW SES Response Arrangements for Ballina
Shire of the Ballina Shire Flood Emergency Sub Flood Plan**

Last Update: February 2024

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1 DETAILS OF THE DAM FAILURE WARNING SYSTEM FOR EMIGRANT CREEK DAM

This Section describes the downstream consequences and specific notification and warning arrangements for the failure of Emigrant Creek Dam and should be read in conjunction with the response arrangements detailed in the Ballina Shire Flood Emergency Sub Plan, Volume 1.

1.1 INTRODUCTION

- 1.1.1 Emigrant Creek Dam is located 11km north-west of Ballina at the headwaters of Emigrant Creek in the Tintenbar Valley. The dam type is post-tensioned gravity section flanked by zoned earthfill embankments with parapet walls. The dam has a height of 13m (top of parapet wall), crest length 140m, capacity at full supply level (FSL) is 820ML. The spillway is post-tensioned gravity ogee shaped crest, crest level RL 62.35m AHD, height 10m and length of 36.6m.
- 1.1.2 The two most likely causes of dam failure are:
 - a. Failure due to flood levels overtopping the embankment
 - b. Failure due to rapidly deteriorating structural deficiency such as may be induced by an extreme earthquake, internal erosion, piping, landslide or sabotage. (This is the so-called “Sunny Day” failure, i.e. not induced by an inflow flood).
- 1.1.3 Although the dam is currently in good condition, an unsafe or emergency condition could occur at any time due to extreme natural events. Failure from a cause not related to extreme natural events is always a possibility although the probability of occurrence is extremely low.
- 1.1.4 Lift off monitoring of the 18 post tensioned anchors have corrosion damage and are returning lift off results slightly below design load. Loss of loads at this time have not been sufficient to indicate there is a risk to the dam failing under PMF conditions. Updated 2023 flood modelling has also determined the PMF level to be approximately 1m lower than the previous modelled results, which now provides an additional available factor of safety when considering the current anchor loads.
- 1.1.5 The Emigrant Creek Dam is estimated to be able to withstand a PMF Inflow of 1049m³/s and PMF Outflow of 950m³/s.

1.2 CONSEQUENCES OF FAILURE

- 1.2.1 Dam failure could result in the following:
 - a. Approximately nine (9) residences have the potential to be adversely affected by a failure of the dam structure on ‘Sunny Day’ conditions, twenty six (26) by a PMF without a dam break and thirty two (32)

residences have the potential to be adversely affected by PMF and the failure of Emigrant Creek Dam.

Table 1: Number of houses at risk of inundation

Flooding Scenario	Number of Houses	Population at Risk
Sunny Day Dambreak	9	23
PMF without Dambreak	26	77
PMF with Dambreak	32	99

- 1.2.2 The number of houses at risk of inundation in the three modelled scenarios is shown in the table above. The study area of the model extends from the dam downstream to Upstream of the Pacific Highway near Cumbalum.
- 1.2.3 The DSEP identifies properties at risk. In the event of an Alert being issued to SES for Emigrant Creek Dam, some or all of these properties may require evacuation.

1.3 FLOW TRAVEL TIMES

- 1.3.1 The table below outlines the wave travel times for various flood scenarios at critical locations.

Table 2: Wave travel times for various flood scenarios along Emigrant Creek

Location	1:100 AEP travel time (hrs)	1:10,000 AEP travel time (hrs)	PMF travel time (hrs)	Sunny Day Failure travel time (hrs)
Crossing at Friday Hut Rd	0.28	0.17	0.16	0.25
Tintenbar Oval	0.65	0.51	0.37	0.64
Crossing at Tintenbar Rd	0.69	1.54	0.42	0.69
Old Bangalow Rd/ Tamarind Drive	1.23	1.15	0.79	2.14
Tamarind Dr Roundabout	1.81	1.69	1.18	7.87
Crossing at Cumbalum Rd	1.86	1.75	1.19	8.64
Upstream of Pacific Highway	1.91	1.79	1.22	8.71

- 1.3.2 It should be noted that the travel times listed relate to only one component of the lead-up time before downstream flooding commences and should be considered indicative only.

1.4 INUNDATION AREA

- 1.4.1 Downstream flood inundation could occur as the result of a dam failure due to a 'Flood' or a 'Sunny Day' failure.

Flood Failure

- 1.4.2 It should be noted that a serious flood event flowing safely through the spillway will produce a more serious flood downstream than a sunny day dam break.
- 1.4.3 The dam has been upgraded to withstand PMF so a flood event does not constitute any additional risk for downstream residents unless some event in addition to the flood occurs.

Sunny Day Failure

- 1.4.4 In the unlikely event of the dam failing under normal inflow conditions, downstream flood inundation would result from water held in the storage.
- 1.4.5 This may occur due to structural issues, a serious earthquake experience at or near the dam, terrorism or sabotage, or malfunction of equipment.
- 1.4.6 The non-flood failure is considered to have the most potential for loss of life as it is likely to occur when there are no flood warnings and hence emergency services are not on standby and the public is unprepared.

1.5 INUNDATION MAPPING

- 1.5.1 Dam break flood inundation mapping has been prepared for Emigrant Creek Dam and is contained in the Emigrant Creek Dam Safety Emergency Plan.

1.6 MONITORING

- 1.6.1 The dam owner/operator is responsible for monitoring and managing any potential emergency at the dam site.
- 1.6.2 **Warning Systems:** Pre-set alarm points are configured into the SCADA system to alert appropriate personal when certain flooding levels are reached. Rous Water hold contact numbers for houses downstream, which are updated annually.
- Monitoring Systems:** Depth of flow over spillway is electronically monitored by a SCADA system; two manual piezometers; seepage weirs.

1.7 NOTIFICATION PROCEDURES

- 1.7.1 The primary contact for dam failure warning notification by the dam owner to the NSW SES is the NSW SES 24hr Operations Centre. The NSW SES Operations Centre will subsequently notify the NSW SES North-Eastern Zone After Hours Duty Officer. An alternate NSW State Emergency Operations Centre (SEOC)

contact is available if this notification procedure was to fail. This number should only be used if primary SES contact cannot be contacted.

1.8 WARNING

1.8.1 Dam failure alerts are issued to NSW SES and are used to trigger appropriate response actions. Alerts from the DSEP for flood failure have been reproduced in Table against NSW SES responses. Responses escalate as the alert migrates from white to red. The conditions that define each of the alerts (as identified in the DSEP) are listed in Table 2. The meaning of each alert is as follows:

- a. **White:** Preliminary alert to assist the NSW SES in its preparation. This is not a public alert. It indicates a potential issue/condition has been observed at the dam and is being investigated.
- b. **Amber:** Alert necessitating the warning of the population at risk to prepare for evacuation.
- c. **Red:** Alert requiring the immediate evacuation of the downstream population at risk.

1.8.2 Actions indicated as occurring at particular alerts may be brought forward if the development of a flood warrants.

Table 3: Emigrant Creek Dam Flood Failure Alerts

Alert	Defining Conditions	Minimum Time to Reach Depth from Full Supply Level
White Alert	63.95m AHD Spillway Water Level 1.6m depth over spillway	4 hrs 20 min
Amber Alert	66m AHD Spillway Water Level 3.65m depth over spillway	8hrs 5 min
Red Alert	66.6m AHD Spillway Water Level 4.25m depth over spillway	3.82 reached in 9hrs 30 min

1.8.3 The NSW SES will disseminate dam failure warnings with Rous County Council also contacting persons listed in the schedule found in the Dam Safety Emergency Plan.

1.8.4 Rous County Council Staff will keep the NSW SES informed of depth over spillway, any changes to alert status, visual inspection reports or change in condition of structure of dam. The dam alerts will be activated in sequence as the storage level rises during the course of a major flood event and will be sent to the NSW SES as they occur.

1.8.5 The following tables outlines the notification, warning and evacuation arrangements for a potential failure of Emigrant Creek Dam.

Table 4: Notification, Warning and Evacuation Arrangements for a potential failure of Emigrant Creek Dam

WHITE ALERT	
Defining Conditions: Depth over spillway >1.6m. Heavy rainfall event.	
Non flood: Bomb threat in vicinity to dam, earth tremor or similar	
Stakeholder	Arrangements and Actions
Dam Owner	<ul style="list-style-type: none"> ▪ Advise NSW SES Operations Centre of White Alert Level being reached and provide regular updates on the situation at the dam.
SES SOC	<ul style="list-style-type: none"> ▪ Receive notification from dam operator. ▪ Advise NSW SES Zone Incident Control Centre or After Hours Duty Officer. ▪ Advise SEOC
NSW SES Zone Incident Control Centre or After Hours Duty Officer	<ul style="list-style-type: none"> ▪ Receive notification from NSW SES SHQ. ▪ Advise NSW SES Unit Commander or after hours Duty Officer. ▪ Advise the Regional Emergency Management Officer (REMO). ▪ Consider need for OOAA for warning and evacuation operations. ▪ Refer to Ballina Shire Flood Emergency Sub Plan for agencies to notify that the White Alert Level has been reached. (See Volume 1)
NSW SES Local Commander and/or Ballina Unit Commander or After Hours Duty Officer	<ul style="list-style-type: none"> ▪ Confirm NSW SES Zone HQ has been notified ▪ Refer to Ballina Shire Flood Emergency Sub Plan for agencies to notify that the White Alert Level has been reached. (See Volume 1).
LEOCON/Other Agencies	<ul style="list-style-type: none"> ▪ When requested by NSW SES Local Incident Controller, coordinate support. ▪ Activation of Ballina Shire Flood Emergency Sub Plan includes notification to the LEOCON and activation of supporting arrangements within the local EMPLAN
People at Risk	<ul style="list-style-type: none"> ▪ No action required. ▪ Some evacuations may be necessary due to mainstream riverine flooding.

AMBER ALERT

Defining Conditions: Depth over spillway >3.65m. Potential to fail if dam level continues to rise.

Non flood: Earth tremor >MM4 and minor damage visible which is unlikely to cause imminent failure, minor explosion or other incident occurs at dam which is unlikely to cause imminent failure

Stakeholder	Arrangements and Actions
Dam Owner	<ul style="list-style-type: none"> ▪ Advise NSW SES Operations Centre of Amber Alert Level being reached and provide regular updates on the situation at the dam. ▪ Closely monitor the condition of Emigrant Creek Dam and implement preventative measures to return it to a safe condition as soon as possible.
NSW SES SOC	<ul style="list-style-type: none"> ▪ Receive notification from dam operator. ▪ Advise NSW SES Zone Incident Control Centre or After Hours Duty Officer. ▪ Advise SEOC.
NSW SES Zone Incident Control Centre or After Hours Duty Officer	<ul style="list-style-type: none"> ▪ Notify NSW SES Local Commander and Unit Commander or Duty Officer, NSW SES units and NSW SES LHQ. ▪ Provide NSW SES AWS warnings to the media organisations listed in Volume 3: Chapter 1, of this Ballina Shire Flood Emergency Sub Plan. ▪ Coordinate provision of out of area assistance for warning and evacuation operations. ▪ Coordinate the notification of other agencies as listed in Ballina Shire Flood Emergency Sub Plan.
NSW SES Local Commander and/or Ballina Unit Commander or After Hours Duty Officer	<ul style="list-style-type: none"> ▪ Confirm NSW SES Zone HQ has been notified ▪ Coordinate the delivery of Evacuation Warning to at-risk residents. ▪ Coordinate the notification of other agencies as listed in Ballina Shire Flood Emergency Sub Plan.
LEOCON/Other Agencies	<ul style="list-style-type: none"> ▪ When requested by the NSW SES Local Incident Controller, coordinate support. ▪ Activation of the Ballina Shire Flood Emergency Sub Plan includes notification to the LEOCON and activation of supporting arrangements within the local EMPLAN
People at Risk	<ul style="list-style-type: none"> ▪ Prepare homes for inundation, pack valuables, mementos and pets and prepare to evacuate. ▪ Notify NSW SES doorknockers if transport to evacuation centres will be required. ▪ Some evacuations may be necessary due to mainstream riverine flooding.

RED ALERT	
<p>Defining Conditions: Depth over spillway >4.25m. Failure is probable, imminent or in progress.</p> <p>Non flood: Earth tremor >MM4 and major damage visible , major explosion causing major damage</p>	
Stakeholder	Arrangements and Actions
Dam Owner	<ul style="list-style-type: none"> ▪ Advise NSW SES Operations Centre of Red Alert Level being reached and provide regular updates on the situation at the dam.
SES SOC	<ul style="list-style-type: none"> ▪ Receive notification from dam operator. ▪ Advise NSW SES Zone Incident Control Centre or After Hours Duty Officer. ▪ Advise SEOC.
NSW SES Zone Incident Control Centre or After Hours Duty Officer	<ul style="list-style-type: none"> ▪ Notify NSW SES Local Commander and Unit Commander or Duty Officer, NSW SES Units and NSW SES LHQ. ▪ Advise the REMO/LEMO. ▪ Confirm that residents immediately downstream of the dam have been notified of Red Alert Level being reached. ▪ Activate the Standard Emergency Warning Signal (SEWS) and ensure that Evacuation Orders are broadcast over the radio stations listed in Volume 3: Chapter 1 of this Ballina Shire Flood Emergency Sub Plan. ▪ Coordinate provision of out of area assistance for evacuation operations.
NSW SES Local Commander and/or Ballina Unit Commander or After Hours Duty Officer	<ul style="list-style-type: none"> ▪ Confirm NSW SES Zone HQ has been notified. ▪ Evacuate at-risk residents. ▪ Coordinate the notification of other agencies as per the Ballina Shire Flood Emergency Sub Plan. ▪ Ensure that evacuation centres are ready to receive evacuees. ▪ Conduct Evacuation of downstream residents by doorknock and public address systems from emergency service vehicles. ▪ Coordinate transport of evacuees without their own vehicles.
LEOCON/Other Agencies	<ul style="list-style-type: none"> ▪ When requested by the NSW SES Local Incident Controller, coordinate support. ▪ Activation of the Ballina Shire Flood Emergency Sub Plan includes notification to the LEOCON and activation of supporting arrangements within the local EMPLAN
People at Risk	<ul style="list-style-type: none"> ▪ Evacuate to nearest evacuation centre or assembly area.

DAM FAILURE ALERT CANCELLATION	
Defining Conditions: Dam owner assesses threat and advises whether the risk to the dam structure has passed.	
Stakeholder	Arrangements and Actions
Dam Owner	<ul style="list-style-type: none"> ▪ Advise NSW SES OCC of the outcome of the risk assessment
SES SOC	<ul style="list-style-type: none"> ▪ Receive notification from dam operator. ▪ Advise NSW SES Zone Commander or After Hours Duty Officer. ▪ Advise SEOC.
NSW SES Zone Commander or Incident Controller	<ul style="list-style-type: none"> ▪ Following risk assessment of the dam, decide in consultation with NSW SES Local and State Incident Controller whether to issue an 'All Clear'. ▪ Issue 'All Clear' message to NSW SES Unit Commander or Duty Officer, NSW SES units, NSW SES Local HQ and NSW SES State HQ. ▪ Advise the REMO/LEMO that 'All Clear' has been issued. <p>Issue 'All Clear' message over radio stations listed in Volume 3: Chapter 1, of this Ballina Shire Flood Emergency Sub Plan.</p>
NSW SES Local Commander and/or Ballina Unit Commander or After Hours Duty Officer	<ul style="list-style-type: none"> ▪ Coordinate issue of 'All Clear' message at evacuation centres or by phone/doorknock. ▪ Deliver 'All Clear' message to other agencies as necessary.
LEOCON/Other Agencies	<ul style="list-style-type: none"> ▪ When requested by the NSW SES Local Incident Controller, coordinate support.
People at Risk	<ul style="list-style-type: none"> ▪ Stay home, return home or await further advice.

Evacuation Planning

Evacuation Timeline in a PMF with Dambreak

- 32 Properties at risk in a PMF, approximately 58 vehicles.
- Warning acceptance factor + Warning Lag Factor + Traffic Movement Time + Traffic Safety Factor = 3.1 hours to evacuate
- It should be noted due to fast travel time to upstream affected locations in a PMF, evacuation needs to be completed at the earliest possible time. The majority of these properties would already be affected by flooding in a PMF and evacuation may have already occurred.
- In a sunny day failure, wave travel time to Old Bangalow Rd/Tamarind Drive is less than the evacuation timeline, however there would be a comparatively smaller number of properties to evacuate.

- Due to the fast wave travel time, evacuation should occur to the closest highest ground outside the PMF extent. This may be to high ground in Tintenbar, or to Tamarind Drive towards the Pacific Motorway to the North.

Roads that may be cut

- Kirklands Crossing Causeway at Friday Hut Rd will flood in heavy rain.
- Teven Rd may be cut at its intersection with Eltham Rd.

BALLINA SHIRE NSW SES CARAVAN PARK ARRANGEMENTS

**Chapter 4 of Volume 3 (NSW SES Response Arrangements for Ballina) of
the Ballina Shire Flood Emergency Sub Plan**

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TABLE 2: CARAVAN PARKS AT RISK FROM COASTAL EROSION AND/OR COASTAL INUNDATION.ERROR! BOOKMARK NOT DEFINED.

1 ARRANGEMENTS FOR THE EVACUATION OF CARAVAN PARKS AND THE RELOCATION OF MOVABLE DWELLINGS

1.1 GENERAL

1.1.1 The following caravan parks are flood liable:

- a. Ballina Central Caravan Park
- b. Ballina Gardens Caravan Park
- c. Ballina Lakeside Holiday Park
- d. Ballina Pacific Palms Village
- e. Hibiscus Gardens Caravan Park
- f. Sandalwood Leisure Village
- g. Shaws Bay Caravan Park
- h. South Ballina Beach Holiday Park
- i. Ballina Waterfront Village and Tourist Park
- j. Riverbend Retirement Village

1.1.2 For more information on individual caravan parks see Table 1 and **Error! Reference source not found.** at the end of this Chapter.

1.2 ADVISING PROCEDURES

1.2.1 Caravan Park proprietors will ensure that the owners and occupiers of movable dwellings are:

- a. Made aware that the caravan park is flood liable by:
 - Providing a written notice to occupiers taking up residence. The notice will indicate that the caravan park is liable to flooding and designate the location of flood liable land within the park (1).
 - Displaying this notice and the emergency arrangements for the Caravan Park prominently in the park.
- b. Made aware that if they are expecting to be absent for extended periods, they should:
 - Provide the manager of the caravan park with a contact address and telephone number in case of an emergency.
 - 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).

- c. Informed of Flood Warning Information. At this time, occupiers will be advised to:
 - Ensure that they have spare batteries for their radios.
 - Listen to a local radio station for updated flood information.
 - Prepare for evacuation and movable dwelling relocation.
- 1.2.2 The NSW SES Ballina Unit Commander will ensure that the managers of caravan parks are advised of Flood Information (described in Volume 1 of the Ballina Shire Local Flood Plan).

1.3 EVACUATION OF OCCUPANTS AND RELOCATION OF MOVEABLE DWELLINGS

- 1.3.1 When an evacuation order is given caravan park occupants should follow the flood evacuation procedures for the park under the direction of the caravan park management. This should include advice to:
- a. Isolate power to moveable dwellings.
 - b. Collect personal papers, medicines, a change of clothing, toiletries and bedclothes.
 - c. Lift the other contents in any remaining dwellings as high as possible.
 - d. Move to friends, relatives or a designated evacuation centre if they have their own transport, or move to the caravan office to await transport.
 - e. If undertaking self-managed evacuation, register their movements with the caravan park management upon leaving the park.
- 1.3.2 Where possible, movable dwellings that can be moved will be relocated by their owners. Park managers will arrange for the relocation of movable dwellings as required. Council and NSW SES personnel may assist if required. Vans are to be moved to the locations outlined in Tables 1 and 2 at the end of this Chapter.
- 1.3.3 Caravan park managers will:
- a. Secure any movable dwellings that are not able to be relocated to prevent floatation.
 - b. Ensure that their caravan park is capable of being evacuated in a timely and safe manner.
 - c. Advise the NSW SES Ballina Unit Commander of:
 - The number of people requiring transport.
 - Details of any medical evacuations required.
 - Whether additional assistance is required to effect the evacuation.
 - d. Check that all residents and visitors are accounted for.

- e. Inform the NSW SES Ballina Unit Commander when the evacuation of the caravan park has been completed.
- f. Provide the NSW SES Ballina Unit Commander with a register of people that have been evacuated.

1.4 RETURN OF OCCUPANTS AND MOVEABLE DWELLINGS

- 1.4.1 The NSW SES Ballina Unit Commander, using council resources as necessary, will advise when it is safe for the caravan parks to be re-occupied.
- 1.4.2 Moveable dwellings will be returned back to the caravan park(s) by owners or by vehicles and drivers arranged by the park managers.
- 1.4.3 Council and NSW SES personnel may assist by request where resources are available.

Table 1: Caravan Parks at risk of Inundation and/or Isolation from Flooding.

Name	Address/ Location description	Town/ Sector	Number of sites	Risk	Evacuation route	Evacuation route closure	Moveable dwelling relocation location	Evacuation centre	Notes
Ballina Central Caravan Park (Ballina Reflections Holiday Park)	1 River St	Ballina Central	61 powered sites	May experience some inundation from a 20% AEP.	Ballina CBD B (Kingsford Smith Drive to East Ballina)	Route remains open up to and including a 1% AEP.	High ground within Ballina near Ballina Indoor Sports Centre in floods not expected to exceed 1%AEP, otherwise, high ground in East Ballina.	Southern Cross Public School or other nominated evacuation centre in East Ballina or Lennox Head.	
Ballina Gardens Village	126 Tamarind Drive	Ballina Central	47 caravan sites, 8 tent sites	May experience some inundation from a 2% AEP	North Ballina B (Tamarind Drive to Angels Beach Drive to East Ballina)	Tamarind Drive	High ground in the vicinity of Piper Drive in floods not expected to exceed 0.2%AEP. Otherwise, high ground in East Ballina.	Southern Cross Public School or other nominated evacuation centre in East Ballina or Lennox Head.	
Ballina Lakeside Holiday Park	25 Fenwick Drive	East Ballina	81 permanent sites, 40 caravan slab sites, 55 tent sites, 48 cabins.	May experience inundation in a PMF. Not in flood extent up to and	Local roads towards high ground in East Ballina	Compton Drive may experience inundation in a PMF	Ballina Lighthouse Surf Lifesaving Club Car Park, Compton Drive.	Southern Cross Public School or other	

				including a 0.2%AEP.				nominated evacuation centre in East Ballina or Lennox Head	
Ballina Pacific Palms Village	59-61 Southern Cross Drive	Ballina	58 permanent sites	May experience inundation in from 0.2%AEP. May become isolated.	North Ballina B (Tamarind Drive to Angels Beach Drive to East Ballina)	Tamarind Drive	Nil moveable sites	Southern Cross Public School or other nominated evacuation centre in East Ballina or Lennox Head.	
Hibiscus Gardens Caravan Park	491 River St	Ballina	65 permanent sites, 7 holiday sites, 2 tent sites.	May experience some inundation from a 5% AEP	West Ballina (River St to Kerr St, Bangalow Rd to Angels Beach Drive to East Ballina)	River St, Kerr St	In smaller events (5% AEP, can be moved to back of park.) In larger events (>1%AEP, high ground in East Ballina)	Southern Cross Public School or other nominated evacuation centre in East Ballina or Lennox Head.	In smaller events, flooding is likely in front portion of park only (River St side) affecting cabins, managers office and some permanent vans.
Sandalwood Leisure Village	978 Pimlico Rd	Wardell	Studio cabins, powered van sites	May experience inundation in a PMF. Is not	Blackwall Drive towards Wardell, the	Wardell Rd near	High ground immediately north of the	Alstonville Leisure and	

			and camping sites.	within flood extent up to and including a 0.2%AEP.	Wardell Rd to Alstonville.	Yellow Creek.	park along Pimlico Rd.	Entertainment Centre or nominated assembly area in Wardell	
Shaws Bay Caravan park (Reflections Caravan Park)	1 Brighton St	East Ballina	16 Cabins, Powered sites, 273 Unpowered sites and 3 tiny homes.	May experience some inundation in a PMF.	Local roads to Links Ave, and East Ballina.	-	Only the front edge of the park (near unpowered sites) is within Southern Cross Public School or other nominated evacuation centre in East Ballina or Lennox Head flood extent. Vans can be moved to back of park, or to Shaws Bay Hotel carpark.	Southern Cross Public School or other nominated evacuation centre in East Ballina or Lennox Head	
South Ballina Beach Holiday Park (Ballina Beach Nature Resort)	440 South Ballina Beach Rd	South Ballina	50 unpowered sites, 59 powered sites, 19 luxury tents, Cabins and luxury villas..	May become isolated from a 20% AEP, is not within flood extent until a PMF.	River Drive towards Wardell, then to Alstonville.	River Drive, Wardell Rd near Yellow Creek.	High ground within park or immediately adjacent.	Alstonville Leisure and Entertainment Centre or nominated assembly area in Wardell	

Ballina Waterfront Village and Tourist Park	Cnr River St & Emigrant Creek Lane	Ballina	Powered sites, cabins.	May experience some inundation from a 20%AEP, or approx. 2.4mRRVD at Byrnes Point Gauge.	West Ballina (River St to Kerr St, Bangalow Rd to Angels Beach Drive to East Ballina)	River St, Kerr St	In smaller events, (Less than or equal to 1%AEP) Ballina Central Carpark. In larger events, high ground in East Ballina.	Southern Cross Public School or other nominated evacuation centre in East Ballina or Lennox Head	
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LIST OF REFERENCES

1. **NSW Government.** *Local Government (Manufactured Home Estates, Caravan Parks, Camping Grounds and Moveable Dwellings) Regulation 2005 Part 3 Division 3 Subdivision 7 Clause 123.* 2005.
2. **BMT WBM.** *Ballina Floodplain Risk Management Study.* 2012
3. **BMT WBM.** *Ballina Floodplain Risk Management Plan.* 2015
3. **BMT WBM.** *Ballina Flood Study Update.* 2008
4. **Bewsher Consulting.** *Flood Intelligence Collection Review for the Tweed and Richmond Valleys.* 2008.
5. **Patterson, Britton & Partners.** *Wardell Floodplain Risk Management Plan.* 2009.
6. **Patterson, Britton & Partners.** *Cabbage Tree Island Floodplain Risk Management Plan.* 2009.
7. **Rous County Council.** *Emigrant Creek Dam Safety Emergency Plan.* 2023.
8. **NSW Government.** *Ballina Shire Local Emergency Management Plan.* 2019
9. **NSW Roads and Maritime Services.** *Woolgoolga to Ballina Pacific Highway Upgrade.* 2012.