



East Gippsland Shire Flood Emergency Plan

A Sub-Plan of the
Municipal Emergency Management Plan

For East Gippsland Shire Council and VICSES Unit(s)
Bairnsdale, Bruthen, Swifts Creek, Bendoc, Buchan, Orbost,
Cann River and Mallacoota

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Distribution List

The Distribution List for this sub plan is the same as in the Municipal Emergency Management Plan.

Document Transmittal Form / Amendment Certificate

This Municipal Flood Emergency Plan (MFEP) will be amended, maintained and distributed as required by VICSES in consultation with the East Gippsland Shire.

Suggestions for amendments to this Plan should be forwarded to VICSES Regional Office Gippsland, 82a Moore Street, Moe.

Amendments listed below have been included in this Plan and promulgated to all registered copyholders.

Amendment Number	Date of Amendment	Amendment Entered By	Summary of Amendment

This Plan will be maintained on the East Gippsland Shire website www.egipps.vic.gov.au.

List of Abbreviations & Acronyms

The following abbreviations and acronyms are used in the Plan:

<u>AEP</u>	Annual Exceedance Probability
<u>AHD</u>	Australian Height Datum (the height of a location above mean sea level in metres)
<u>AIIMS</u>	Australasian Inter-service Incident Management System
<u>AoCC</u>	Area of Operations Control Centre / Command Centre
<u>ARI</u>	Average Recurrence Interval
<u>ARMCANZ</u>	Agricultural & Resource Management Council of Australia & New Zealand
<u>AV</u>	Ambulance Victoria
<u>BoM</u>	Bureau of Meteorology
<u>CEO</u>	Chief Executive Officer
<u>CERA</u>	Community Emergency Risk Assessment
<u>CERM</u>	Community Emergency Risk Management
<u>CFA</u>	Country Fire Authority
<u>CMA</u>	Catchment Management Authority
<u>RERC</u>	Regional Emergency Response Coordinator
<u>RERCC</u>	Regional Emergency Response Coordination Centre
<u>DHS</u>	Department of Human Services
<u>DH</u>	Department of Health
<u>DoI</u>	Department of Infrastructure
<u>DPI</u>	Department of Primary Industries
<u>DSE</u>	Department of Sustainability and Environment (successor body to DNRE)
<u>EMMV</u>	Emergency Management Manual Victoria
<u>EMT</u>	Emergency Management Team
<u>EO</u>	Executive Officer
<u>FO</u>	Floodway Overlay
<u>FWS</u>	Flood Warning System
<u>FZ</u>	Floodway Zone
<u>IC</u>	Incident Controller
<u>ICC</u>	Incident Control Centre
<u>IMT</u>	Incident Management Team
<u>IMS</u>	Incident Management System
<u>EMLO</u>	Emergency Management Liaison Officer
<u>LSIO</u>	Land Subject to Inundation Overlay
<u>MECC</u>	Municipal Emergency Coordination Centre
<u>MEMP</u>	Municipal Emergency Management Plan
<u>MEMPC</u>	Municipal Emergency Management Planning Committee
<u>MERC</u>	Municipal Emergency Response Coordinator
<u>MERO</u>	Municipal Emergency Resource Officer
<u>MFB</u>	Metropolitan Fire and Emergency Services Board
<u>MRM</u>	Municipal Recovery Manager
<u>PMF</u>	Probable Maximum Flood
<u>RCC</u>	Regional Control Centre
<u>RDO</u>	Regional Duty Officer
<u>SBO</u>	Special Building Overlay
<u>SCC</u>	State Control Centre
<u>SEWS</u>	Standard Emergency Warning System
<u>SHERP</u>	State Health Emergency Response Plan
<u>SOP</u>	Standard Operating Procedure
<u>VicPol</u>	Victoria Police
<u>VICSES</u>	Victoria State Emergency Service

Part 1. INTRODUCTION

1.1 Municipal Endorsement

The East Gippsland Shire Council is the custodian of this Municipal Flood Emergency Plan (MFEP), as a sub plan of the Municipal Emergency Management Plan.

This MFEP has been prepared by the Municipal Flood Planning Sub-Committee with the authority of the Municipal Emergency Management Committee (refer to section 1.6 endorsement of plan) pursuant to Section 20 of the Emergency Management Act 1986 (as amended).

The East Gippsland Shire Council has and will continue to undertake consultations with the communities of East Gippsland about the arrangements contained within this plan as detailed in Appendix 26 *East Gippsland Community and Stakeholder Engagement Plan* to the MEMP.

This MFEP is a sub plan to the East Gippsland Shire Municipal Emergency Management Plan (MEMP), is consistent with the Emergency Management Manual Victoria (EMMV), the Victoria Flood Management Strategy (DNRE, 1998a), the Regional Flood Emergency Plan, the State Flood Emergency Plan and takes into account the outcomes of the Community Emergency Risk Assessment (CERA) process undertaken by the Municipal Emergency Management Planning Committee (MEMPC).

This Municipal Flood Emergency Plan is a result of the cooperative efforts of the East Gippsland Shire Flood Planning Sub-Committee (MFPC) and its member agencies. The signatories below, on behalf of their respective agencies commit to the implementation of this plan as it applies to each agency.

Steve Kozlowski

Chief Executive Officer
East Gippsland Shire

Date:

Clint Saarinen

Regional Manager
VICSES East Region

Date:

Ricky Ross

Regional Emergency Management Inspector
Victoria Police

Date:

1.2 The Municipality Flood Risk Profile

An outline of East Gippsland Shire in terms of its location, demography and other general matters is provided in the MEMP.

The 2011 CERM Review identified Flood as an extreme risk within East Gippsland Shire, as detailed in the MEMP. Further risk assessment processes (including the Community Emergency Risk Assessment – CERA process) have identified the risks in relation to Rivers and communities within East Gippsland.

Detailed flood threats, information and response information for each river system and identified at risk community is provided in the attachments to this plan.

1.3 Purpose and Scope of this Flood Emergency Plan

The purpose of this MFEP is to detail arrangements agreed for the planning, preparedness/prevention, response and recovery from flood incidents within East Gippsland Shire.

As such, the scope of the Plan is to:

- Identify the Flood Risk to East Gippsland Shire;
- Support the implementation of measures to minimise the causes and impacts of flood incidents within the East Gippsland Shire;
- Detail Response and Recovery arrangements including preparedness, Incident Management, Command and Control and Co-ordination;
- Identify linkages with Local, Regional and State emergency and wider planning arrangements with specific emphasis on those relevant to flood.

1.4 Municipal Flood Planning Sub-Committee (MFPC)

Membership of the East Gippsland Shire Flood Planning Sub-Committee (MFPC) will comprise of the following representatives from the following agencies and organisations:

- Victoria Police (i.e. Municipal Emergency Response Co-ordinator) (MERC) (**Chair**);
- VICSES, Regional Officer – Emergency Management;
- East Gippsland Shire, MERO;
- Catchment Management Authority; and
- Other agencies and community representatives or consultants as required.

1.5 Responsibility for Planning, Review & Maintenance of this Plan

This Municipal Flood Emergency Plan must be maintained in order to remain effective.

VICSES through the Flood Planning Committee has responsibility for preparing, reviewing, maintaining and distributing this plan.

The MFPC will meet at least once per year.

The plans should be reviewed and where necessary amended following:

- any new flood study;
- any change in non-structural and/or structural flood mitigation measures;
- the occurrence of a significant flood event within the Municipality.

1.6 Endorsement of the Plan

The MFEP will be circulated to Municipal Flood Planning Sub-Committee members seeking acceptance of the draft plan.

Upon acceptance, the MFEP is forwarded to the MEMPC and Council for endorsement with the recommendation to include the MFEP as a sub-plan of the MEMP.

Part 2. PREVENTION / PREPAREDNESS ARRANGEMENTS

2.1 Community Awareness for all Types of Flooding

Details of this MFEP will be released to the community through local media, the FloodSafe program and websites (VICSES and the Municipality) upon formal adoption by East Gippsland Shire.

VICSES will co-ordinate community education programs for flooding within the Council area, with the support of East Gippsland Shire and West and East Gippsland CMA's, eg StormSafe / FloodSafe.

An all hazards Community and Stakeholder Engagement Plan is attached to the MEMP at Appendix 26.

2.2 Structural Flood Mitigation Measures

A listing of any existing structural flood mitigation measures that exist within the Council area are listed in the river system attachments to this plan.

2.3 Non-structural Flood Mitigation Measures

2.3.1 Exercising the Plan

Arrangements for exercising this Plan will be at the discretion of the MEMPC. This Plan should be regularly exercised, preferably on an annual basis. Refer to section 4.7 of the EMMV for guidance.

2.3.2 Flood Warning

Arrangements for flood warning are contained within the State Flood Emergency Plan and the EMMV (Part 3.7) and on the BoM website.

Specific details of local flood warning system arrangements are provided in Appendix E in each River System Attachment to this plan.

2.3.3 Flood Wardens

Flood Wardens provide a means of gathering information in real time on flood behaviour along a stream system, and a network for the distribution of community information and warnings to the community along the stream system.

No arrangements exist or are planned in East Gippsland Shire for Flood Wardens.

Part 3. RESPONSE ARRANGEMENTS

3.1 Introduction

3.1.1 Activation of Response

Flood response arrangements may be activated by the Regional Duty Officer (RDO) VICSES Region or Incident Controller.

The Incident Controller/RDO VICSES will activate agencies as required and documented in the State Flood Emergency Plan.

3.1.2 Responsibilities

There are a number of agencies with specific roles that will act in support of VICSES and provide support to the community in the event of a serious flood within the East Gippsland Shire. These agencies will be engaged through the Emergency Management Team (EMT).

The general roles and responsibilities of supporting agencies are as agreed within the East Gippsland Shire MEMP, EMMV (Part 7 'Emergency Management Agency Roles'), State Flood Emergency Plan and Regional Flood Emergency Plan.

3.1.3 Municipal Emergency Coordination Centre (MECC)

If a MECC is established for a flood event, VICSES will provide an EMLO.

The VICSES RDO / ICC will liaise with the MECC directly.

If an Incident EMT is established, the Municipality will maintain involvement in the Incident EMT.

The function, location, establishment and operation of the MECC will be as detailed in the East Gippsland Shire MEMP.

3.1.4 Escalation

Most flood incidents are of local concern and an appropriate response can usually be coordinated using local resources. However, when these resources are exhausted, the State's arrangements provide for further resources to be made available, firstly from neighbouring Municipalities (on a regional basis) and then on a State-wide basis.

Resourcing and event escalation arrangements are described in the EMMV ('State Emergency Response Plan' – section 3.5).

The six Gippsland Municipalities have a resource sharing agreement in place for emergency events as detailed in the MEMP.

3.2 Strategic Control Priorities

To provide guidance to the Incident Management Team (IMT), the following strategic control priorities shall form the basis of incident action planning processes:

1. Protection and preservation of life is paramount - this includes:
 - a. safety of emergency services personnel; and

-
- b. safety of community members including vulnerable community members and visitors/tourist located within the incident area.
 2. Issuing of community information and community warnings detailing incident information that is timely, relevant and tailored to assist community members make informed decisions about their safety.;
 3. Protection of critical infrastructure and community assets that supports community resilience;
 4. Protection of residential property as a place of primary residence;
 5. Protection of assets supporting individual livelihoods and economic production that supports individual and community financial sustainability; and
 6. Protection of environmental and conservation values that considers the cultural, biodiversity, and social values of the environment.

Circumstances may arise where the Incident Controller is required to vary these priorities, with the exception being that the protection of life should remain the highest. This shall be done in consultation with the State Controller and relevant stakeholders based on sound incident predictions and risk assessments.

3.3 Command, Control & Coordination

The Command, Control and Coordination arrangements in this MFEP must be consistent with those detailed in State and Regional Flood Emergency Plans. For further information, refer to sections 3.4, 3.5 & 3.6 of the EMMV.

3.3.1 Control

Functions 5(a) and 5(c) at Part 2 of *the Victoria State Emergency Service Act 1986 (as amended)* detail the authority for VICSES to plan for and respond to flood.

Part 7.1 of the EMMV prepared under the *Emergency Management Act 1986 (as amended)*, identifies VICSES as the Control Agency for flood. It identifies DSE as the Control Agency responsible for “*dam safety, water and sewerage asset related incidents*” and other emergencies

All flood response activities within the East Gippsland Shire including those arising from a dam failure or retarding basin / levee bank failure incident will therefore be under the control of the appointed Incident Controller, or his / her delegated representative.

3.3.2 Incident Controller (IC)

An Incident Controller (IC) will be appointed by the VICSES (as the Control Agency) to command and control available resources in response to a flood event on the advice of the Bureau of Meteorology (or other reliable source) that a flood event will occur or is occurring. The Incident Controller responsibilities are as defined in Part 3.5 of the EMMV

3.3.3 Incident Control Centre (ICC)

As required, the Incident Controller will establish an Incident Control Centre (ICC) from which to initiate incident response command and control functions. The decision as to if and when the ICC should be activated, rests with the Control Agency (i.e. VICSES).

Pre-determined Incident Control Centre locations are

-
- **Level 1** – Local VICSES Unit
 - **Level 2** - VICSES East Region Headquarters, 82a Moore St Moe or VICSES East Region Office, 130 Macleod Street, Bairnsdale
 - **Level 3** – Multi Agency control facility, Franklin Street, Traralgon or VICSES East Region Office, 130 Macleod Street, Bairnsdale

3.3.4 Divisions and Sectors

To ensure that effective Command and Control are in place, the Incident Controller may establish Divisions and Sectors depending upon the complexity of the event and resource capacities.

3.3.5 Incident Management Team (IMT)

The Incident Controller will form an Incident Management Team (IMT). Refer to 3.5 of the EMMV for guidance on IMT's and Incident Management Systems (IMS's).

3.3.6 Emergency Management Team (EMT)

The Incident Controller will establish a multi-agency Emergency Management Team (EMT) to assist the flood response. The EMT will consist of key personnel (with appropriate authority) from stakeholder agencies and relevant organisations who need to be informed of strategic issues related to incident control and who are able to provide high level strategic guidance and policy advice to the Incident Controller for consideration in developing incident management strategies.

Organisations, including East Gippsland Shire, required within the EMT will provide an Emergency Management Liaison Officer (EMLO) to the ICC if and as required as well as other staff and / or resources identified as being necessary, within the capacity of the organisation.

Refer to 3.5 of the EMMV for guidance on EMTs.

3.3.7 On Receipt of a Flood Watch / Severe Weather Warning

East Gippsland Shire Council will operate as defined within their Flood Response Standard Operating Procedures.

The **VICSES** Incident Controller/ RDO will:

- Ensure flood bulletins and community information are prepared and issued to the community;
- Notify and brief appropriate officers, this includes (if established) Regional Control Centre (RCC), State Control Centre (SCC), Council and other emergency services through the EMT;
- Assess ICC readiness (including staffing of IMT and EMT) and open if required;
- Review flood intelligence to assess likely flood consequences;
- Monitor weather and flood information – www.bom.gov.au;
- Assess Command and Control requirements;
- Review local resources and consider needs for further resources regarding personnel, property protection, flood rescue and air support;
- Monitor watercourses and undertake reconnaissance of low-lying areas;
- Ensure flood mitigation works are being checked by owners eg Snowy Hydro;
- Develop and issue incident action plan, if required; and
- Develop and issue situation report, if required.

3.3.8 On Receipt of the First and Subsequent Flood Warnings

East Gippsland Shire Council will operate as defined within their Flood Response Standard Operating Procedures.

The **VICSES** Incident Controller/ RDO will:

- Continue to review flood intelligence to assess likely flood consequences;
- Determine what the at-risk community need to know and do as the flood develops;
- Continue to warn the at-risk community including ensuring that an appropriate warning and community information strategy is implemented;
- Liaise with relevant asset owners as appropriate (i.e. water and power utilities);
- Implement response strategies as required based upon flood consequence assessment;
- Continue to monitor the flood situation – www.bom.gov.au/vic/flood/; and
- Continue to undertake reconnaissance of low-lying areas.

3.4 Community Information and Warnings

The **BoM** has the responsibility for issuing Flood and Severe Weather Warnings.

VICSES, as the Control Agency, co-ordinates further community messaging.

Council has the responsibility to assist **VICSES** to warn individuals within the community including activation of flood warning systems, where they exist.

Other agencies such as **CFA**, **DSE** and **VICPOL** may be requested to assist **VICSES** with the communication of community flood warnings.

In cases where severe flash flooding is predicted, dam failure is likely or flooding necessitating evacuation of communities is predicted, the Incident Controller may consider the use of the Emergency Alert System and Standard Emergency Warning System (SEWS).

The **Department of Health** will coordinate information regarding public health and safety precautions.

Guidelines for the distribution of community information and warnings are contained in the State Flood Emergency Plan.

Community information and warnings will be targeted at local, regional and state wide needs and may include:

- Emergency Alert;
- Radio and Television;
- Verbal Messages (i.e. Doorknocking);
- Agency Websites;
- **VICSES** Flood Storm Information Line;
- Variable Message Signs (i.e. road signs);
- Community meetings & newsletters; and
- Social media.

Refer to Appendices C and E in each River System Attachment for the specific details of how community information and warnings may be provided.

3.5 Media Communication

The Incident Controller through the Public Information Unit established at the ICC will manage Media communication. If the ICC is not established the RDO will manage all media communication.

3.6 Rapid impact assessment

Rapid impact assessment can be conducted in accordance with part 3 of the EMMV to assess and record the extent and nature of damage caused by flooding. This information may then be used to provide the basis for further needs assessment and recovery planning by DHS and recovery agencies.

3.7 Preliminary Deployments

When flooding is expected to be severe enough to cut access to towns, suburbs and/or communities, the Incident Controller will consult with relevant agencies to ensure that resources are in place if required to provide emergency response. These resources might include emergency service personnel, food items and non-food items such as medical supplies, shelter, assembly areas, relief centres etc.

3.8 Response to Flash Flooding

Emergency management response to flash flooding should be consistent with the guidelines within the State Flood Emergency Plan.

When conducting pre-event planning for flash floods the following steps should be followed, and in the order as given:

1. Determine if there are barriers to evacuation by considering warning time, safe routes, resources available etc;
2. If evacuation is possible, then evacuation should be the adopted strategy and it must be supported by a public information capability and a rescue contingency plan;
3. Where it is likely people will become trapped by floodwaters due to limited evacuation options, safety advice needs to be provided to people at risk advising them not to attempt to flee by entering floodwater if they become trapped and that it may be safer to seek the highest point within the building and to telephone 000 if they require rescue. This advice needs to be provided even when evacuation may be possible, due to the likelihood that not all community members will evacuate.
4. For buildings known to be structurally unsuitable, an earlier evacuation trigger will need to be established (return to step 1 of this cycle).
5. If an earlier evacuation is not possible then specific preparations must be made to rescue occupants trapped in structurally unsuitable buildings either pre-emptively or as those people call for help.

During a flash flood it will often be difficult, due to the rapid development of flooding, to establish evacuation (relief) centres ahead of actually triggering the evacuation as is normal practice but this is insufficient justification for not adopting evacuation.

3.9 Evacuation

VicPol is the control agency responsible for evacuations. The decision to recommend evacuation to VicPol rests with the Incident Controller.

Once the decision is made, VicPol are responsible for the management of the evacuation process. VICSES and other agencies will assist where practical.

VICSES is responsible for the development and communication of evacuation warnings.

VicPol and/or Australian Red Cross may take on the responsibility of registering people affected by a flood emergency including those who have been evacuated.

Refer to section 3.8 of the EMMV and the Evacuation Guidelines for guidance of evacuations for flood emergencies.

3.10 Flood Rescue

VICSES may conduct flood rescues. Appropriately trained and equipped VICSES units or other agencies that have appropriate training, equipment and support may carry out rescues.

Rescue operations may be undertaken where voluntary evacuation is not possible, has failed or is considered too dangerous for an at-risk person or community. An assessment of available flood rescue resources (if not already done prior to the event) should be undertaken prior to the commencement of Rescue operations.

Rescue is considered a high-risk strategy to both rescuers and persons requiring rescue and should not be regarded as a preferred emergency management strategy. Rescuers should always undertake a dynamic risk assessment before attempting to undertake a flood rescue.

3.11 Aircraft Management

Aircraft can be used for a variety of purposes during flood operations including evacuation, resupply, reconnaissance, intelligence gathering and emergency travel.

Air support operations will be conducted under the control and approval of the Incident Controller.

3.12 Resupply

Communities, neighbourhoods or households can become isolated during floods as a consequence of road closures or damage to roads, bridges and causeways. Under such circumstances, the need may arise to resupply isolated communities/properties with essential items.

When predictions/intelligence indicates that communities, neighbourhoods and/or households may become isolated, VICSES will advise businesses and/or households that they should stock up on essential items.

After the impact, VICSES can support isolated communities through assisting with the transport of essential items to isolated communities and assisting with logistics functions.

Resupply operations are to be included as part of the emergency relief arrangements with VICSES working with the relief agencies to service communities that are isolated.

3.13 Essential Community Infrastructure and Property Protection

Essential Community Infrastructure and Property (e.g. residences, businesses, roads, power supply etc.) may be affected in the event of a flood.

Each SES Unit maintains a small stock of sandbags, back-up supplies are available through the VICSES Regional Headquarters. The Incident Controller will determine the priorities related the use of sandbags, which will be consistent with the strategic priorities.

If VICSES sandbags are becoming limited in supply, then priority will be given to protection of Essential Community Infrastructure. Other high priorities may include for example the protection of historical buildings.

The Incident Controller will ensure that owners of Essential Community Infrastructure are kept advised of the flood situation. Essential Community Infrastructure providers must keep the Incident Controller informed of their status and ongoing ability to provide services.

Refer to Appendix C of each River System attachment to this Plan for further specific details of essential infrastructure requiring protection.

3.14 Disruption to Services

Disruption to services other than essential community infrastructure and property can occur in flood events. Refer to Appendix C in each River System Attachment to this Plan for specific details of likely disruption to services.

3.15 Road Closures

East Gippsland Shire and VicRoads will carry out their formal functions of road closures including observation and placement of warning signs, road blocks etc. to its designated local and regional roads, bridges, walking and bike trails.

East Gippsland Shire will advise VicRoads as to the need or advisability of erecting warning signs and / or of closing roads and bridges under its jurisdiction.

East Gippsland Shire will advise VicRoads of all road closures within Council's jurisdiction.

VicRoads are responsible for designated main roads and highways and Council's are responsible for the designated local and regional road network.

VicRoads will communicate community information regarding road closures.

3.16 Dam Failure

DSE is the Control Agency for dam safety incidents (e.g. breach, failure or potential breach / failure of a dam), however VICSES is the Control Agency for any flooding that may result.

Major dams with potential to cause structural and community damage within the Municipality are listed in Appendix A of each River System attachment to this Plan.

3.17 Waste Water related Public Health Issues and Critical Sewerage Assets

Inundation of critical sewerage assets including septic tanks and sewerage pump stations may result in water quality problems within the Municipality. Where this is likely to occur or has occurred East Gippsland Water (East Gippsland Shire in relation to septic tanks) should undertake the following:

- Advise VICSES of the security of critical sewerage assets to assist preparedness and response activities in the event of flood;
- Maintain or improve the security of critical sewerage assets;
- Check and correct where possible the operation of critical sewerage assets in times of flood;
- Advise the ICC in the event of inundation of critical sewerage assets.

It is the responsibility of the East Gippsland Shire Environmental Health Officer to inspect and report to the MERO and the ICC on any water quality issues relating to flooding.

3.18 After Action Review

VICSES will coordinate the after action review arrangements of flood operations as soon as practical following an event.

All agencies involved in the flood incident should be represented at the after action review.

Part 4. EMERGENCY RELIEF AND RECOVERY ARRANGEMENTS

4.1 General

Relief and recovery arrangements within the East Gippsland Shire are detailed in the East Gippsland Shire MEMP and/or the Relief and Recovery Sub-plan.

4.2 Emergency Relief

The decision to recommend the opening of an emergency relief centre rests with the Incident Controller. Incident Controllers are responsible for ensuring that relief arrangements have been considered and implemented where required under the State Emergency Relief and Recovery Plan (Part 4 of the EMMV).

The range and type of emergency relief services to be provided in response to a flood event will be dependent upon the size, impact, and scale of the flood. Refer to 4.4 of the EMMV for details of the range of emergency relief services that may be provided.

Details of the relief arrangements are available in the MEMP / Relief and Recovery Plan.

4.3 Animal Welfare

Matters relating to the welfare of livestock, companion animals and wildlife (including feeding and rescue) are to be referred to DPI.

Requests for emergency supply and/or delivery of fodder to stranded livestock or for livestock rescue are passed to DPI.

Matters relating to the welfare of wildlife are to be referred to DSE.

4.4 Transition from Response to Recovery

VICSES as the Control Agency is responsible for ensuring effective transition from response to recovery. This transition will be conducted in accordance with existing arrangements as detailed in Part 3 Section 3.10 of the EMMV.

EASTERN RIVERS

Genoa River

Cann River

Bemm River

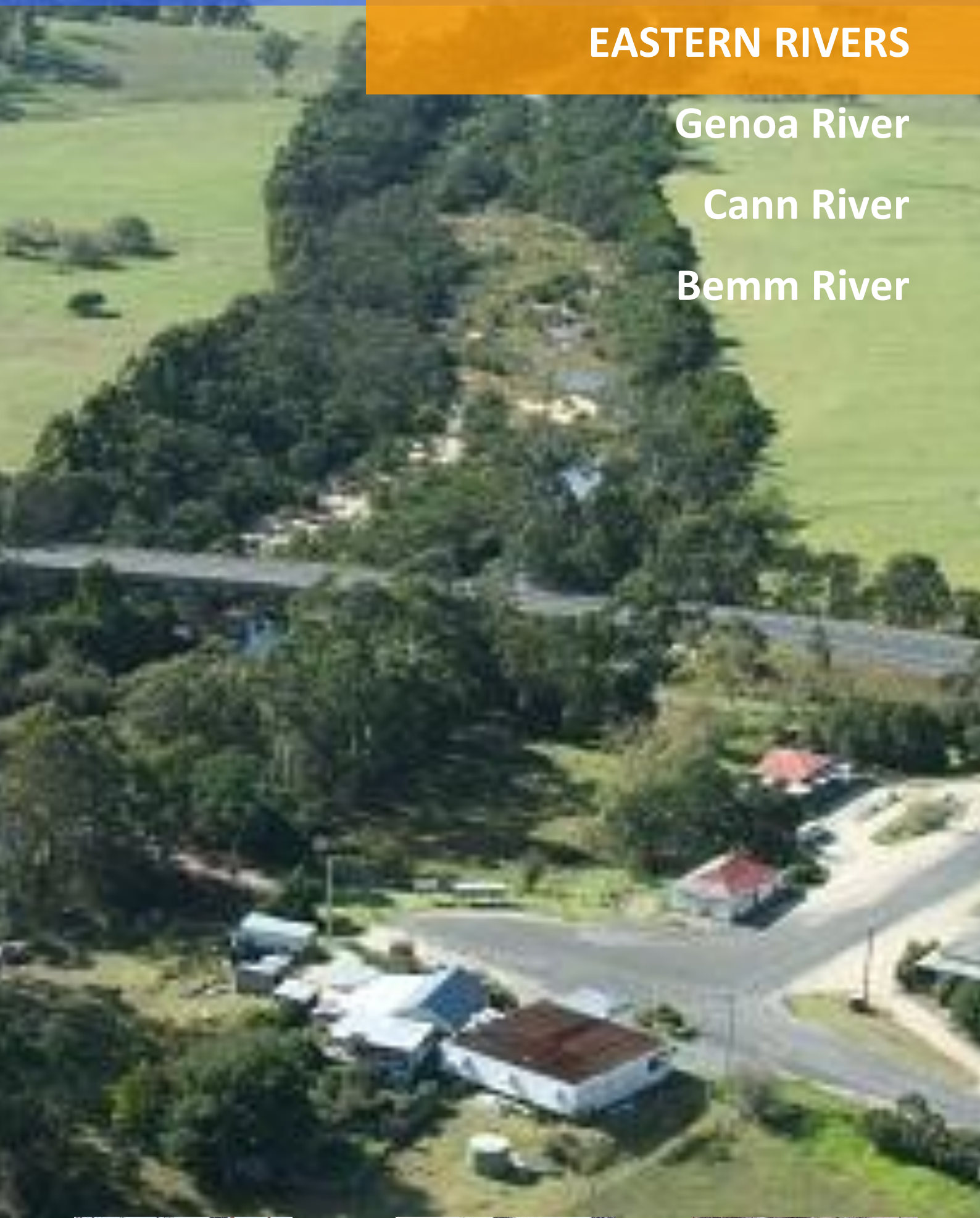


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ASSOCIATED REPORTS

- | SES State Flood Intelligence Report
- | East Gippsland Shire Council Flood Response Plan, Far East Region
- | SES East Region Mallacoota Unit Sub Response Plan
- | Thiess Environmental Services Gauge Rating Tables
- | *East Gippsland Floods*, East Gippsland Catchment Management Authority, East Gippsland News Wednesday July 25th 2007
- | 1998 Flood – The Road to Recovery in East Gippsland, East Gippsland Shire, DHS, NRE, EGCMA, Dec 1999
- | The Gippsland Floods of June / July 2007, East Gippsland Catchment Management Authority, DRAFT 2011
- | Catchment Goals: Cann River, EGCMA

ACCURACY & CONFIDENTIALITY

Use this information as a guide to the possible effects of a flood. This card is based on estimates of flood behaviour and particular effects may occur at heights different from those indicated here. They may also occur at slightly different heights in different floods. This card may contain sensitive information about the effects of flooding on private property. Specific reference to private addresses or businesses must be made directly to owners or other emergency services but not via broadcast or print media.

APPENDIX A.01 – FLOOD THREATS

OVERVIEW OF RIVER SYSTEM

WEATHER PATTERNS

Low pressure weather systems off the NSW south coast (east coast lows) often cause heavy rain in the Genoa, Cann & Bemm River catchments resulting in significant river rises. So, too, do low pressure weather systems entering the catchment from central Australia and rainfall on the Great Divide and adjoining catchments.

GENOA RIVER

The Genoa River originates in New South Wales on the southern slopes of the Monaro Plateau.

The Upper Genoa River is listed as a heritage river based on the geological/ geomorphological significance of the Genoa River gorge, scenic landscapes and sites of botanical significance. The catchment is predominantly public land with small townships and little freehold land.

The major tributaries of the Genoa River are:

- Wangarabell Creek (township of Wangarabell);
- Wallagaurough River (Timbillica / Gipsy Point); and
- Genoa Creek (Genoa).

There are only two significant communities in the catchment, Genoa and Mallacoota, both of which are impacted by flood events.

CANN RIVER

The Cann River catchment (1,167 km²) comprises the forested upland areas on the Victorian and New South Wales border, the cleared agricultural land on the Cann floodplain around Noorinbee and Cann River township and the Tamboon Inlet on the lower reaches of the river.

The river is formed at the confluence of two streams - the East and West branches of the Cann - at Weeragua. The main tributaries are the Buldah, Chandlers, Lock Up, Reedy, Kate, Tonghi, Granite and Gibbs Creeks. The Cann River flows into Tamboon Inlet, a coastal lagoon that is intermittently open to the ocean. Lake Furnell is also located on the lowland reach of the river.

Public land in the catchment includes sections of Coopracambra and Croajingolong National Parks. These remote areas support a number of ecosystems including eucalypt forests, heathlands, rainforests, granite peaks and coastal headlands. These ecosystems support a diversity of flora and fauna, including 328 fauna and 1000 flora species recorded in the Croajingolong National Park.

The fertile Cann River floodplain mainly supports dairying and beef cattle grazing. The small township of Cann River, located at the junction of the Princes and Monaro Highways, is a rest stop for travellers and a starting point for visitors to the Coopracambra and Croajingolong National Parks.

Historical flood records indicate that it is not unusual to have multiple flood events in any single year, once the catchment is wet (eg 1971, 1978, 1983, 1985, 2011 & 2012).

BEMM RIVER

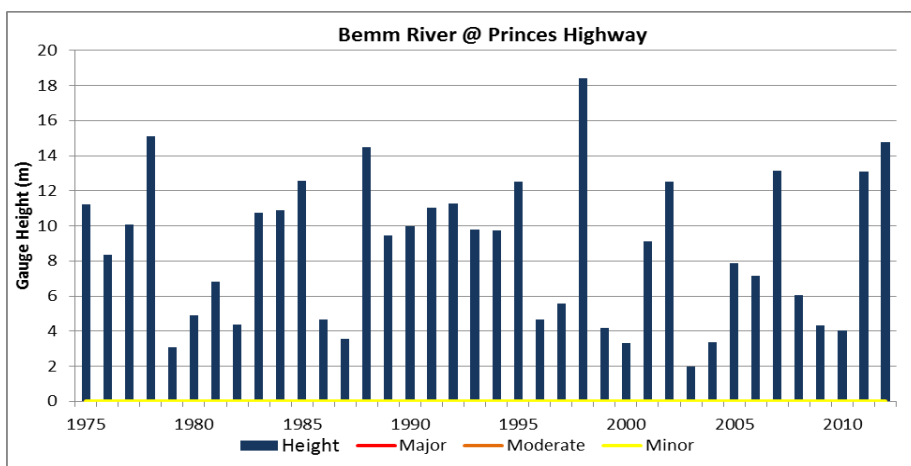
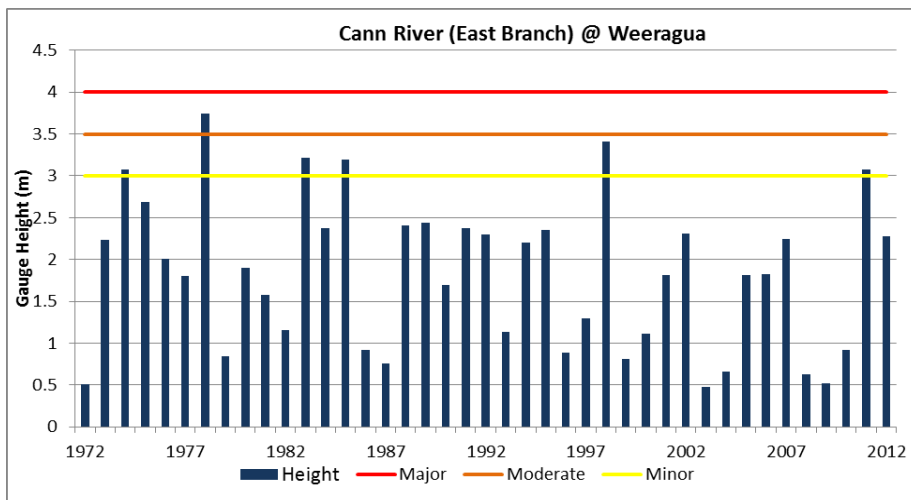
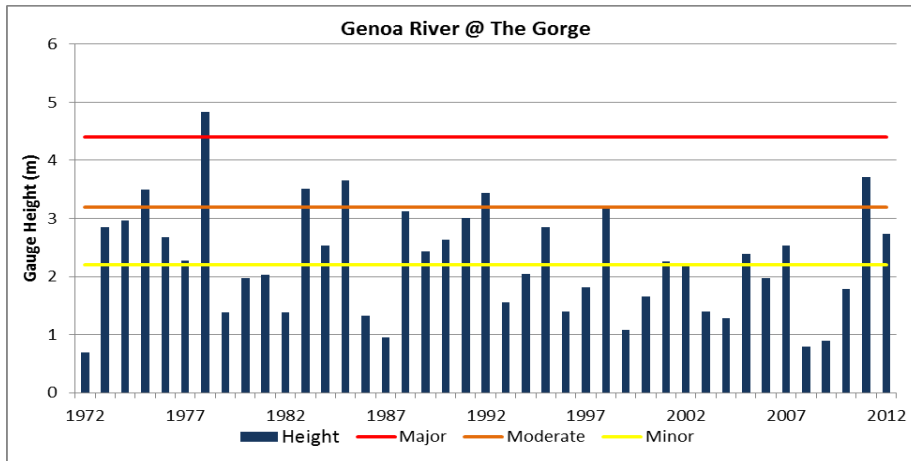
The Bemm River begins at the confluence of the Errinundra and Combienbar Rivers, which originate on the southern slopes of the Errinundra Plateau. Much of the catchment is public land and forested, however the river system passes through two small farming communities, Combienbar and Club Terrace, before discharging to Sydenham Inlet near the small coastal township of Bemm River.

FLOOD RISKS

A rainfall event usually impacts all three river catchments and they usually peak at around the same time due to the similarity in their catchment size and characteristics. A significant risk is isolation of communities, vehicles and recreational visitors throughout the area (and along the Princes and Monaro Highways) when river/ creeks rise, landslips and falling vegetation make roads impassable. Storms also cause power and communication outages simultaneous to flooding.

FLOODING FREQUENCY

Highest Annual Flood Peaks are shown below for the Genoa, Cann & Bemm Rivers. Flood Class Levels are shown where they exist.



RIVERINE RISK

- | **Genoa River** – There are two significant communities on the Genoa River, Genoa and Mallacoota. Both are impacted by riverine floods, the most significant impact being the closure of the Mallacoota-Genoa Rd isolating Gipsy Point and Mallacoota. There are also roads and low lying areas that experience inundation in Mallacoota. Mallacoota is a small isolated coastal community which is closer to some services in NSW than in Victoria. The population in Mallacoota swells during the Christmas and Easter Holidays, filling the large caravan park on the foreshore. Due to its size, the community supports and assists each other during emergencies. There is a primary and secondary school, aged care facility, medical clinic, and representatives of several government departments located in the town.
- | **Cann River** – Cann River township is the only significant community on the Cann River. The Cann River Caravan Park is located on the floodplain and needs early evacuation. The Bluenose levee is designed to protect rural land to the west of the river however it has not had any significant monitoring or maintenance for many years.
- | **Bemm River** – Bemm River township is the only significant community on the Bemm River. The highest risk for Bemm River is the closure of the only access road to the township. The township itself is not at risk of riverine flood. The Princes Highway was closed in the June 1998 flood event when the Bemm River overtopped the Highway bridge.

FLASH FLOODING

There is a flash flooding risk in Mallacoota, Cann River and other rural areas around the area. Further study needs to be done to determine the specific flood risk.

RURAL FLOOD RISK

Throughout the catchments there a number of areas that have significant rural flood risk. Though these areas are not highly populated, rural properties are susceptible to isolation or inundation.

- | **Genoa River** – Wangarabell, Genoa, Mallacoota
- | **Cann River** – Noorinbee North, Noorinbee, Cann River, Tonghi Creek
- | **Bemm River** – Combienbar (Combienbar River), Club Terrace

HEALTH & ENVIRONMENTAL RISKS

There are many septic tanks in the rural areas that may be inundated by floodwaters and farm chemicals stored in farm sheds on the floodplain.

PROPERTIES AT RISK

The table below is a breakdown of the number of properties impacted in a 1% AEP riverine event. These figures are **indicative only** and based on a mixture of actual impacts during historical events which were less than the 1% event and mapping.

River	# properties flooded in 1% AEP				
	Residential	Business	Industrial	Rural	Total
Genoa River	14	0	0	29	43
Cann River	23	0	0	94	117
Bemm River	0	0	0	9	9
TOTAL	37	0	0	132	169

HISTORICAL FLOODS

Significant floods have occurred in the Genoa, Cann and Bemm River Catchments as shown in the table below. The 1971 Event is the worst flood in memory on the Genoa and Cann Rivers. It is reported that in Genoa, floodwaters reached the top of the counter in the general store and first step from ground on east side of Hotel.

EVENT	GENOA			WINGAN	CANN			BEMM		
	Rockton	The Gorge	Gipsy Point	Wingan R @ Wingan Inlet National Park	West Branch @ Weeragua	East Branch @ Weeragua	Cann River	Combiobar R @ Combeinbar	Errinundra R @ Errinundra	Princes Hwy
1971 Feb	-	-	-	-	6.29	-	-	-	-	-
1974 Jun	-	2.97	-	-	2.85	3.08	-	-	3.32	-
1975 Jun	-	3.50	-	-	2.68	2.69	-	3.74	2.70	11.21
1978 Jun	-	4.84	-	-	4.46	3.74	-	5.21	4.73	15.11
1983 Mar	-	3.03	-	1.45	2.00	2.84	3.18	2.48	1.09	03.87
1983 May	-	3.51	-	3.65	2.98	3.22	3.90	3.88	2.19	10.74
1983 Oct	-	2.58	-	3.13	2.47	3.43	3.27	2.54	1.58	06.01
1984 Jul	-	2.53	-	4.33	2.38	2.37	3.80	3.96	2.96	10.89
1985 Sep	-	2.46	-	3.65	3.11	3.19	4.65	3.78	2.77	11.96
1985 Nov	-	3.66	-	6.09	2.99	2.68	4.36	4.23	3.46	09.47
1992 Dec	-	3.44	-	4.95	2.36	2.30	-	4.22	2.58	11.28
1998 Jun	1.55	3.20	2.99	6.46	4.68	3.41	-	7.30	6.05	18.39
2007 Jun	1.79	2.54	-	4.00	3.44	2.25	-	3.36	3.84	10.16
2011 Jun	2.35	3.07	-	4.79	4.45	3.08	-	4.34	-	12.35
2012 Mar	1.96	2.73	-	3.84	3.44	2.28	-	4.22	4.21	11.85
2012 Jun	1.71	2.33	-	4.24	3.54	2.00	-	4.93	4.81	14.76
Major	-	4.40	-	-	4.00	2.80	-	-	-	-
Moderate	-	3.20	-	-	3.50	2.30	-	-	-	-
Minor	-	2.20	-	-	3.00	2.00	-	-	-	-

MAJOR WATER STORAGES

There are no water storages over 1,000ML within this catchment.

LEVEES

There are no major levees recorded. The following levees have been extracted from the Victorian Flood Database and are listed as communally or publically owned. Information on design standard, condition or construction date has not been provided in the VFD.

Name	River	Location	Condition	Operator
Alcocks Levee	Bemm	Sydenham Inlet Rd north of township is constructed on the levee	Unknown	East Gippsland Shire?
Pardews Levee	Bemm	Private Land, CA 2A, upstream of Bemm River township, in paddock on left hand side (east of river)	Unknown	Private landholder
Bluenose Levee	Cann	Between Noorinbee and Cann River, right hand bank (west bank)	Unknown	Multiple private landholders

MAJOR ROAD CLOSURES

Riverine Flooding	Flash Flooding
GENOA RIVER	
<p>Mallacoota-Genoa Rd – Halls Ck near Mangans Lake to a depth of 1m (closes when Genoa River @ The Gorge gauge reaches approximately 3.5m)</p> <p>Lakeside Drive, Mallacoota – bottom of Martin St</p>	
PAMBULA RIVER	
<p>Princes Hwy – Pambula Flats NSW (hospital access)</p>	
CANN RIVER	
<p>Monaro Hwy – just nth of Bennet St</p> <p>Monaro Hwy - 4km north of Cann River township</p> <p>Monaro Hwy - 15km north of Cann River township</p> <p>Monaro Hwy – bridge at Noorinbee > 1.0m</p> <p>Princes Hwy – just west of Blue Nose Creek</p> <p>Princes Hwy – causeway between Cann River bridge and Blue Nose Creek (688340/5839514)</p>	
BEMM RIVER	
<p>Princes Highway – where it crosses the Bemm River</p> <p>Bemm River Rd (Sydenham Inlet Rd) – approximately 300m north of Alans Rd (upstream of township) AND east of Alcocks Level (d/stream of township)</p> <p>Bemm River Rd - Elephant Corner (water over road @ 13m, closed @ 13.3m)</p>	

RURAL ROAD CLOSURES

Riverine Flooding	Flash Flooding
GENOA RIVER	
Wangarabell Rd – at bridge over Flat Ck 1m deep	Wallagaraugh Rd - near Black Creek
CANN RIVER	
Cape Everard Rd (Tamboon Rd) – at first Thurra River bridge	
West Cann River Rd – 0.5km west of Monaro Hwy	

DISRUPTION TO SERVICES

Electricity interruptions are frequent events during storms along with reduced fuel supplies and closure of transport corridors. Extended durations of this disruption can cause concern with the operation of East Gippsland Water assets in these locations.

GAUGE LOCATIONS

Gauge Name	Location	Gauge Zero m AHD	No.
GENOA RIVER			
Genoa R @ Rockton	Monaro Highway Bridge at Rockton E:705839, N:5887257		221001
Genoa R @ Wangarabell			221202
Genoa R @ The Gorge	400m d/s of the Dinner Ck junction 37/24.4 lat 149/31.4 lon	0	221210
Genoa R @ d/s Big Flat River junction			221216
Genoa R @ Gipsy Point			221217
WINGAN RIVER			
Wingan R @ Wingan Inlet National Park			221208
CANN RIVER			
Cann R West Branch @ Weeragua	180m u/stream of the Monaro H'way Bridge Lat 37/22.5 Long 149/11.9	153.956	221201
Cann R East Branch @ Chandlers Ck	A 2.5km ds of Chandlers Ck junction Lat 37/21.8 Long 149/12.1	153.956	221209
Cann R @ Cann River	6km d/s of Cann River township Lat 37/36.7 Long 149/8.0	0	221214
Bemm R @ Bemm River			221205
Bemm R @ Princes Highway	50m upstream of Princes Highway bridge on west bank, on Club Terrace Loop Road		221212
BEMM RIVER			
Combienbar R @ Combienbar			221211
Errinundra R @ Errinundra			221207
Bemm R @ Princes Hwy			221212

GAUGE LEVEL INFORMATION

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)
GENOA RIVER				
Genoa R @ Rockton (221001)	2011 Mar	3.10		
	2011 Jun	2.35		
	2000 Mar	1.98		
	2012 Mar 8	1.96		
	2012 Mar 1	1.83		
	2007 Jun	1.79		
	2012 Jun	1.71		
	2005 Jul	1.67		
Genoa R @ The Gorge (221210)		6.09	192,000	100
		5.47	163,000	50
		4.88	134,000	25
	1978 Jun	4.84	132,000	24
	Major	4.40	112,000	16
		3.97	94,500	10
	2011 Mar	3.71	82,558	
	1985 Nov	3.66	80,500	7
	1983 May	3.51	73,900	6
	1975 Jun	3.50	73,200	6
	1992 Dec	3.44	70,700	6
		3.32	65,300	5
	1998 Jun	3.20	60,100	5
	Moderate	3.20	60,026	
	1988 Jul	3.13		
	1988 Nov	3.12		
	2011 Jun	3.07		
	1983 Mar	3.03		
	1991 Jul	2.86		
	1973 Nov	2.85		
	1995 Nov	2.85		
	1985 Oct	2.79		
2012 Mar	2.73			
1974 Aug	2.68			
1976 Oct	2.68			
1978 Apr	2.67			
1985 Apr	2.66			
1990 Apr	2.58			
2007 Jun	2.54			
1984 Jul	2.53	34,000		
2012 Jun	2.33			
Minor	2.20	21,000	4	
WINGAN RIVER				
Wingan River @ Wingan Inlet National Park (221208)	1998 Jun	6.46		
	1985 Nov	6.09		
	1985 Oct	5.45		
	1991 Jul	5.40		
	1995 Nov	5.18		
	1992 Dec	4.95		
	2011 Jun	4.79		
	1989 Jul	4.59		
	1984 Jul	4.33		
	2012 Jun	4.24		

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)	
CANN RIVER					
Cann R East Branch @ Weeragua (Chandlers Ck) (221209)		5.85	48,100	100	
		5.06	38,300	50	
		4.37	29,500	25	
	1978 Jun	3.74	17,599		
		3.45	19,300	10	
	1983 Oct	3.43	14,793		
	1998 Jun	3.41	14,666		
	1983 May	3.22			
	1985 Sep	3.19			
	1974 Jun	3.08			
	2011 Jun	3.08			
	1983 Mar	2.84			
	Major		2.80	14,400	
			2.72	12,800	5
	1975 Jun	2.69			
	1985 Nov	2.68			
	1989 Jul	2.44			
1988 Nov	2.41				
1991 Jun	2.38				
1984 Jul	2.37				
1995 Nov	2.35				
2002 Apr	2.31				
Moderate		2.30	10,200		
	1992 Dec	2.30			
	2012 Mar	2.28			
	1985 Oct	2.26			
	2007 Jun	2.25			
	1973 Nov	2.23			
	1994 Apr	2.20			
	1978 May	2.12			
Minor		2.00	6,370		
Cann R West Branch @ Weeragua (221201)	1998 Jun	4.68			
	1978 Jun	4.46			
	2011 Jun	4.45			
	1971 Jan	4.29			
	Major		4.00		
	2012 Jun	3.54			
Moderate		3.50			
	2007 Jun	3.44			
	2012 Mar	3.44			
	2011 Jul	3.18			
	1985 Sep	3.11			
Minor		3.00			
Cann R @ d/s Cann River (221214)	1985 Sep	4.65	33,500		
	1985 Nov	4.36			
	1988 Nov	4.10			
	1983 May	3.90			
	1984 Jul	3.80			
	1983 Oct	3.27			
	1983 Mar	3.18			
	1985 Apr	3.08			

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)
BEMM RIVER				
Combienbar R @ Combienbar (221211)	1998 Jun	7.30		
	1978 Jun	5.21		
	1988 Nov	5.08		
	2012 Jun	4.93		
	1978 Apr	4.76		
	1985 Dec	4.41		
	2002 Apr	4.38		
	2011 Jun	4.34		
	1995 Oct	4.31		
	2011 Jul	4.24		
	1985 Nov	4.23		
	2012 Mar	4.22		
	Errinundra R @ Errinundra (221207)	1998 Jun	6.05	
2012 Jun		4.81		
1978 Jun		4.73		
2002 Apr		4.58		
2012 Mar		4.21		
1988 Nov		3.99		
2007 Nov		3.84		
1985 Oct		3.74		
1978 Apr		3.51		
1985 Nov		3.46		
1969 Jun		3.38		
1974 Jun		3.32		
Bemm R @ Princes Highway (221212)		1998 Jun	18.39	
	1978 Jun	15.11		
	2012 Jun	14.76		
	2011 Jul	13.10		
	1985 Oct	12.57		
	1995 Nov	12.54		
	2011 Jun	12.35		
	2002 Apr	12.25		
	1985 Sep	11.96		
	2012 Mar	11.85		
	1992 Dec	11.28		
	1975 Jun	11.21		
	1991 Jun	11.01		
	1975 Jun	11.21		
	1984 Jul	10.89		
	1983 May	10.74		
2007 Jun	10.16			

APPENDIX B.01 –FLOOD PEAK TRAVEL TIMES

- | Travel times are calculated as the time the peak of the event takes to move from one gauge to the next. Note the onset of flooding can occur before the peak water level occurs.
- | It is possible for flooding to commence at downstream locations prior to peak heights being reached in the upper parts of the catchment due to both locally heavy rainfall and the backwater effects mentioned earlier.
- | Due to the high level of variability in antecedent catchment conditions, flood travel times can vary significantly, as demonstrated in previous floods.
- | Travel times listed here are **INDICATIVE ONLY** and are **HIGHLY VARIABLE**.

THERE IS INSUFFICIENT GAUGE INFORMATION TO PROVIDE TRAVEL TIMES

APPENDIX D.07 – EVACUATION ARRANGEMENTS

The Incident Controller may make the decision to evacuate an at-risk community. Evacuation is the responsibility of VICPOL and will be conducted as per the EMMV and the MEMP.

APPENDIX E.07 - FLOOD WARNING SYSTEM

GENOA RIVER

The Bureau of Meteorology provides warnings for the Genoa River @ The Gorge gauge, which is approximately 40km upstream of Mallacoota. There is no flood warning system for flooding caused by estuarine conditions.

CANN RIVER

The Bureau of Meteorology provides warnings for Cann River East Branch @ Chandlers Creek and Cann River West Branch @ at Weeragua. Both of these gauges are approximately 30 km upstream of the town of Cann River and neither gauge monitors the combined flow of the east and west Cann River branches.

BEMM RIVER

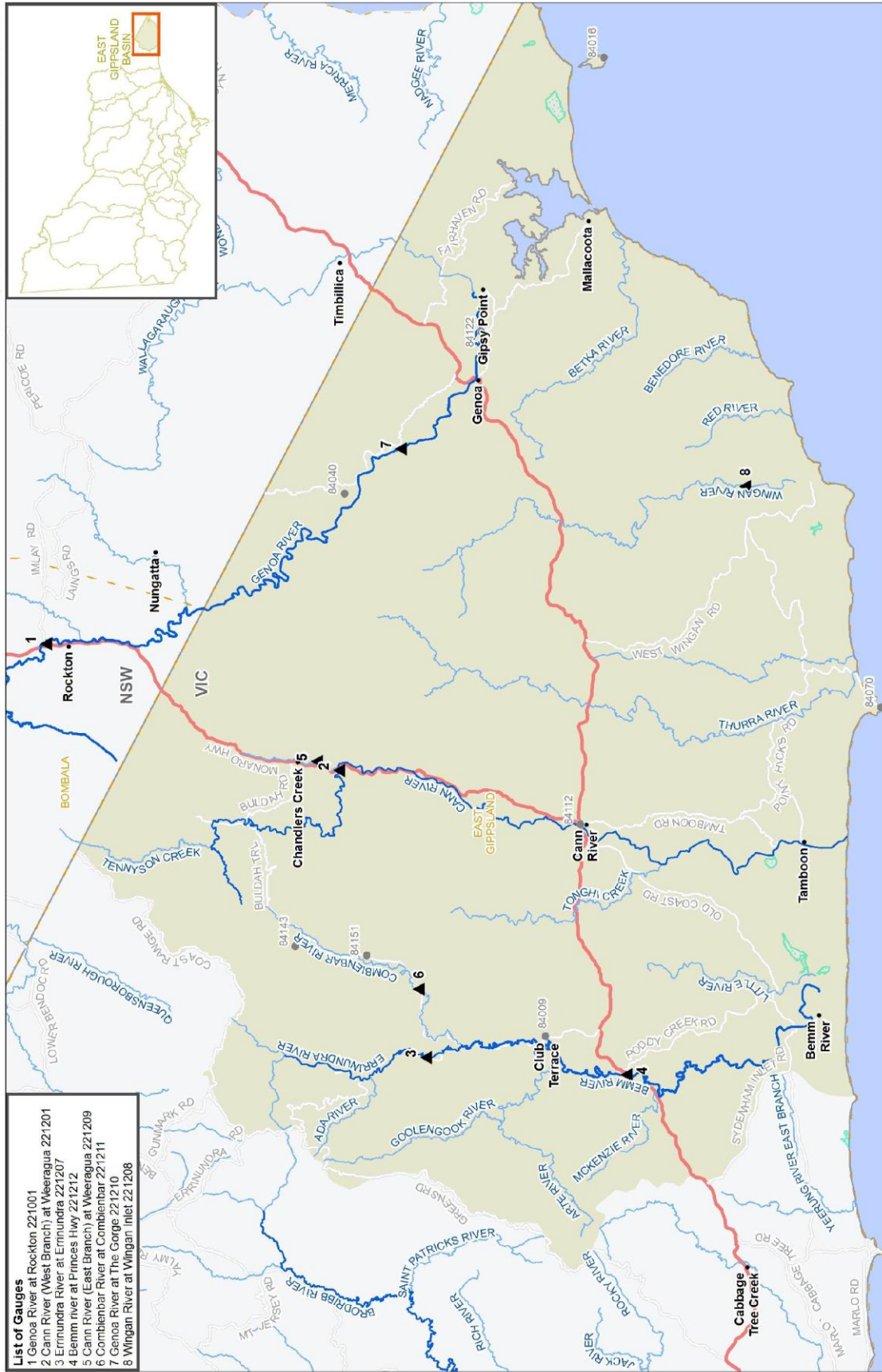
There is no flood warning system for the Bemm River.

APPENDIX F.07 – MAPS

- | Eastern Rivers (East Gippsland Basin) Catchment Map
- | Genoa River Catchment Map
- | Cann River Catchment Map
- | Bemm River Catchment Map

EASTERN RIVERS (EAST GIPPSLAND BASIN) CATCHMENT MAP

Cann, Bemm and Genoa River Catchments



- List of Gauges**
- 1 Genoa River at Rocklton 221001
 - 2 Cann River (West Branch) at Weeragaa 221201
 - 3 Ernundra River at Ernundra 221207
 - 4 Bemm river at Princess Hwy 221212
 - 5 Cann River (East Branch) at Weeragaa 221209
 - 6 Combenbar River at Combenbar 221211
 - 7 Genoa River at The Gorge 221210
 - 8 Wangan River at Wangan Inlet 221208

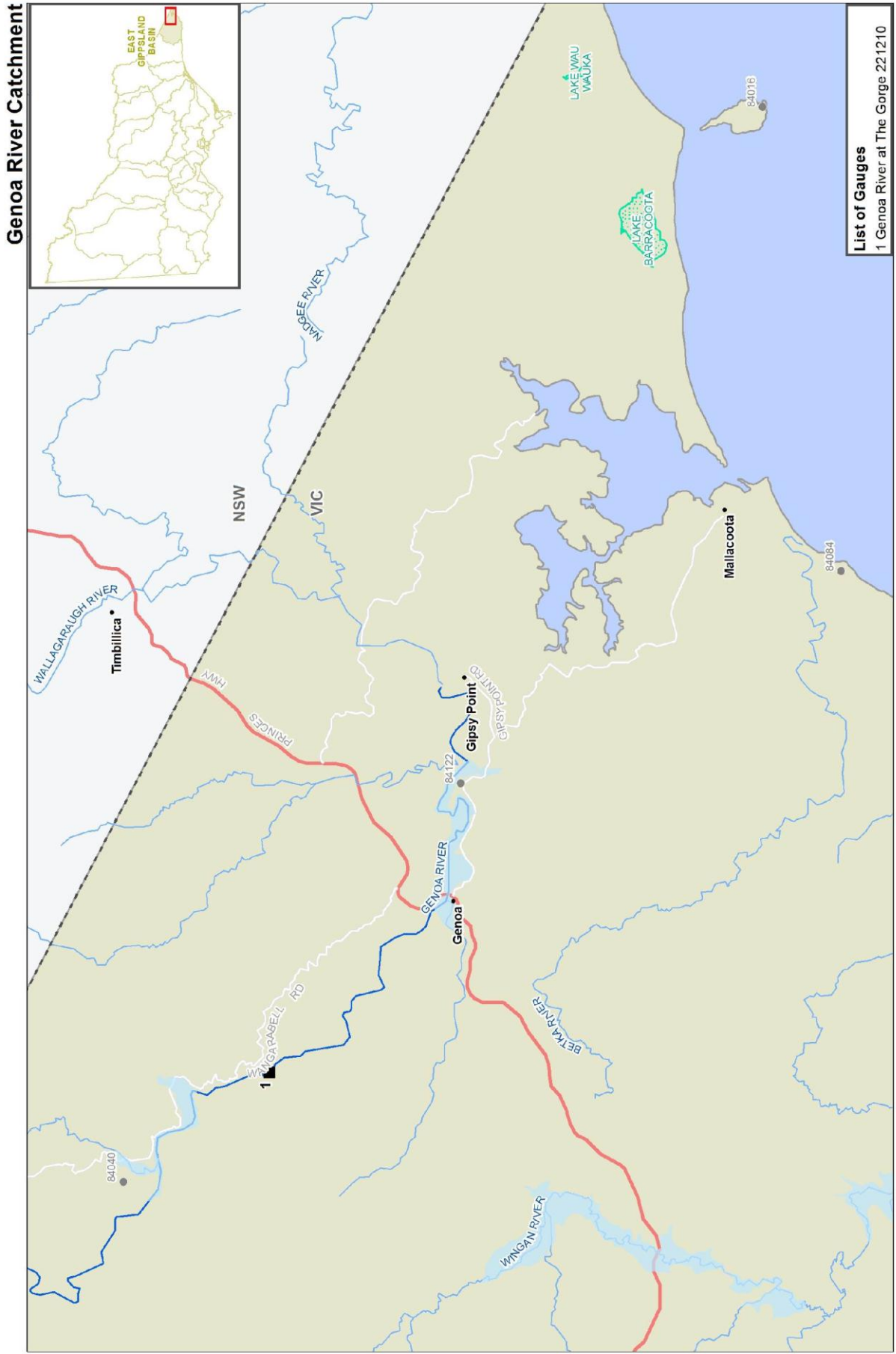
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SES
 STATE EMERGENCY SERVICES
 AUTHORITY

- Legend**
- ▲ River Gauge
 - Rain Gauge
 - Township
 - Major Road
 - Secondary Road
 - Major River
 - River/Creek
 - Coastline
 - Cann, Bemm and Genoa River Catchments
 - Lake/Swamp
 - LGA Boundary
 - Ocean

Scale at A4
 Kilometers
 0 5 10 20
 1:450,000

GENOA RIVER CATCHMENT MAP



Genoa River Catchment

List of Gauges
1 Genoa River at The Gorge 221210

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2012. VCMMap data sourced from DSE, November, 2012.

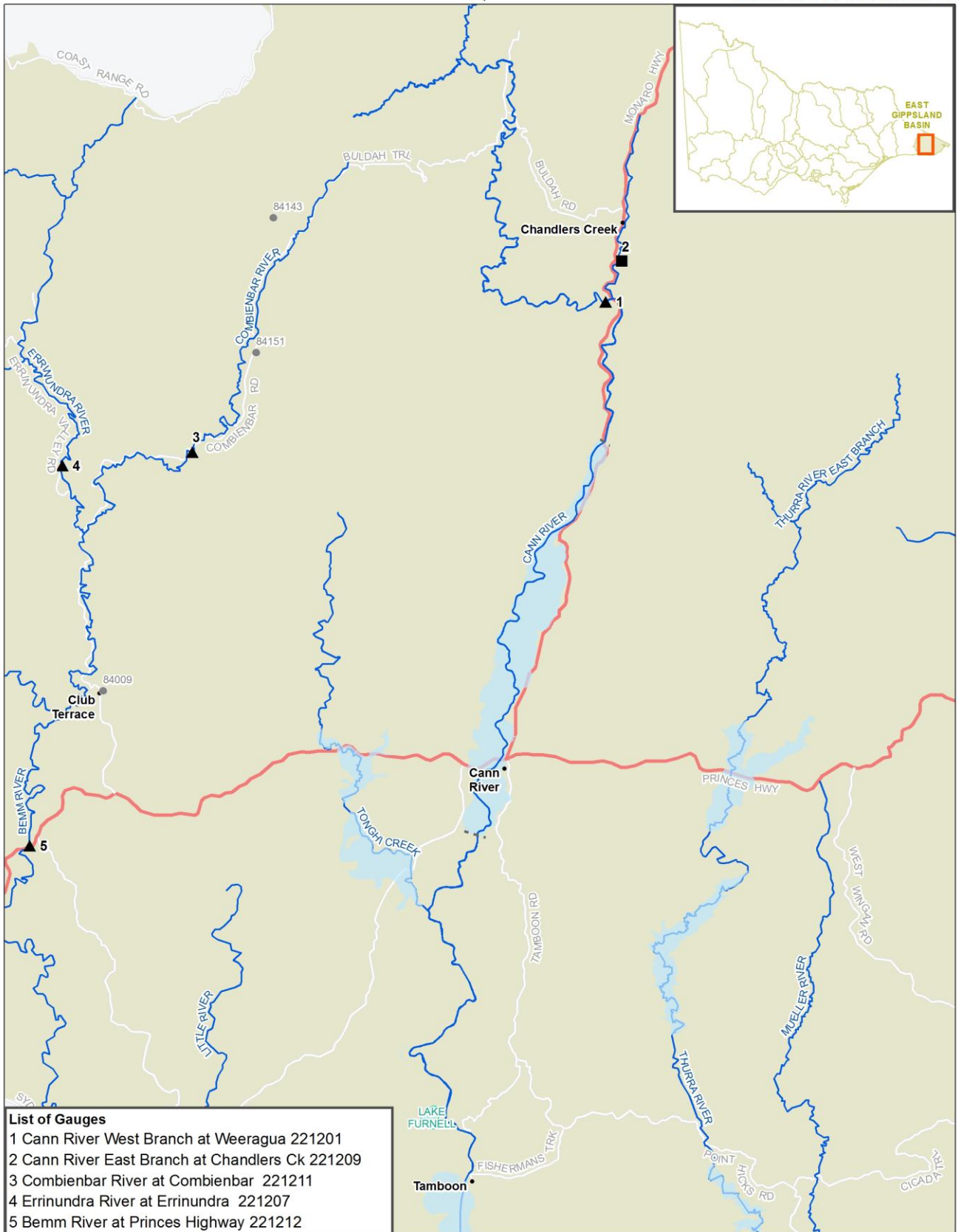


- Major Road
- Secondary Road
- State Border
- Major River
- River/Creek
- Coastline
- Combined Gauge
- Rain Gauge
- Township
- 1% AEP Flood
- Genoa River Catchment
- Lake/Swamp
- Ocean

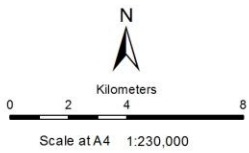


CANN RIVER CATCHMENT MAP

Cann River Catchment



- List of Gauges**
- 1 Cann River West Branch at Weeragua 221201
 - 2 Cann River East Branch at Chandlers Ck 221209
 - 3 Combiobar River at Combiobar 221211
 - 4 Errinundra River at Errinundra 221207
 - 5 Bemm River at Princes Highway 221212



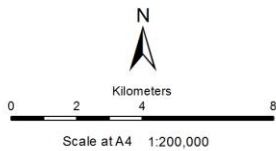
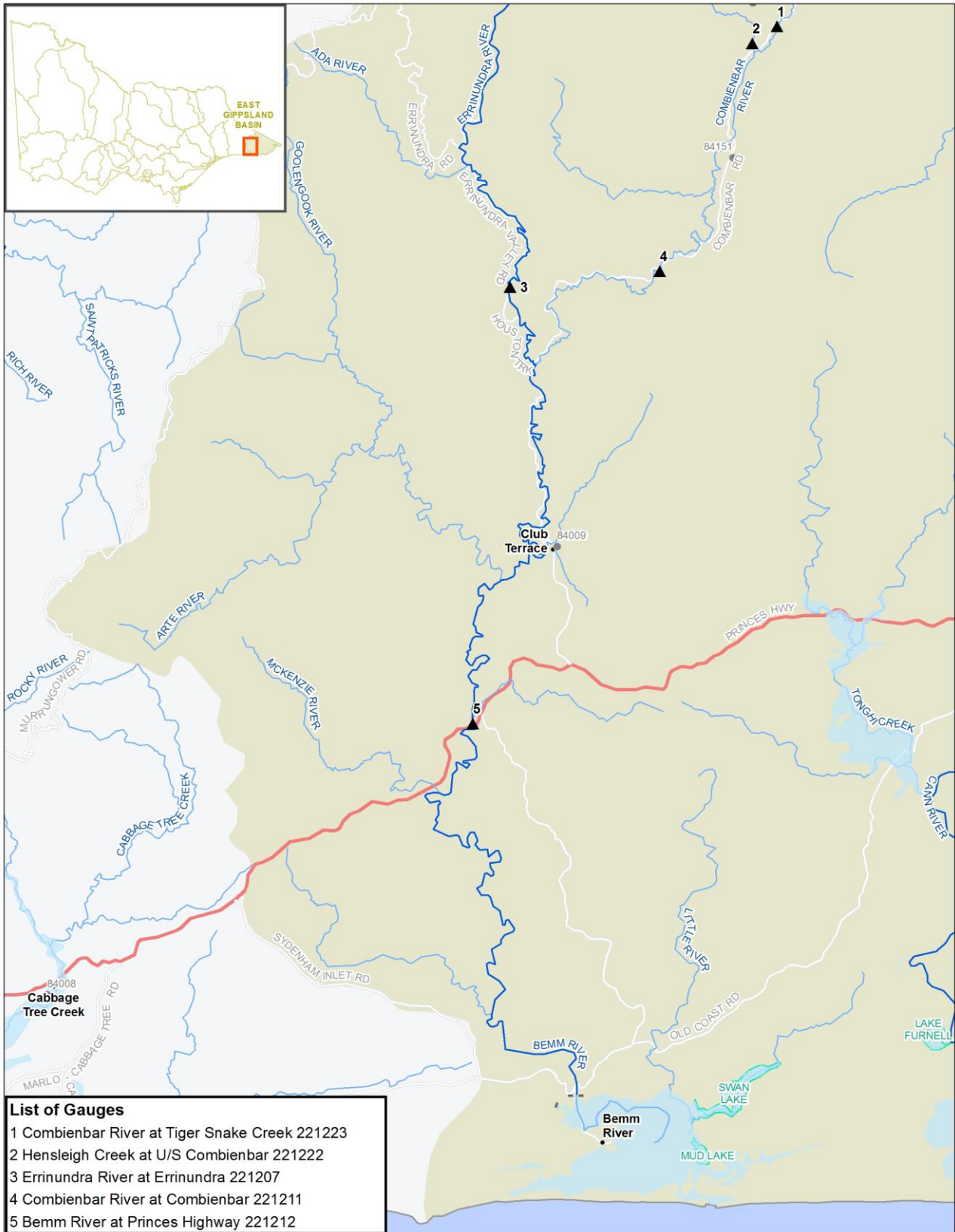
- Combined Gauge
- ▲ River Gauge
- Rain Gauge
- Township
- Rail Line
- Major Road
- Secondary Road
- - - Extent of Flood Data
- River/Creek
- Coastline
- 1% AEP Flood
- Cann River Catchment
- Lake/Swamp

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BEMM RIVER CATCHMENT MAP

Bemm River Catchment



- ▲ River Gauge
- Rain Gauge
- Township
- Major Road
- Secondary Road
- - - Extent of Flood Data
- Coastline
- Major River
- River/Creek
- 1% AEP Flood
- Bemm River Catchment
- Lake/Swamp
- Ocean

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EAST GIPPSLAND CATCHMENT MANAGEMENT AUTHORITY

SNOWY RIVER

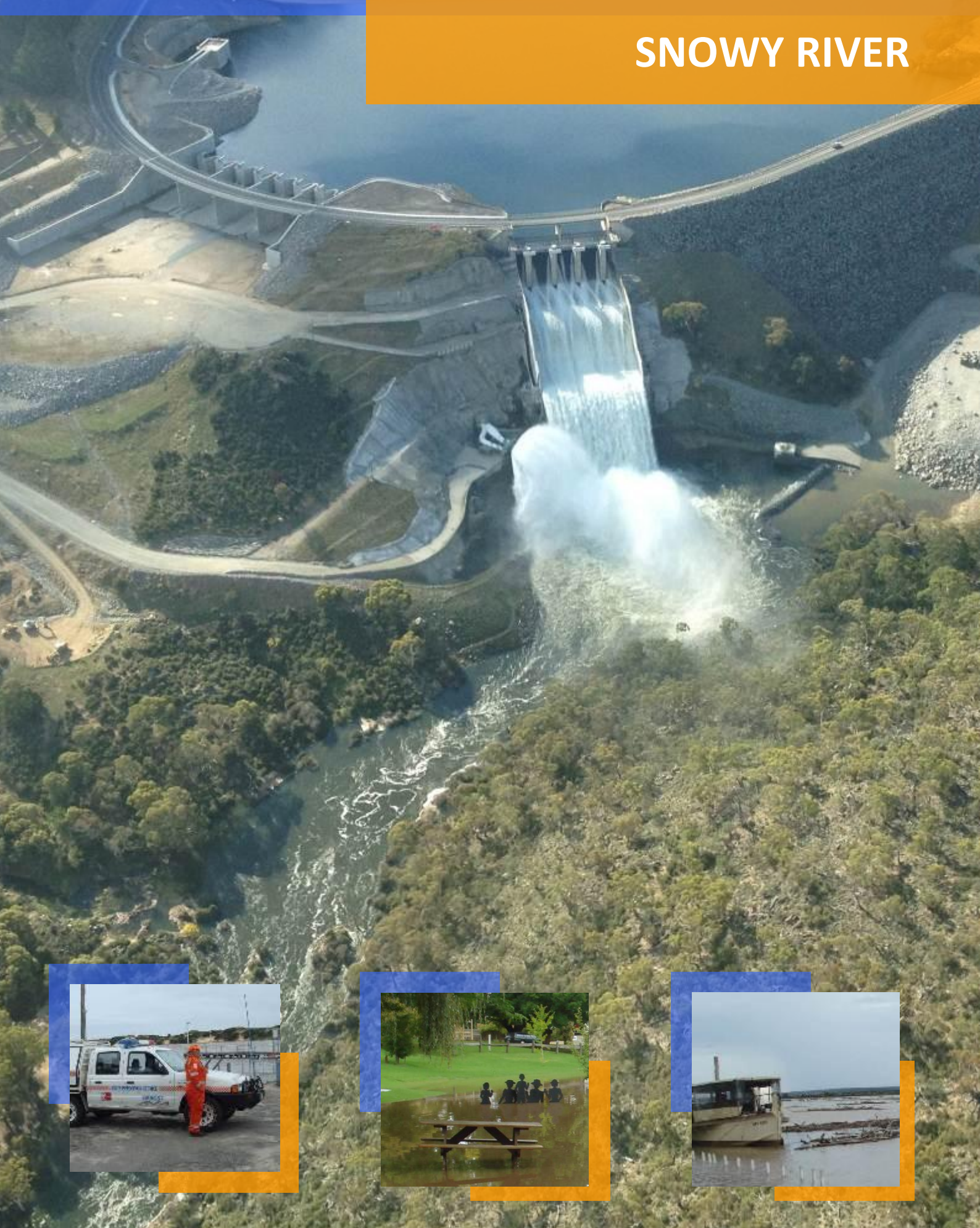


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- | Bonzle.com
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- | <http://www.egcma.com.au/file/Catchment%20Goal%204%20-%20Week%202.pdf>
- | The Australian, March 14, 2012-05-08”

ACCURACY & CONFIDENTIALITY

Use this information as a guide to the possible effects of a flood. This card is based on estimates of flood behaviour and particular effects may occur at heights different from those indicated here. They may also occur at slightly different heights in different floods. This card may contain sensitive information about the effects of flooding on private property. Specific reference to private addresses or businesses must be made directly to owners or other emergency services but not via broadcast or print media.

APPENDIX A.04 – FLOOD THREATS

OVERVIEW OF RIVER SYSTEM

WEATHER PATTERNS

Low pressure weather systems off the NSW south coast (east coast lows) often cause heavy rain in the Snowy River catchment, as do low pressure weather systems entering the catchment from central Australia.

East Coast Lows are generally associated with gale force southeast winds which can be followed by a change which brings strong to gale force southwest winds, these can give rise to storm tides in Bass Strait which, when coinciding with peak flood flows coming down the river, can further exacerbate the effects of a major flood event.

THE ORIGIN OF THE SNOWY RIVER

Originating on the slopes of Mount Kosciuszko, the Snowy River has a catchment of nearly 16,000km² (nearly 12,000km² below Lake Jindabyne), drops approximately 1840m over its total 403km length and has more than 50 tributaries. The Snowy River makes its way from the Alps through three major dams and relatively inaccessible national parks and private land in both NSW and Victoria before breaking out into floodplains near Orbost in Victoria and joining Bass Strait at Marlo.

The Snowy can be broadly divided into five parts:

- **Mountain Rivers;**
- **Lake Jindabyne;**
- **Monaro Reach;**
- **The Escarpment;** and
- **Lower Snowy Floodplain.**

MOUNTAIN RIVERS

The Mountain Rivers section (headwaters to Lake Jindabyne) begins in the Kosciuszko National Park where the highest annual rainfall (up to 3,800mm) occurs on the mountain peaks in the form of winter snow. The main tributaries in this section are **Eucumbene, Thredbo, Gungarlin & Mowamba Rivers** and **Wullwye Creek**. Almost all of the water that would normally flow to the coast is collected and stored by the Snowy Mountains Hydroelectric Scheme (completed 1974) and then diverted via trans-mountain tunnels and power stations and released into the Murray and Murrumbidgee Rivers.

LAKE JINDABYNE

Under natural conditions the Snowy River experienced a number of floods each year that could occur at any time, although more frequent in the spring when rainfall coincided with snowmelt. After the construction of the Snowy Scheme, flows were reduced to 1% of normal flow at Jindabyne.

In 2006 a new spillway was constructed to allow for planned releases into the Snowy below Jindabyne to mimic the snow melt season. The first spring melt release occurred in November 2010 with a peak discharge of 3,080ML per day, the second release in November 2011 had a peak discharge of 12,000ML per day which triggered a Minor Flood at Orbost.

During the March 2012 flood event, Jindabyne could not contain inflows and released floodwaters into the Snowy, increasing flood impact downstream at Orbost. A further release occurred after the flood event to reduce flooding impact around Lake Jindabyne. These are discussed later under **Historical Flood Events**. A Jindabyne lake level calculator is provided on line at <http://www.snowyhydro.com.au/lakeLevels.asp?pageID=360&parentID=6>

MONARO REACH

The Monaro reach (between Jindabyne Dam and upstream of the Delegate River) is in a rain shadow and experiences a mean annual rainfall of 500 mm, increasing to 800 mm at the coast. The main contributing tributary in the Monaro reach is the **Maclaughlin River** which includes **Cooma Airport** and **The Hut** rainfall gauges.

THE ESCARPMENT - Major floods in the lower Snowy are generated in this zone.

The Escarpment (large tract of land stretching between the Delegate River to upstream of the Buchan River) is thinly populated and mainly covered in forest reserves and National Parks.

The main tributaries in this zone are **Delegate, Suggan Buggan, Deddick** and **Rodger Rivers**.

The **Delegate River** (2,687km² catchment) contributes approximately 30% of the current mean annual flow to the Snowy. It rises on the northern slopes of the Errinundra Plateau in Victoria and flows north into NSW, receiving water from several tributaries including **Haydens Bog Creek (Bendoc)** and the **Bombala River (Bombala)** before travelling through **Delegate** and heading south, joining the Snowy River from the east.

The **Suggan Buggan River** rises in a wilderness area near the NSW / Victoria border before flowing through **Suggan Buggan** and joining the Snowy River from the west, downstream of Willis.

The **Bonang River** runs through **Bonang** before joining the **Deddick River** which flows through **Tubbut** and joins the Snowy River from the east, upstream of McKillops Bridge.

The **Rodger** and its tributary the **Yalmy River** join the Snowy River from the east below McKillops Bridge.

LOWER SNOWY FLOODPLAIN

In the lower reaches of the Snowy River catchment (Buchan River to the river mouth) the larger tributaries have a distinctly different flow regime to the snow melt rivers of the alps. They are dominated by winter rainfall with peak flows being experienced June through July and are far more variable and unpredictable.

The main tributaries in this section are the **Buchan and Brodribb Rivers** and **Ewings Marsh**.

The **Buchan River** (1214km² catchment- including Murrindal River) travels through the township of **Buchan** before joining the Snowy River from the west downstream from **Basin Creek**. The BoM operates a flood warning service for the Buchan River.

Downstream of the Buchan River, the Snowy changes from riverine to estuarine as it passes through the rural areas of **Jarrahmond** and **Orbost** (population 2,452) and makes its way towards the confluence with the **Brodribb River**.

The **Brodribb River** rises in the Errinundra National Park, through the town of **Goongerah**, crosses the Princes Highway 10kms east of Orbost, travels through **Lake Curlip** and joins the Snowy from the east.

Below the confluence with the **Brodribb River**, the river forms an intermittently closed and open coastal lagoon which is subject to tidal inflow and inputs from **Lake Corringe** and **Ewings Marsh** to the west.

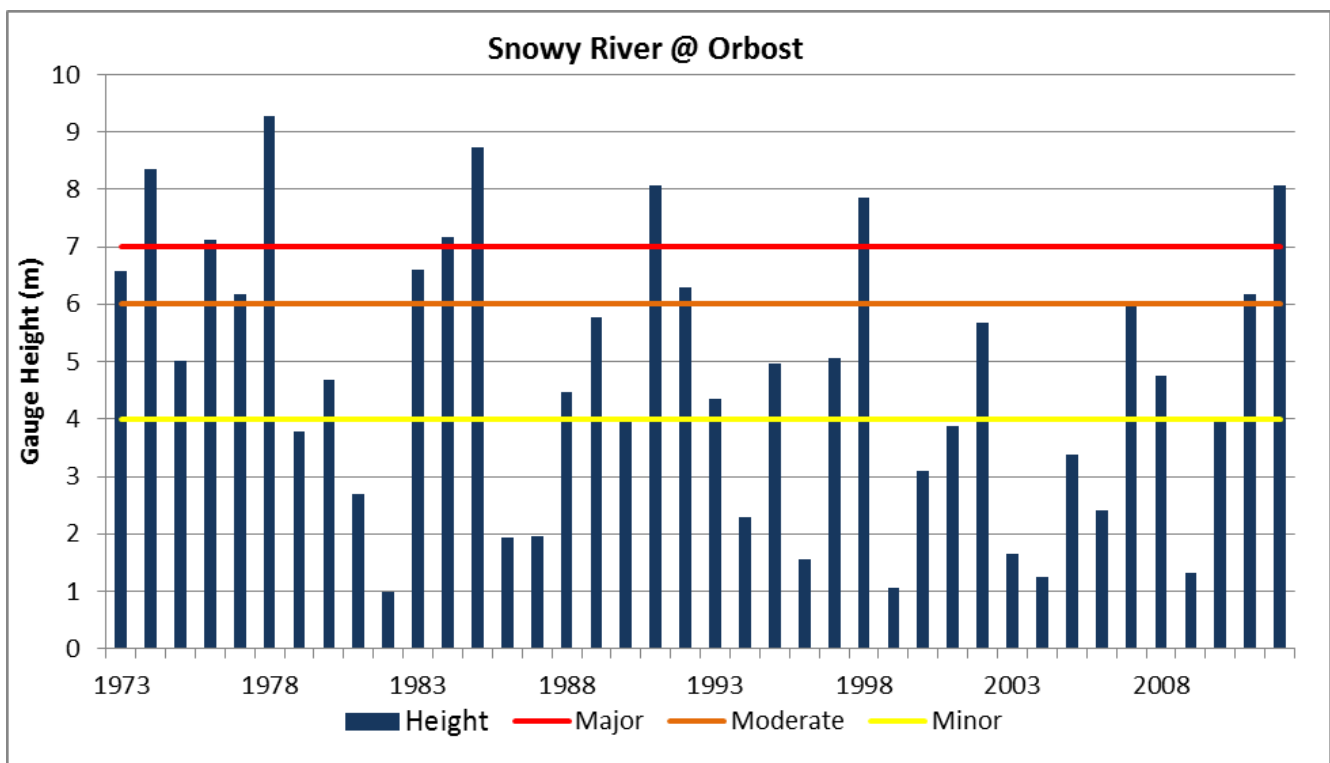
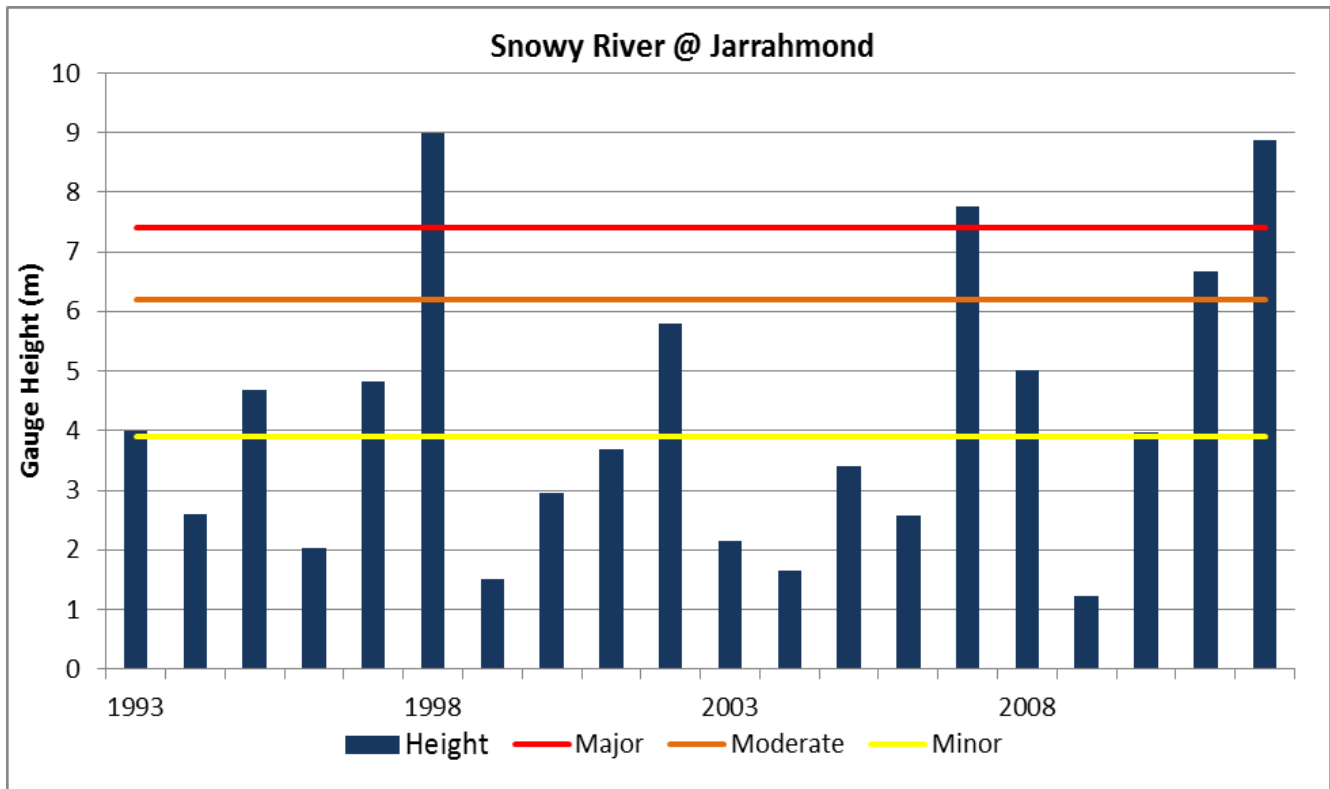
Ewings Marsh (415km² catchment) has four tributaries (Hartland River and Hospital, Dinner and Simpsons Cks) and flows into **Lake Corringe** via **Corringe Creek**. It can contribute significant flows to the Snowy. During moderate to major flood events floodwater can back up along **Corringe Creek** to affect Ewing Marsh.

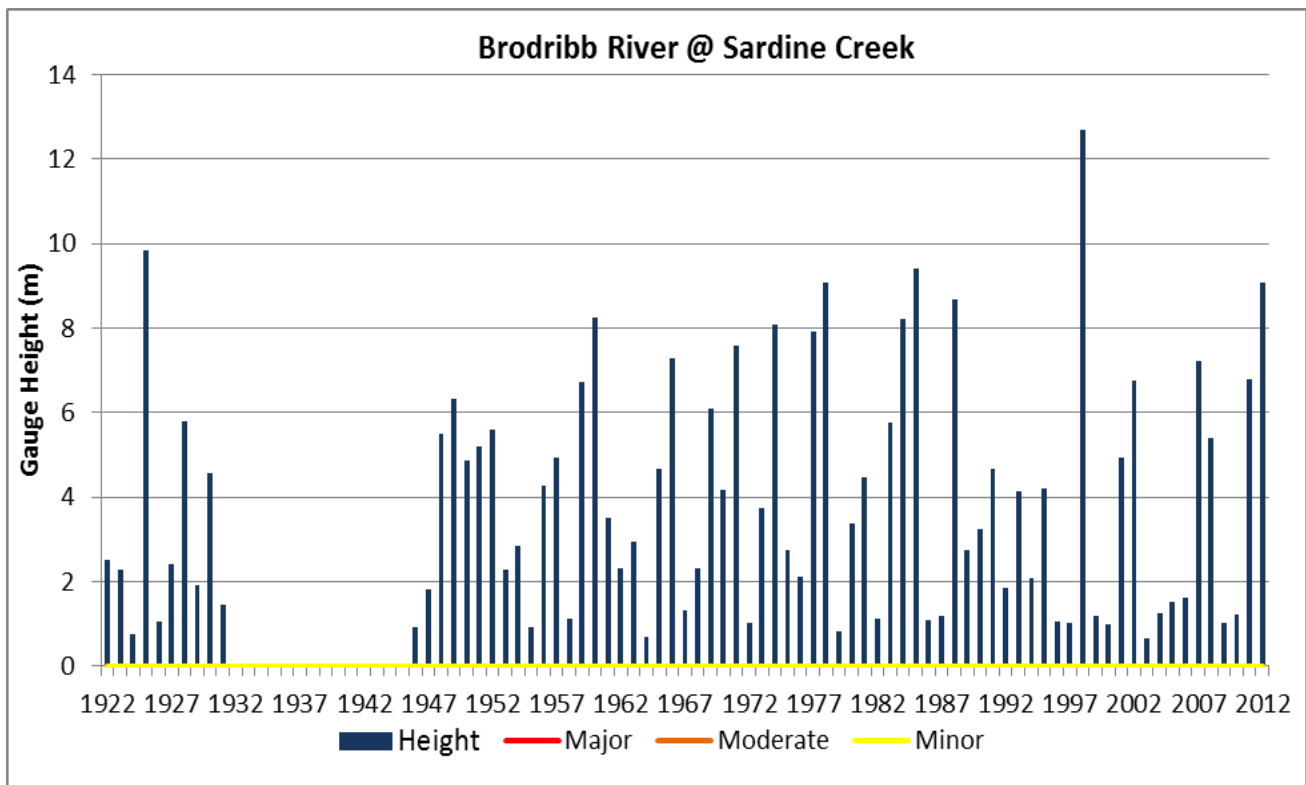
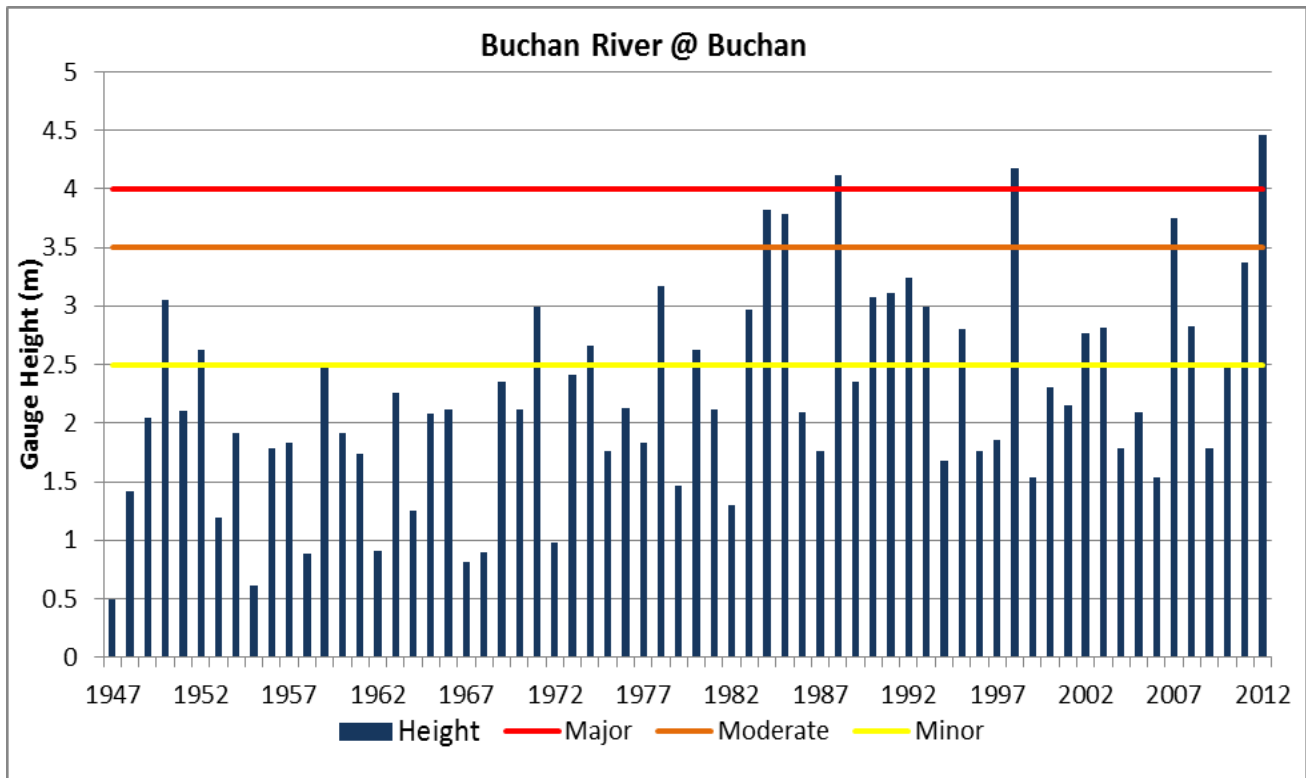
The nature of flooding in the lower snowy river is very dependent upon where the main rainfall occurs within the different catchments. The largest flood on record occurred in 1971 (100 yr ARI). The main rainfall during this event occurred over Escarpment and Mountain Rivers sections of the catchment. During the 1998 flood event (100yr ARI Brodribb – 50yr ARI lower Snowy) rainfall occurred mainly over the Lower Snowy section, particularly the Brodribb River.

There are many constructed levees at low points (gulches) in the lower Snowy to prevent flooding on the fertile floodplain areas and many channels were built to drain farmland and wetlands.

FLOOD RISKS

FLOODING FREQUENCY – MEAN ANNUAL GAUGE HEIGHTS





RURAL FLOOD RISK

- **Snowy River** – Orbost township and low lying areas around Orbost, Deddick Valley, Wulgulmerang East, Bete Belong North, Jarrahmond, Newmerella
- **Suggan Buggan River** – low lying areas around Suggan Buggan
- **Buchan River** – Buchan township and low lying areas around Wulgulmerang West and Buchan
- **Snowy River Estuary** - Marlo township and low lying areas in the flood plain and estuary downstream of Orbost

HEALTH & ENVIRONMENTAL RISKS

There are many septic tanks in the rural areas that may be inundated by floodwaters and farm chemicals stored in farm sheds on the floodplain.

PROPERTIES AT RISK

The table below is a breakdown of the number of properties impacted in a 1% AEP riverine event. These figures are **indicative only** and based on a mixture of actual impacts during historical events which were less than the 1% event and mapping. Any revisions will **increase** the number of properties.

River	Community	# properties flooded in 1% AEP				
		Residential	Business	Industrial	Rural	Total
Snowy River	Bendoc	0	0	0	0	0
	Bonang	0	0	0	0	0
	Delegate River	0	0	0	15	15
	Corringle	0	0	0	15	15
	Bete Belong	0	0	0	38	38
	Marlo	17	0	0	34	58
	Newmerella	1	0	0	47	48
	Jarrahmond	0	0	0	47	47
	Orbost	2	3	0	114	119
Buchan River	Gelantipy	0	0	0	0	0
	Murrindal	0	0	0	0	0
	Buchan	50	0	0	13	63
Brodribb River	Cabbage Tree	0	0	0	20	20
	Brodribb River	0	0	0	21	21
Total		70	3	0	364	437

HISTORICAL FLOODS

Periods of heavy rain leading to major flood events can occur in East Gippsland at any time of the year.

Significant floods have occurred in the Snowy Catchment as shown in the table below. Impacts of significant events are discussed below the table. NB there are other Minor and Moderate flood events that are not yet included.

EVENT	Dalgety Weir	Delegat R @ Quidong	Burnt Hut Crossing	Suggan Buggan	Mckillops Bridge	Basin Creek	Buchan	Jarrahmond	Orbost
1952 Feb				-	-	-	0.21	-	9.49
1971 Feb		8.64		4.31	13.59	-	4.13	12.12	9.96
1973 Nov				1.61	5.04	-	2.41	5.98	6.57
1974 May		3.51		1.29	-	-	2.36	7.67	6.85
1974 Jun				2.05	-	-	2.66	7.90	6.96
1974 Aug				3.83	-	-	2.26	8.09	8.34
1974 Oct				2.63	-	-	1.98	6.06	6.24
1975 Jun		2.71	8.02	2.56	7.43	-	1.76	7.97	7.49
1976 Oct		1.85	6.34	3.40	6.12	-	2.13	7.56	7.13
1977 Jul				1.92	3.82	-	1.83	6.50	6.17
1978 Apr				2.38	2.37	-	2.57	7.16	7.01
1978 May		1.75	6.26	2.28	6.82	-	1.03	6.64	6.23
1978 Jun		7.38	11.69	3.46	10.58	-	4.53	10.84	9.28
1983 Mar		2.37	7.79	2.08	5.75	7.57	1.54	6.90	6.22
1983 May				2.45	5.51	6.37	2.72	7.06	6.61
1984 Jul				2.46	5.43	6.31	3.82	7.35	7.17
1985 Oct				2.81	5.25	5.98	3.68	6.59	6.32
1985 Nov		2.16	6.69	2.87	6.34	7.13	3.79	7.92	8.38
1985 Dec				2.29	3.60	6.41	3.76	8.25	8.74
1988 Nov				2.46	4.69	5.80	4.12	7.85	7.30
1991 Jun		1.67	8.21	2.94	7.67	9.14	2.59	8.98	7.75
1991 Jul			8.93	2.87	8.07	9.70	3.11	9.07	8.07
1992 Dec				3.24	4.75	5.67	3.24	6.57	6.29
1998 Jun	1.04	1.26	4.85	2.73	3.23	6.81	4.18	9.06	7.85
2007 Jun	0.99	2.08	4.42	2.41	5.43	6.38	3.75	7.75	7.10
2011 Mar	0.99	3.25	7.35	7.95	7.03	6.87	1.63	6.66	6.07
2011 Jul	0.97	1.32	2.21	2.43	2.53	4.82	3.37	6.48	6.18
2012 Mar 1-3	4.34	3.33	6.93	-	7.48	8.13	3.48	8.87	8.07
2012 Mar 8-10	2.95	1.86	5.70	-	5.75	6.50	3.55	7.50	7.34
2012 Jun				3.97	4.97	6.35	4.45	8.38	7.79
Major					8.00	6.60	4.00	7.40	7.00
Moderate					6.00	5.50	3.50	6.20	6.00
Minor					2.50	3.50	2.50	3.90	4.00



SNOWY, TEN MILES WIDE, REACHES FOR 400 HOMES

The Argus, Wed, June 18, 1952

Hundreds of terrified Orbost families are fleeing before the roar of the raging Snowy River in the worst flood in the district's history." Late last night weary police and volunteers were battling desperately against the Snowy - now 10 miles wide - to rescue marooned families.

At Orbost 400 men, women, and children have been flooded out. About half of them were rescued by two Army "ducks" and improvised rafts.

THE ROAR OF THE SNOWY CAN BE HEARD FIVE MILES AWAY

At 11 p.m. Orbost police station said: "It's desperate down here. . . . The whole town has turned out to fight the flood. . . . Can't talk any-more . . . the line is open ' only for emergency calls."

Stories of terror, destruction, and misery were being, told in the streets of Orbost late into the night.

The bellowing of drowning sheep and cattle could be heard a few miles away.

Some farms are inundated to a depth of 25ft., and west of Orbost the Princes High way is covered by 10ft. of water for three miles.

The main bridge across the river at Orbost was trembling with the rush of water last night.

Nearly half of Orbost rail way station is washed away. The stationmaster and four members of his staff were rescued by police.

Many of the families rescued yesterday were last night huddled together in barn lofts. Some of them had carried light furniture and valuables with them the only possessions they saved.

MAN TRAPPED

Fears are held for the safety of a married man who has been trapped in the ceiling of his home on the out- skirts of Orbost for two days.

Police have tried several times to reach the house by "duck," but have been forced to turn back each time rather than risk their lives in the churning water.

Only the roof of the house was above water yesterday, and the floods were still rising.

Police would not disclose the man's name last night, but said his wife left the home two days ago after being warned of the acute danger.

It is not known whether the man has food supplies.

2007 FLOOD EVENT

WEATHER SYSTEM

By early morning Friday 20th April, a low pressure centre had developed over western NSW which intensified and moved to the southeast locating just off the far south NSW coast by early morning Saturday 21st April. At this stage a strengthening and extremely moist south easterly airstream had extended across Gippsland to the Great Dividing Range and intense rainfall had commenced. The intense rainfall persisted for a period of 35 to 48 hours over a substantial part of the area.

FORECASTS

Indications on Friday 20th April were that prolonged and heavy rain would be required to overcome the dry state of Gippsland catchments. In addition, the low flows observed in Gippsland streams over the preceding weeks suggested substantial runoff would be needed to cause rivers to rise to flood level.

Although rain with local heavy falls was the main theme of meteorological forecasts and outlooks issued for Gippsland on the Friday, it was considered the dryness of catchments would lessen the likelihood of immediate flooding from even moderately heavy rain.

IMPACTS

In the last week of June 2007, Gippsland received record rainfall associated with an intense low pressure system. The storm followed one of the state's worst fire seasons, the 2006/07 Great Divide Bushfires, when 1.2 million hectares were burnt and vast areas of soil were exposed. Further compounded by other minor floods in March and November 2007, the storm in June 2007 resulted in major flooding and widespread damage to community and public assets in Gippsland. The upper parts of the Snowy River catchment experienced minor flooding while the Buchan River and the lower reaches experienced moderate flooding, with the exception of the area around Jarrahmond where the river exceeded the major flood level by around 300mm.

MARCH 2012 EVENT

The 2012 event is a combination of two consecutive rain events combined with Jindabyne Dam reaching capacity and spilling, followed by a managed spill from Jindabyne to relieve flooding impacts around Lake Jindabyne. In just six days, the inflows into the Snowy catchment accounted for nearly as much water as all the rain that fell in the whole of the drought-hit year of 2006. Over the course of this month, the Snowy has experienced what experts say is a one-in-500-years flood, turning the lower river into a torrent.

RAINFALL

High rainfall totals were experienced widespread across the catchment as per the table below.

	THREDBO	KHANCOBAN	JINDABYNE	COOMA	BOMBALA	DELEGATE	BONANG	BUCHAN	GELANTIPY	BASIN CK	ORBOST
28 Feb	36	28	0	5	5	9	19	15	31	18	7
29 Feb	26	23	48	30	19	13	7	4	5	4	4
01 Mar	78	72	*	0	0	62	31	64	49	76	35
02 Mar	110	30	40	45	56	63	60	51	65	76	34
04 Mar	157	42	38	20	14	20	13	11	11	14	12
07 Mar	2	4	9	1	13	11	7	9	17	15	5
08 Mar	19	4	0	6	40	20	27	18	22	43	10
09 Mar	18	11	19	16	37	19	29	35	38	42	31
16 Mar	20	5	0	2	0	0	0	3	5	2	4
17 Mar	43	8	7	4	15	21	26	16	23	31	19

JINDABYNE

The latest flood has filled Lake Jindabyne to capacity and seen the dam overflow, the first time it had spilt due to a flood since 1974.



The Snowy River, left, after an environmental flow release in October 2011 and, right, the river in flood in March.

MAJOR WATER STORAGES

Name	Location	Capacity	Outflow	Operator
Jindabyne Reservoir		690,000 ML	Hydro Electric	Snowy Hydro
Guthega			Hydro Electric	Snowy Hydro
Island Bend			Hydro Electric	Snowy Hydro
Eucumbene			Hydro Electric	Snowy Hydro

Snowy Mountains Control Centre – 02 6453-2484 / 2485

<http://www.snowyhydro.com.au/lakeLevels.asp?pageID=360&parentID=6>

LEVEES

Name	River	Location	Condition	Operator
Bete Belong Levee	Snowy			
Gilberts Gulch Bank	Snowy			
Lynns Bank	Snowy			
Lynns Gulch Bank	Snowy			
Nixons Bank	Snowy			
Radwell	Snowy			
Russell Bank	Snowy			
Trewins Bank	Snowy			

MAJOR ROAD CLOSURES

Riverine Flooding	Flash Flooding
<p>Princes Hwy – to the west of the Snowy River bridge</p> <p>Princes Hwy – Cabbage Tree Creek</p> <p>Orbost Marlo Rd</p> <p>Buchan Orbost Rd, Bete Belong – bet. Deaseys cutting & Reeves Rds</p> <p>Ambyne Rd – lower end on the Deddick River</p> <p>Hayden's Bog Rd – bet. Delegate (NSW) and Bendoc (VIC)</p> <p>Snowy River Rd, Suggan Buggan –</p> <p>Aberdeen Rd, Goongerah - bet. Bonang Rd & Bonang Rd</p>	

RURAL ROAD CLOSURES

Road	Nearest River	Description
Kirkenong Road		Delegate River east
Hospital Creek		On road to Wairewa near Bills Creek
Buchan Orbost Rd	Buchan River	Road closed at Bete Bolong
Buchan Jindabyne Rd	Suggan Buggan	Depth to 1m. At bridge. Once every 3-4 years.
Buchan Jindabyne Rd	Gelantipy Ck @ Butchers Ridge	Depth of 30-750mm. At Butchers Ridge (just below Karoonda Park Roadhouse) and at the bridge over the Suggan Buggan River. Once a year.
Buchan South Rd	Tea Tree Ck	Depth to 300mm
Buchan Bruthen Rd	Tea Tree Ck	Depth to 600mm
Buchan Bruthen Rd	Canni Ck	Depth to 600mm across road, 100mm length of road affected.
Buchan Bruthen Rd	Boggy Ck	Depth to 600mm. Worst at Buchan end at gully crossing. Flooded for length of 800mm. Very fast flowing. Severe danger. Vehicles washed off road. May last 2 to 3 days.
Buchan Orbost Rd	Buchan R	Flood depth to 100mm over road. Once every 5 years.
Buchan Orbost Rd in Buchan	Buchan R	Flood depth to 300-450mm over road.
Buchan Timbarra Rd	Buchan R	Road cut at Timbarra

DISRUPTION TO SERVICES

The communities of Bendoc and Bonang generally associate with the township of Delegate across the border in NSW. Many only receive radio and tv transmissions from NSW and have NSW phone numbers and are unable to access Victorian emergency phone numbers or information.

GAUGE LOCATIONS

Gauge Name	Location	Gauge Zero m AHD	No.
Snowy R @ Dalgety Weir	S 36° 30' 00" - E 148° 50' 00"	740.456	
Snowy R @ The Hut			
Maclaughlin R @ The Hut	S 36° 39' 18" - E 149° 06' 06"		222017
Bombala R @ The Falls	S 36° 55' 00" - E 149° 12' 36"		222009
Bombala R @ Bombala			
Delegate R @ Wellesley			
Delegate R @ Quidong	S 36° 54' 24" - E 149° 02' 00"		222208
Snowy R @ Burnt Hut Crossing	S 36° 50' 30" - E 148° 55' 54"		222013
Snowy R @ Willis			
Deddick R @ Deddick (Caseys)	S 37° 05' 30" - E 148° 25' 30"		222210
Suggan Buggan R @ Suggan Buggan	200m d/s Wulgulmerang-Jindabyne Rd Bridge S 36° 57' 12" - E 148° 19' 30"		222213
Snowy R @ McKillops Bridge	@ McKillops Bridge	n/a	222209
Rodger R @ Jacksons Crossing			222217
Snowy R @ d/s Basin Ck	2.5km d/s from Basin Creek & Raymond Creek S 37° 30' 00" - E 148° 16' 12"	n/a	222219
Buchan R @ Buchan	40m u/s Bruthen Rd Bridge S 37° 30' 00" - E 148° 10' 30"		222206
Snowy R @ Jarrahmond	500m u/s of the junction of Wibenduck Creek S 37° 39' 42" - E 148° 21' 30"	3.67m	222200
Snowy R @ Orbost	n/a S 37° 43' 00" - E 148° 27' 30"	0.124m	222201
Brodribb R @ Sardine Creek			222202
Snowy R @ Marlo Jetty	S 37° 47' 54" - E 148° 31' 42"		

GAUGE LEVEL INFORMATION

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)
Snowy R @ Dalgety Weir	2012 Mar 1	4.34	67,563	
	2012 Mar 4	2.95	33,552	
	2011 Oct 10	2.21	14,700	
	2012 Mar 9	2.20	14,556	
	2012 Mar 26	2.07	12,132	
	1998 Aug 19	1.42	3,484	
	2003 Mar 28	1.40	3,364	
	2008 Feb 04	1.40	3,183	
	2010 Nov 6+9	1.37	2,940	
	2011 Apr 24	1.17	1,321	
	2010 Sep 06	1.17	1,323	
	2010 Oct 16	1.07	848	
	2011 Jan 31	1.03	719	
	2007 Jun 30	0.99	542	

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)
Bombala R @ Bombala	2011 Mar 22	7.00		
	2010 May 31	4.96		
	1997 Jun 29	4.62		
	2012 Mar 01	3.84		
	2012 Mar 09	3.83		
	2012 Mar 02	3.81		
	2007 Jun 27	3.65		
	2012 Apr 19	3.18		
	2001 Jul 10	2.51		
	2010 Feb 16	2.45		
	2005 Jul 10	2.41		
	2007 Jul 09	2.39		
	1995 Dec 06	2.31		
	2001 Aug 28	2.27		
	1998 Aug 18	2.25		
	2005 Nov 29	2.22		
	2005 Nov 01	2.20		
	2010 Jun 01	2.15		
Delegate R @ Quidong 222208	1971 Feb 06	8.64	152,998	
	1978 Jun 03	7.38	114,148	
	1952 Jun 16	6.40	87,192	
	1952 Dec 12	6.29	84,384	
	1991 Jul 11	4.06	36,301	
	1974 May 24	3.51	27,112	
	2012 Mar 01	3.33	24,250	
	2011 Mar 22	3.25	23,057	
	1956 May 13	3.05	20,270	
	1956 Jun 26	3.05	20,270	
	1989 Jul 18	3.03	19,961	
	1961 Sep 17	2.90	18,234	
	2012 Mar 08	1.86	7,315	
	2012 Mar 17	1.08	2,030	
Snowy R @ Burnt Hut Crossing 222013	1978 Jun 03	11.69	285,152	
	1991 Jul 11	8.93	170,366	
	1991 Jun 13	8.21	144,081	
	1978 Jun 18	8.09	139,854	
	1975 Jun 22	8.02	137,570	
	1983 Mar 22	7.79	130,424	
	2011 Mar 22	7.35	116,941	
	2012 Mar 2	6.93	104,847	
	1991 Jul 12	6.82	107,725	
	1985 Nov 27	6.69	98,013	
	1976 Oct 16	6.34	88,613	
	1978 May 20	6.26	86,479	
	1975 Jun 25	6.22	85,400	

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)
	1978 Jun 15	6.20	85,049	
Suggan Buggan R @ Suggan Buggan 222213	2011 Mar	7.95		
		4.82	15,100	100
	1990 Apr	4.49	12,500	50
	1971 Feb	4.31	11,100	
		4.13	9,840	25
	2012 Jun	3.97		
	1974 Aug	3.83		
		3.64	6,750	10
	1978 Jun	3.46		
	1976 Oct	3.40		
	1992 Dec	3.24		
		3.23	4,630	5
Deddick R @ Deddick (Caseys) 222210	1978 Jun	4.87		
	1977 Jul	4.52		
	2007 Jun	4.00		
	1969 Jun	3.83		
	1985 Oct	3.75		
	1985 Dec	3.75		
	1974 Jun	3.68		
	1977 Sep	3.59		
	1991 Jul	3.59		
	1984 Jul	3.55		
Snowy R @ McKillops Bridge 222209			703,000	100
	1971 Feb	13.59	661,000	
		11.98	527,000	50
	1978 Jun	10.58	416,000	
		10.09	377,000	25
	1991 Jul	8.07		
Major		8.00	227,000	11
		7.89	220,000	10
	1991 Jul	7.67		
	2012 Mar	7.48		
	1975 Jun	7.43		
	2011 Mar	7.03		
	1978 May	6.82		
	1985 Nov	6.33		
	1976 Oct	6.12		
		6.24	129,000	5
Moderate		6.00	118,000	5
There are 74 Minor floods on record. Details can be found on the Victorian Data Warehouse				
Minor		2.50	13,600	<2
Rodger R @ Jacksons Crossing 222217	1998 Jun	4.91		
	1985 Dec	4.57		
	2012 Jun	4.51		

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)
	1984 Jul	4.50		
	1978 Jun	4.26		
	1977 Jul	4.12		
	1978 Apr	3.94		
	2007 Jun	3.74		
	2011 Jul	3.55		
	2008 Nov	3.39		
Snowy R @ d/s Basin Ck 222219		12.20	429,000	100
		10.63	344,000	50
	1991 Jul	9.70	292,000	
		9.24	264,000	25
	1991 Jun	9.14	258,000	
	2012 Mar	8.13		
		7.65	169,000	10
	1983 Mar	7.56		
	1985 Nov	7.13		
	2011 Mar	6.87		
	1998 Jun	6.81	123,440	
	Major	6.60	116,000	6
There are 9 Moderate floods on record. Details can be found on the Victorian Data Warehouse				
		6.44	107,000	5
	Moderate	5.50	72,500	4
There are 33 Minor floods on record. Details can be found on the Victorian Data Warehouse				
	Minor	3.50	20,000	<2
Buchan R @ Buchan 222206		4.79	46,900	100
		4.62	38,800	50
	2012 Jun	4.46		
		4.40	31,100	25
	1998 Jun	4.18	25,575	
	1988 Nov	4.12		
	Major	4.00	22,300	11
		3.95	21,400	10
	1984 Jul	3.82		
	1985 Nov	3.79		
	1985 Dec	3.76		
	2007 Jun	3.75		
	1985 Oct	3.68		
	2012 Mar	3.55		
	Moderate	3.50	14,700	5
	2011 Jul	3.37		
	1985 Sep	3.33		
	1992 Dec	3.24		
	1978 Jun	3.17		
	1992 Sep	3.12		
	1991 Jul	3.11		
	1990 Apr	3.08		

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)
	1950 Apr	3.05		
	1971 Feb	2.99		
	1993 Oct	2.99		
	1983 Oct	2.97		
	1971 Jan	2.94		
	1990 Sep	2.89		
	2008 Nov	2.83		
	2003 Dec	2.82		
	1995 Oct	2.80		
	2002 Apr	2.77		
	1983 May	2.72		
	1974 Jun	2.66		
	1952 Dec	2.62		
	1980 Jan	2.62		
	2002 Feb	2.61		
	1991 Jun	2.59		
	1978 Apr	2.57		
	1952 Dec	2.54		
	Minor	2.50	5,050	<1
Snowy R @ Jarrahmond 222200	1971 Feb	12.13	673,000	
	1934 Jan	12.07	664,000	
		11.76	616,000	100
		10.84	483,000	50
	1978 Jun	10.81		
		9.65	364,000	25
	1991 Jul	9.07	232,000	10
	1991 Jun	8.98		
	1998 Jun	8.98	226,957	
	1934 Jan	8.96		
	2012 Mar	8.87		
		8.40	150,000	5
	2012 Jun	8.38		
	1985 Dec	8.25		
	1974 Aug	8.09		
	1975 Jun	7.97		
	1985 Nov	7.92		
	1974 Jun	7.90		
	1988 Nov	7.85		
	2007 Jun	7.75		
	1974 May	7.67		
	1934 Aug	7.56		
	1976 Oct	7.56		
	Major	7.40	103,000	3
There are 22 Moderate floods on record. Details can be found on the Victorian Data Warehouse				
	Moderate	6.20	71,100	2
There are 62 Minor floods on record. Details can be found on the Victorian Data Warehouse				

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)
	Minor	3.90	32,400	<2
Snowy R @ Orbost 222201	1971 Feb	9.96		
	1952 Feb	9.49		
	1978 Jun	9.28		
	1985 Dec	8.74		
	1974 Aug	8.34		
	1991 Jul	8.07		
	2012 Mar	8.07		
	1998 Jun	7.85		
	2012 Jun	7.78		
	1991 Jun	7.75		
	1975 Jun	7.49		
	1988 Nov	7.30		
	1984 Jul	7.17		
	1976 Oct	7.13		
	2007 Jun	7.10		
	1978 Apr	7.01		
	Major	7.00		
There are 13 Moderate floods on record. Details can be found on the Victorian Data Warehouse				
	Moderate	6.00		
There are 27 Minor floods on record. Details can be found on the Victorian Data Warehouse				
	Minor	4.00		
Brodribb R @ Sardine Creek 222202	1998 Jun	12.69		
	1925 Jul	9.85		
	1985 Dec	9.41		
	1978 Apr	9.08		
	2012 Jun	9.08		
	1988 Nov	8.69		
	1960 Jun	8.23		
	1984 Jul	8.20		
	1974 Jun	8.08		
1977 Jul	7.90			

APPENDIX B.04 –FLOOD PEAK TRAVEL TIMES

Travel times are calculated as the time the peak of the event takes to move from one gauge to the next. Note the onset of flooding can occur before the peak water level occurs.

It is possible for flooding to commence at downstream locations prior to peak heights being reached in the upper parts of the catchment due to both locally heavy rainfall and the backwater effects mentioned earlier.

Due to the high level of variability in antecedent catchment conditions, flood travel times can vary significantly, as demonstrated in previous floods.

Travel times listed here are **INDICATIVE ONLY** and are **HIGHLY VARIABLE**.

Gauge Name	June 1998	July 1991	June 1978
Snowy R @ McKillops Bridge		0	0
Snowy R @ Basin Ck	0	3.5hrs	-
Snowy R @ Jarrahmond	3hrs	9.5hrs	2.5hrs
Snow R @ Orbost	5.5hrs	11hrs	5.5hrs



Minor 4.00m
Moderate 6.00m
Major 7.00m

LOCATION

Orbst is situated on the Snowy River downstream of the confluence with the Buchan River and upstream of the confluence of the Brodribb River and Snowy River estuary.

Close to National Parks – Snowy Rive,r Alpine, Errinundra, Croajingolong & Cape Conron

CONSEQUENCES AND IMPACTS SUMMARY

Community	# properties flooded in 1% AEP				
	Residential	Business	Industrial	Rural	Total
Marlo	18	0	0	37	55
Newmerella	1	0	0	48	49
Jarrahmond	0	0	0	59	59
Orbst	1	4	0	125	130
Total	20	4	0	269	293

FLOOD MITIGATION SYSTEMS

There are no flood mitigation systems in Orbst.

FLOOD WARNINGS

The Bureau of Meteorology provides warnings for both the NSW and Victorian parts of the Snowy River and is able to provide warnings and flood height predictions approximately 12-24 hours ahead of peaks in rural areas, approximately 24-48 hours in Orbost.

ROAD CLOSURES

- | The Princes Highway in Orbost has been upgraded to ensure closure only occurs during very high floods.
- | Many local roads in and around Orbost are closed at low levels with some becoming dangerous with high velocity flows.
- | Properties along the Marlo Rd are isolated early for the duration of the flood event.
- | Full intelligence on when a road is closed and what component is listed in the attached detailed consequences and impacts section.

ORBOST	
Riverine Flooding	Flash Flooding
Jarrahmond Rd	Jarrahmond Rd @ Major Creek
Huxters Rd	
Marlo Rd -	
Orbost Camp Park Rd	
Lochend Rd	
Sandy Flat Rd	
'B' Road – 0.5km out of Orbost	
Corringale Rd	
Lynns Gulch	
Pattens Corner	
Forest Rd	

CRITICAL INFRASTRUCTURE

PATRICIA BALEEN GAS PLANT, CORRINGLE CREEK

- | The Patricia Baleen Gas Plant is located on a ridge of higher ground along the north side of Corringale Creek. Access to the plant is provided by a gravel access road that connects the plant site to Ewing Marsh Road in the north. The access road is approximately 1.6km long with approximately 1.0km of the road across the floodplain area immediately to the north of the plant.
- | The 1 in 100yr ARI for Corringale Creek at the Patricia Baleen or Sole Gas Plant is approximately 4.50m, 1 in 500yr ARI is approximately 5.00m. The Gas Plant has a flood plan in place and will require shutdown if the access road is cut. This does not reduce gas supply to Orbost. Plant shutdown and evacuation takes 6 hours. The plant will be shut down if the access road is likely to become impassable. The lowest point of the access road is 1.67m ahd. Once the access road gauge is at 1.77m only 4WD diesel vehicles with snorkels can use the road. Once the gauge reaches 2.17m AHD the road is impassable and the plant should already be evacuated and closed down. Although the plant has their own flood plan, it is important to ensure they have sufficient warning for rainfall in the Ewing Marsh catchment and/or major flooding in the snowy river to ensure safe shutdown and evacuation of the plant. If persons are stranded at the plant there is shelter and food and water available on site. There is a septic sewage system on site which may be inundated.
- | Refer: Patricia Baleen Gas Facility Flood Response Plan

COMMUNITY PROFILE

| The community in and around Orbost is made up of many people whose families have been in the area for generations and who are very familiar with flooding in their area.

| The following is a demographic profile of Orbost as at the 2006 census.

Pop'n	Dwellings	Language	Needs Assistance	Age Profile
2,452		English %	Disability %	Avg yrs
			Living Alone %	<15 %
			No Car %	55-74 %
				15-54 %
				>75 %

GAUGE LEVEL INFORMATION

Flood Class	Flood Event	Jarrahmond	Orbost
	1971 Feb	12.12	9.96
	1934 Jan	12.07	-
	1952 Feb	-	9.49
	1978 Jun	10.84	9.28
	2012 Mar	8.67	8.07
	1988 Jun	9.06	7.85
	2012 Jun	8.38	7.79
Major		7.40	7.00
	2011 Jul	6.48	6.16
Moderate		6.20	6.00
Minor		3.90	4.00
	2011 Aug	3.07	3.31

DETAILED CONSEQUENCES & IMPACTS - FLOOD INTELLIGENCE CARD

Gauge	No.	Location	Datum Type
Snowy River @ Orbost			

NB Depths quoted are above ground level. Properties are considered isolated when 20cm of water is across the road

Height (m)	Consequences	Operational Considerations
4.00	<p>MINOR FLOOD LEVEL</p> <hr/> <p>PROPERTIES</p> <ul style="list-style-type: none"> ▷ Low lying agricultural land beside the river <p>ROADS</p> <ul style="list-style-type: none"> ▷ Nil 	
5.20	<p>ROADS</p> <ul style="list-style-type: none"> ▷ 'B' Road - 0.5km out of Orbost - dangerous ▷ Lynns Gulch ▷ Marlo Rd - between Forest & Healeys Rd ▷ Lochend Rd ▷ Gilberts Gulch 	<ul style="list-style-type: none"> ▷ EGSC & VicRoads re road closure signs, especially B Road ▷ Consider alternative route due to Marlo Rd being cut.
6.00	<p>MODERATE FLOOD LEVEL</p> <hr/> <p>ROADS</p> <ul style="list-style-type: none"> ▷ B Road - Forest & Nixon Rds ▷ Lochend Rd - 	<ul style="list-style-type: none"> ▷
6.16	<p>JULY 2011</p>	<ul style="list-style-type: none"> ▷
6.2 0	<p>ROADS</p> <ul style="list-style-type: none"> ▷ Lochend Rd @ bottom end near Sederlans Corner ▷ Buchan Rd @ Russell's stockyard ▷ Pattens Corner ▷ Sandy Flat Rd - Brodribb River ▷ Tabbara Rd - Brodribb River & Raymond Creek - in various places. Lower end of both roads flood at early stages of the flood. Tidal influence applies. ▷ Orbost Camp Park Rd ▷ Forest Rd 	<ul style="list-style-type: none"> ▷
6.80	<p>ROADS</p> <ul style="list-style-type: none"> ▷ Corringle Rd @ Corringle Creek. 	<ul style="list-style-type: none"> ▷
7.00	<p>MAJOR FLOOD LEVEL</p>	<ul style="list-style-type: none"> ▷
7.4-7.5	<p>ROADS</p>	<ul style="list-style-type: none"> ▷

Height (m)	Consequences	Operational Considerations
	<ul style="list-style-type: none"> ▷ Jarrahmond Rd @ Wall Creek ▷ Gunns Rd ▷ Buchan Rd @ Ashbys Gulch 	
7.85	JUNE 1988	▷
8.00	ROADS <ul style="list-style-type: none"> ▷ Huxters Rd to Gunns Rd ▷ Jarrahmond Rd to Gunns Rd ▷ Jarrahmond Rd @ Gunns Creek newar J W Lynns Rd 	▷
8.07	MARCH 2012	▷
9.28	JUNE 1978	▷

APPENDIX D.04 – EVACUATION ARRANGEMENTS

The Incident Controller may make the decision to evacuate an at-risk community. Evacuation is the responsibility of VICPOL and will be conducted as per the EMMV and the MEMP.

APPENDIX E.04 - FLOOD WARNING SYSTEM

FLOOD WARNING

The Bureau of Meteorology provides a Flood Warning Service for the Buchan River

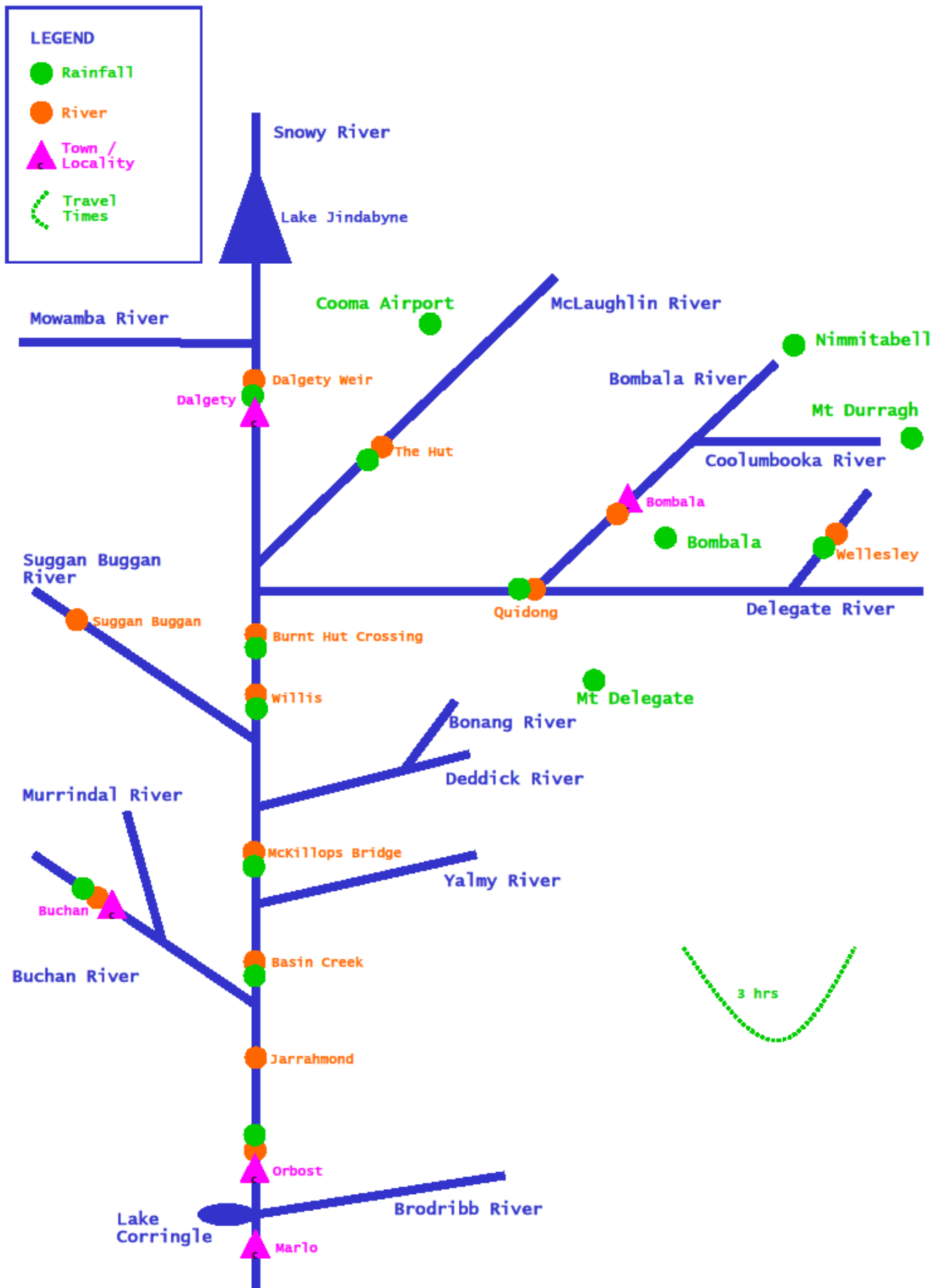
LOCAL FLOOD WARNING SYSTEM ARRANGEMENTS

There are no local flood warning systems.

APPENDIX F.04 – MAPS

- | Schematic Diagram Snowy River
- | Bureau of Meteorology Flood Warning Data Network
- |

SCHEMATIC DIAGRAM SNOWY RIVER

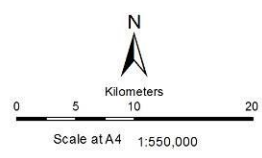


SNOWY RIVER

SNOWY RIVER CATCHMENT MAP

Snowy River Catchment

- List of Gauges**
- 1 Snowy River at Jarrahmond 222200
 - 2 Deddick River at Deddick 222210
 - 3 Brodrigg River at Sardine Creek 222202
 - 4 Snowy River at Orbost 222201
 - 5 Rodger River at Jacksons Crossing 222217
 - 6 Buchan River at Buchan 222206
 - 7 Suggan Buggan River at Suggan Buggan 222213
 - 8 Snowy River at D/S of Basin Creek 222219
 - 9 Snowy River at McKillop Bridge 222209

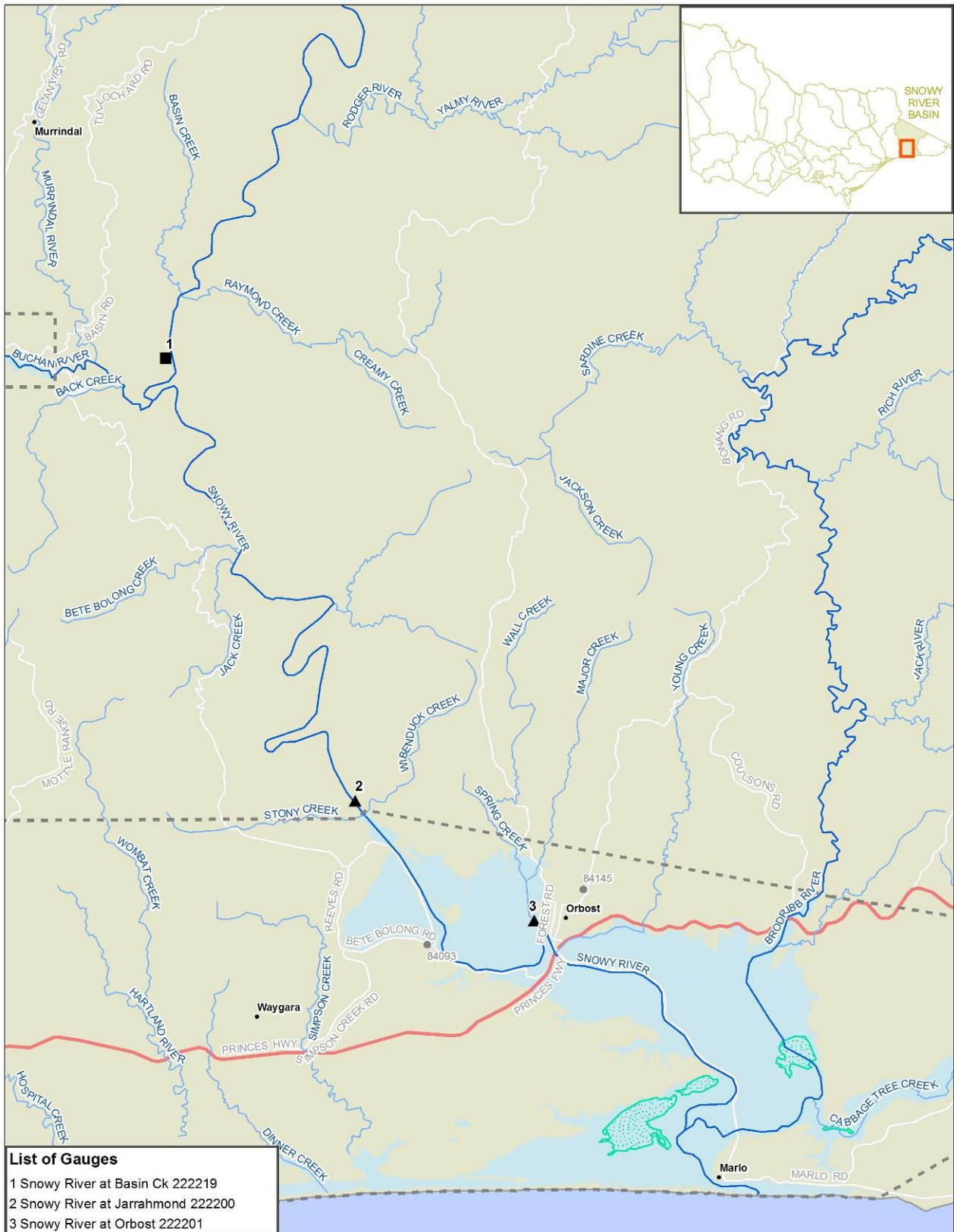


- ▲ River Gauge
- Rain Gauge
- Township
- Major Road
- Secondary Road
- Major River
- River/Creek
- Coastline
- Snowy River Catchment
- Lake/Swamp
- LGA Boundary
- Ocean

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JARRAHMOND TO ORBOST FLOOD EXTENT

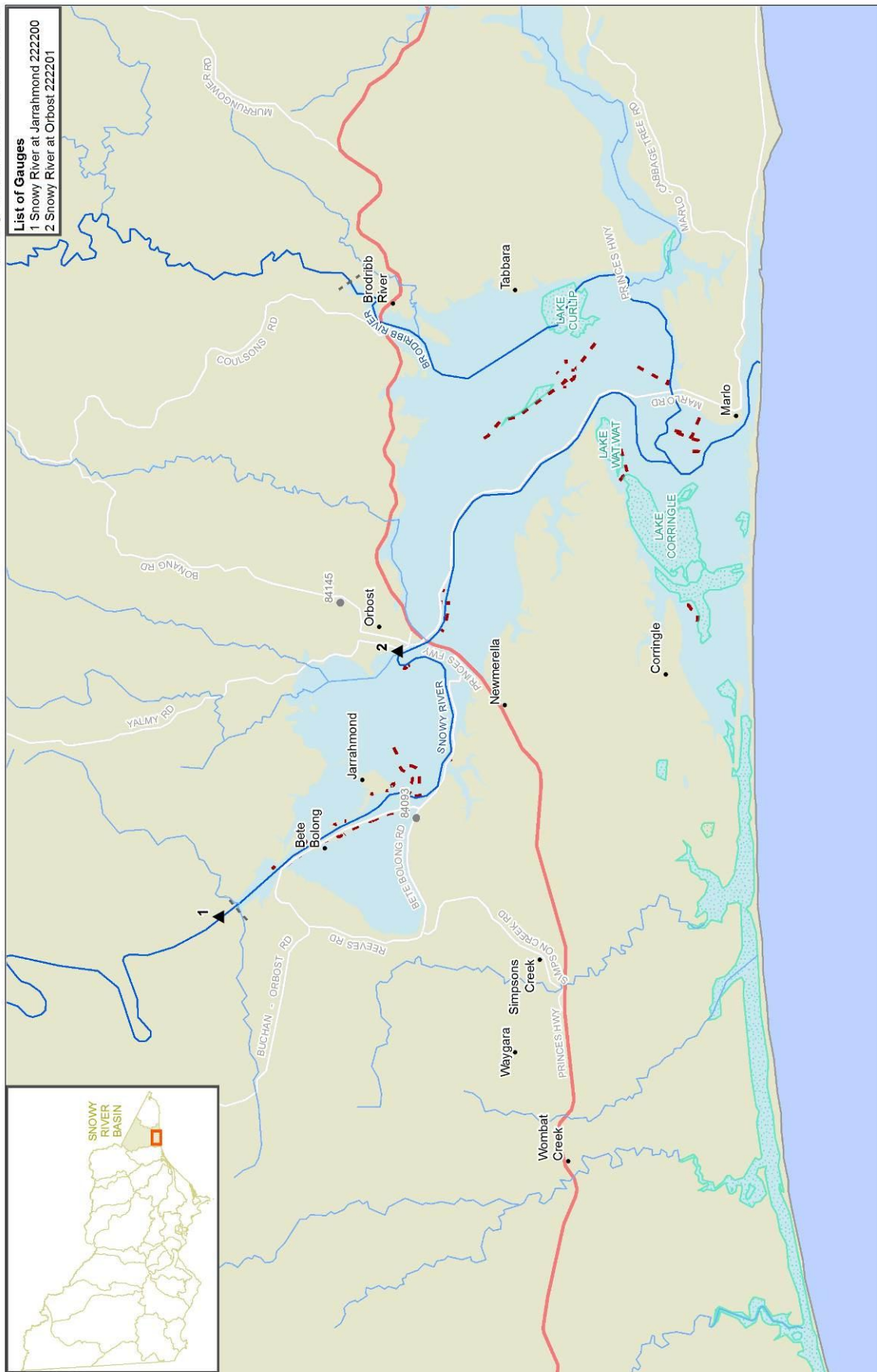
Snowy River Catchment: Basin Creek to Marlo



JARRAHMOND TO MARLO FLOOD EXTENT

Snowy River: Marlo to Jarrahmond

- List of Gauges**
 1 Snowy River at Jarrahmond 222200
 2 Snowy River at Orbost 222201



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- ▲ River Gauge
- Rain Gauge
- Township
- Major Road
- Secondary Road
- Levee
- Extent of Flood Data
- Major River
- River/Creek
- Coastline
- Ocean
- 1% AEP Flood
- Snowy River Basin
- Lake/Swamp



BUCHAN FLOOD EXTENT

Snowy River Catchment: Buchan



List of Gauges
1 Snowy River at Basin Ck 222219

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- Combined Gauge
- Rain Gauge
- Township
- Secondary Road
- - - Extent of Flood Data
- Major River
- River/Creek
- 1% AEP Flood
- Snowy River Catchment



TAMBO VALLEY

Tambo River

Nicholson River

Mitta Mitta River

Boggy Creek

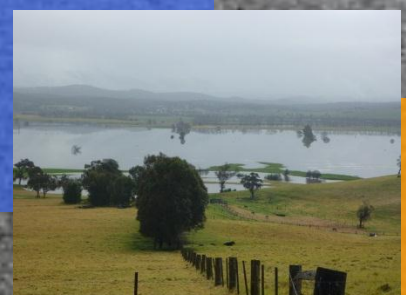


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Stephensons Road, Tambo Upper, June 2012

ASSOCIATED REPORTS

- | SES State Flood Intelligence Report
- | East Gippsland Shire Council Flood Response Plan, Tambo
- | Thiess Environmental Services Gauge Rating Tables
- | 1998 Flood – The Road to Recovery in East Gippsland, East Gippsland Shire, DHS, NRE, EGCMA, Dec 1999
- | The Gippsland Floods of June / July 2007, East Gippsland Catchment Management Authority, DRAFT 2011
- | [http://en.wikipedia.org/wiki/Nicholson_River_\(Victoria\)](http://en.wikipedia.org/wiki/Nicholson_River_(Victoria))
- | [http://en.wikipedia.org/wiki/Tambo_River_\(Victoria\)](http://en.wikipedia.org/wiki/Tambo_River_(Victoria))
- | <http://www.bonzle.com>
- | <http://www.floodvictoria.vic.gov.au>
- | <http://www.abc.net.au/news/2003-12-03/big-hailstones-rain-down-on-swifts-creek/99808>
- | <http://trove.nla.gov.au/ndp/del/article/8613864>

ACCURACY & CONFIDENTIALITY

Use this information as a guide to the possible effects of a flood. This card is based on estimates of flood behaviour and particular effects may occur at heights different from those indicated here. They may also occur at slightly different heights in different floods. This card may contain sensitive information about the effects of flooding on private property. Specific reference to private addresses or businesses must be made directly to owners or other emergency services but not via broadcast or print media.



Great Alpine Road, June 2007

APPENDIX A.01 – FLOOD THREATS

OVERVIEW OF RIVER SYSTEM

The Tambo Valley includes the entirety of the Tambo Basin, including the Tambo River, Nicholson River and Boggy Creek, along with the communities of Omeo and Benambra who are part of the Tambo Valley community and East Gippsland Shire, but are situated in the Livingstone Creek and Mitta Mitta River catchments in the Upper Murray Basin.

TAMBO RIVER (Timbarra River, Haunted Stream, Junction Creek, Deep Creek)

The Tambo River is the longest in the Tambo Basin with a total length in excess of 170km.

THE ORIGIN OF THE TAMBO RIVER

The Tambo River starts on the southern slopes of the Great Dividing Range about 20km east of **Benambra** and flows south into **Lake King**, part of the **Gippsland Lakes**, and then into **Bass Strait**.

Initially there are two branches of the river – one beginning in the **Bowen Mountains** and the other (called the South Branch) on the slopes of **Mt Bindi**. Around Bindi where the *Tambo River @ Bindi* BoM gauge is located, the river channel is about 5 m in width.

From the junction of the two branches, the river flows from the mountains north of **Swifts Creek** and flows generally south through the **Tambo Valley** to **Bruthen**. In the Swifts Creek and Ensay region, the river is up to 12m wide, with deep pools of up to 140 cm.

The Tambo Valley from the locality of Bindi to just south of **Ensay** is relatively open and flat, however it closes in to steep forested mountains then opens out once more into fertile river flats north of Bruthen. In the steep forest sections between Ensay and Bruthen, the channel width is up to 20m. Between Bruthen and **Tambo Upper** the channel width exceeds 25m, but with a summer depth typically less than 50 cm.

Beyond the flood plain at Bruthen, the river narrows and deepens and is confined by sandstone escarpments. Below **Swan Reach**, the river enters the coastal plain, eventually flowing into Lake King in the Gippsland Lakes system.

TRIBUTARIES

The Tambo River has a number of significant tributaries, with the two largest being the Little River which enters the Tambo from the north at Ensay, and the **Timbarra River** which enters the Tambo from the east, south-east of **Tambo Crossing**. The Tambo River South Branch, which originates on the **Nunniong Plains** in the hills east of Bindi, flows north to join the main river near its origin. The Tambo also has a number of more seasonal creeks entering along its length, including Swifts Creek which enters from the west at the town of Swifts Creek, **Haunted Stream** which enters from the west to the north of Tambo Crossing, with other minor tributaries including **Junction Creek**, **Deep Creek** and **Dead Horse Creek**.

NICHOLSON RIVER (Barmouth, Navigation, Store, Black Snake, Nicholson and Yahoo Creeks)

The **Nicholson River** lies between the **Mitchell** and the Tambo Rivers. It has a length of 72.5 kms. The Nicholson River begins in the Angora **Range** at **Marthavale** west of Ensay. It flows south-east passing through the Nicholson River Reservoir, and the small town of Nicholson before passing through the estuarine reach and entering **Lake King** at **Jones Bay**.

The Nicholson River catchment has an area of approximately 450km².

Six tributaries flow into the Nicholson River: - **Barmouth Creek**, **Navigation Creek**, **Store Creek**, **Black Snake Creek**, **Nicholson Creek** and **Yahoo Creek**.

LIVINGSTONE CREEK (Reedy, Wilson , Jim & Jack Creek and Butcher Creeks)

Livingstone Creek is a wide shallow creek in eastern Victoria which starts below **Mount Delusion** and flows north west, through the town of **Omeo** before flowing into the **Mitta Mitta River** which in turn flows north into the **Murray River**.

The following creeks and rivers flow into the Livingstone Creek: **Reedy Creek, Wilson Creek, Jim & Jack Creek and Butcher Creek**.

BOGGY CREEK (Ironstone, Breakfast and Yellow Waterholes Creeks)

Boggy Creek rises in steep forest on the southern slopes of the Great Dividing Range and flows south through Boggy Creek gorge to the Nowa Nowa arm of Lake Tyers.

FLOOD RISKS

Low lying agricultural land on the Tambo and Nicholson River floodplains are subject to riverine flooding which can isolate rural properties.

Areas around Nowa Nowa on Boggy Creek are subject to inundation including the Recreation Reserve and the boat ramp and carpark.

The boat ramp and carpark at Nicholson on the Nicholson River is subject to flooding when the Nicholson River @ d/s Pumphouse gauge reaches 2.5 metres.

Road closures do not pose a threat of isolation to the towns in the area due to the availability of alternate routes except in extreme circumstances although the Great Alpine Road between Bruthen and Omeo can be cut due to riverine flooding or landslip.

FLOODING FREQUENCY

Floods are a regular occurrence on the Tambo River flats, with minor events occurring every year or so, but sometimes as often as three or four times in the one year. During these minor events, a large part of the low lying area surrounding the river is inundated with floodwater spreading across the floodplain to Mossiface at the site of the former river course.

Major events usually result from heavy rain across the whole catchment and are less frequent but have been recorded during 1893, 1920, 1952, 1988, 2007, 2012. The event in December 1893 changed the course of the river below Bruthen.

FLASH FLOODING

Omeo, Benambra, Cassilis, Brookville, Swifts Creek

RURAL FLOOD RISK

Throughout the Tambo River catchment there a number of areas that have significant rural flood risk. Though these areas are not highly populated, rural properties are susceptible to isolation or inundation.

- | **Tambo River** – Mossiface, Johnsonville, low lying areas around Swifts Creek, Bruthen, Nicholson, Johnsonville, Swan Reach & Tambo Upper
- | **Nicholson River** – Low lying areas around Sarsfield,
- | **Boggy Creek** -

HEALTH & ENVIRONMENTAL RISKS

There are many septic tanks in the rural areas that may be inundated by floodwaters and farm chemicals stored in farm sheds on the floodplain.

PROPERTIES AT RISK

The table below is a breakdown of the number of properties impacted in a 1% AEP riverine event. These figures are **indicative only** and based on a mixture of actual impacts during historical events which were less than the 1% event and mapping.

River	Community	# properties flooded in 1% AEP				
		Residential	Business	Industrial	Rural	Total
Tambo River	Kalimna	19	0	0	7	26
Tambo River	Lake Tyers	0	0	0	2	2
Tambo River	Swifts Creek	70	0	0	81	151
Tambo River	Nowa Nowa	0	0	0	2	2
Tambo River	Bindi	0	0	0	1	1
Tambo River	Tambo Upper	0	0	0	17	17
Tambo River	Swan Reach	12	0	0	33	45
Tambo River	Wiseleigh	5	0	0	9	14
Tambo River	Mossiface	0	0	0	18	18
Tambo River	Lake Bunga	0	0	0	2	2
Tambo River	Johnsonville	2	0	0	4	6
Tambo River	Bumberrah	0	0	0	6	6
Tambo River	Bruthen	2	0	0	48	50
TOTAL						

HISTORICAL FLOODS

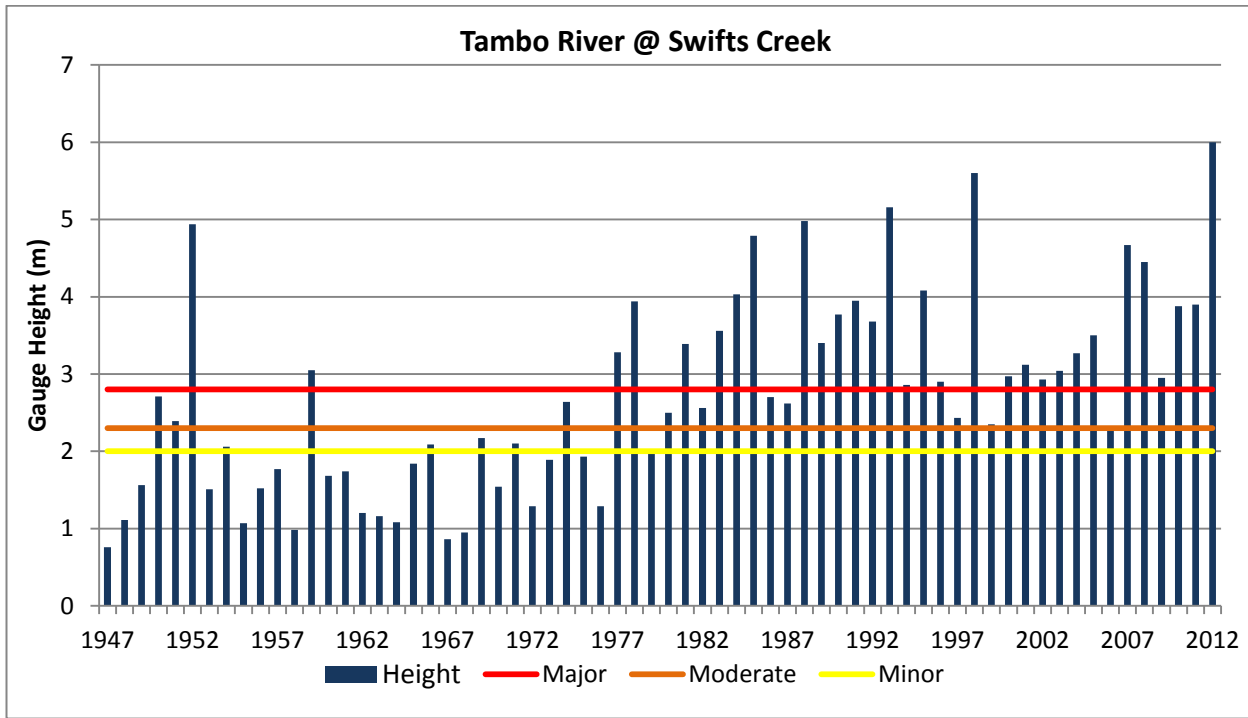
Significant floods have occurred in the Tambo Catchment as shown in the table below. Impacts of significant events are discussed below the table. NB there are other Minor and Moderate flood events that are not yet included.

EVENT	Tambo R @ Bindi	Timbarra R @ d/s Wilkinson Ck	Timbarra R @ d/s Duggan Ck	Haunted Stream @ Hells Gate	Tambo R @ u/s Smiths Ck	Tambo R @ Swifts Ck	Tambo R @ Duggans Ck	Tambo R @ d/s Ramrod Ck	Tambo R @ Battens Landing
1959 Sep 21	3.42	-	-	-	-	3.05	-	-	-
1971 Feb	1.83	-	-	-	-	2.71	-	5.59	-
1974 Jun	1.87	-	-	-	-	2.64	-	7.24	-
1975 Sep	3.42	-	-	-	-	1.93	-	2.10	-
1978 Apr	2.08	-	-	-	-	2.84	-	8.14	8.10
1978 Jun	3.21	-	-	-	-	3.94	-	9.19	8.33
1983 Aug		2.85	-	-	-	3.56	-	2.56	-
1984 Jul		5.52	-	-	-	4.03	-	8.55	-
1985 Sep		4.47	-	-	-	3.45	-	5.16	-
1985 Oct		5.77	-	-	-	4.79	-	6.50	-
1985 Dec		5.20	-	-	-	4.12	-	8.26	-
1988 Nov	3.33	6.48	0.74	-	-	4.98	0.81	9.53	-
1989 Nov		3.00	1.13	-	2.43	3.40	1.13	2.20	-
1990 Apr		2.89	0.52	2.50	1.54	2.81	0.52	5.00	-
1990 Sep	2.82	3.97	0.99	2.26	2.36	3.77	0.99	3.52	-
1991 Jul	2.87	4.02	0.73	2.42	1.78	3.95	0.73	4.21	-
1992 Sep	2.85	3.41	0.99	2.35	2.27	3.68	0.76	3.58	-
1992 Oct	2.83	3.41	0.91	2.27	2.32	3.53	0.91	3.26	-
1993 Oct	3.88	3.89	1.61	1.42	2.59	5.16	1.61	4.45	-
1995 Oct	3.07	3.32	1.25	2.01	2.46	4.08	1.25	3.14	-
1998 Jun	4.75	6.71	1.30	4.96	2.47	5.60	1.30	11.96	-
2002 Apr		4.16	0.35	1.94	1.35	2.60	0.35	4.80	-
2005 Jul		2.79	0.56	2.50	1.56	3.27	0.56	3.45	3.88
2005 Sep		2.37	1.39	1.44	2.48	3.50	1.39	2.08	2.26
2007 Jun		5.49	0.92	3.70	1.94	4.67	0.56	7.37	7.15
2008 Nov		4.82	0.88	3.31	1.68	4.45	0.56	5.59	5.40
2010 Aug		2.64	0.81	2.00	2.18	3.53	0.56	2.06	2.47
2010 Oct		2.33	1.32	1.57	2.54	3.88	1.32	2.18	2.39
2011 Jul		5.20	0.79	3.20	1.94	3.90	0.56	5.75	5.79
2011 Aug		3.40	0.78	3.56	2.02	3.75	0.56	6.65	6.19
2012 Mar		4.99	1.01	2.86	2.23	3.95	0.56	5.91	6.03
2012 Jun		7.57	1.40	3.92	2.51	6.00	1.40	9.71	7.90
Major	3.30					2.80		-	-
Moderate	2.90					2.30		5.50	-
Minor	2.40					2.00		4.00	-

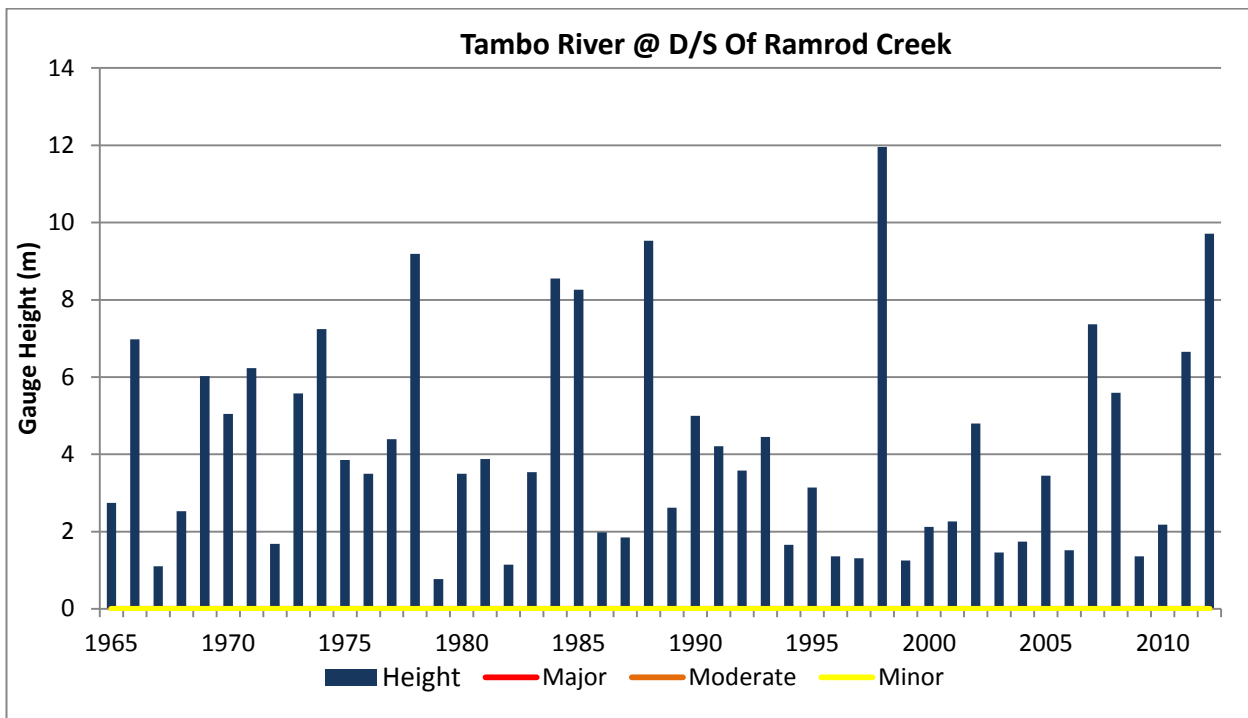
■ < Minor
 ■ Minor
 ■ Moderate
 ■ Major

Flood class levels for Swifts Creek are no longer in operation due to the changes in the river system.
Flood class levels for Ramrod Creek are indicative only

MAXIMUM ANNUAL GAUGE HEIGHTS



* Flood Class Levels for Tambo River @ Swifts Creek are no longer in operation



1890 FLOOD EVENT

THE FLOODS IN THE COUNTRY

The Argus, Sat, June 28, 1890

OMEEO, FRIDAY

The rainfall since Saturday has been 5 inches. The floods have been extraordinary, that on the Tambo exceeding in height the flood of 1870.

All the settlers on the river between Ensay and Bruthen have been flooded out. The township at Tongio is under water, and the bridges at Swift- Creek and Tongio have been washed away, the station homesteads at Tongio and Hinnomunjie are surrounded by water, and Lake Omeo has risen over its banks.

There has been no mail communication between Omeo and other centers since Thursday, when the mail arrived five hours late from Bairnsdale. On Wednesday the coach driver arrived from Ensay with the mails on a packhorse to try and reach Bruthen across the mountains. Yesterday he was found by a search party, having failed through the horses getting bogged. The mail coach from Bairnsdale is stuck six miles this side of Bruthen.

The approaches to all the bridges on the mail route are washed away, and should the weather clear up it is anticipated that traffic cannot be resumed before Sunday. The passengers who left Bairnsdale on Monday night arrived here last night at 12 o'clock. They report having walked from Fraser's to Thorburn's, who kindly drove them for six miles. The water was flowing through the body of the trap.

So far no fatalities have been reported, but a selector named Greenwood had a narrow escape from drowning in crossing Wilson's Creek. The current overturned his horse, and Greenwood was entangled with the reins, but luckily the bridle was dragged off before he became exhausted. The horse was drowned. It is still raining heavily, but although the barometer is rising rapidly there are no other indications of the weather clearing up.

THE FLOODS IN THE COUNTRY

The Argus, Sat, June 28, 1890

BRUTHEN, TUESDAY

A heavy flood is coming down the Tambo, which has risen 8ft since 8 o'clock this morning. It is still rising rapidly. The flats at Kilmorie are submerged. The water has risen 2ft-in the last hour.

BRUTHEN, WEDNESDAY

The highest, flood since that of 1870 has occurred, and much damage has resulted. The river was still rising when the 22ft. gauge was washed away. A woman named Hunt and her family of small children were surrounded by deep water, but were rescued.

The whole of the Kilmorie flats and a large portion of the Mossiface estate are submerged. Mr Thomas Greenwood, the lessee of Kilmorie has lost the whole of his maize crop the water rose so suddenly that he had not time to remove anything. The water is now over the eaves of the house.

Haystacks and quantities of corn in cobs are floating down the river. If the water does not abate, it is feared that a large number of stock will be drowned. Great dissatisfaction is felt at there being no boat in the vicinity. There are plenty of volunteers, but no means of rendering assistance. The Greenwood family lost everything but the clothes they stand in. The wall of the house has given way.

It is still raining, with no sign of abatement. The Bairnsdale and Omeo coach is blocked.

1998 FLOOD EVENT

There had been 2.5 years of drought in the lead up to the 1998 flood event. On June 23-24 the BoM reported a severe weather event with an intense low pressure system building across the east coast of Victoria.

2007 FLOOD EVENT

During June 2007 four major east coast lows formed off the coast of NSW and east of Victoria. Each east coast low produced varying amounts of heavy rain with a total in excess of 300mm over two weeks resulting in a flood level on the Tambo River of an estimated 6.18 metres. Omeo, Swifts Creek, Bruthen, Tambo Upper, Swan Reach, Johnsonville, Metung, and Nicholson all experienced varying degrees of flooding.

Major damage was sustained to the old timber bridge over the Tambo River on Stephenson Road which was subsequently replaced by a higher concrete bridge.

The Princes Hwy. was cut at Nicholson and at Lakes Entrance, impacting the townships of Nicholson, Johnsonville and Swan Reach preventing deliveries for two days.

The jetty and car park at Nicholson was totally submerged resulting in damage to the toilet block and the Nicholson Angling Club meeting rooms.

2012 FLOOD EVENT

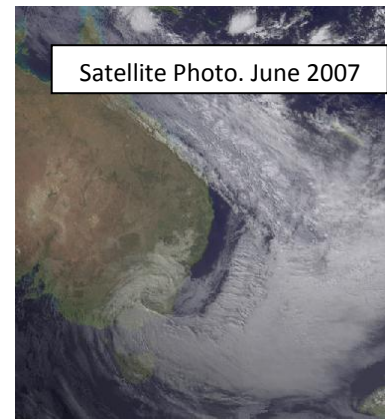
On Sunday 3 June 2012, a low pressure weather system developed and then deepened rapidly during the next day directing a strong south-easterly flow over eastern Victoria. This resulted in significant rainfall across Gippsland.

In the next 24 hours to early Tuesday 5 June 2012, there was further substantial rainfall, resulting in major flooding in ten catchments across Gippsland. Rainfall levels included 173mm on the Tambo River at Mt. Elizabeth.

Infrastructure, such as bridges, roads and recreational areas (including caravan parks) was damaged. Some locations east of Bairnsdale temporarily lost power and landline phones. There was significant rural inundation, including crop losses and more than 1,500 Gippsland farmers were impacted.

New rainfall records were set at towns such as Orbost (which received 91.8 millimetres in the 24 hours to 9am yesterday), Ensay (125.6) and Omeo (131.4). Meteorologist Steven McGibbony said Omeo recorded its single wettest day since records began 133 years ago.

Read more: <http://www.theage.com.au/environment/weather/more-towns-under-threat-as-record-rain-moves-downstream-20120605-1zucf.html#ixzz2PHTYD1Cd>



MAJOR WATER STORAGES

There are no water storages over 1,000ML within this catchment.

LEVEES

There are no major levees recorded. The following levees have been extracted from the Victorian Flood Database and are listed as communally or publically owned. Information on design standard, condition or construction date has not been provided in the VFD.

Name	River	Location	Condition	Operator
Blunose Levee				

MAJOR ROAD CLOSURES

Riverine Flooding	Flash Flooding
MITTA MITTA RIVER	
OMEO	
	Great Alpine Rd - @ Livingstone Creek. Great Alpine Rd - @ Jim & Jack Ck (snowmelt)
TAMBO RIVER	
SWIFTS CREEK	
The Great Alpine Rd - near Tambo Valley Gun Club & various places towards Bruthen	
BRUTHEN	
Great Alpine Rd - between Bruthen & Wiseleigh. Mossiface Rd - @ Wharf Corner Mossiface-Swan Reach Rd - @ Wharf Corner. Tambo Upper Rd - 2km south of Stephenson Rd & various other places	
SWAN REACH / JOHNSONVILLE	
Metung Rd - various places	
NICHOLSON RIVER	
Princes Highway - @ Nicholson (Boss Swamp)	
BOGGY CREEK	

RURAL ROAD CLOSURES

Riverine Flooding	Flash Flooding
MITTA MITTA RIVER	
OMEO	
Connleys Road - @ Livingstone Creek	
BENAMBRA	
Corryong Road - @ RG Pendergasts, Stony, Garden & Japan Creeks Mathews Lane - @ Morass Creek Pyles Lane - @ Morass Creek	

Tablelands Rd - @ Morass Creek

TAMBO RIVER

SWIFTS CREEK

Cassilis Road - to Swifts Creek

Cassilis Rd - @ Shelton Gully

Swifts Creek East Rd

Doctors Flat-Ensay Rd - @ Swifts Creek

Charlotte Spur Track Ford - @ Swifts Creek

O'Reilly's Access - @ Tambo River

ENSAY

Ensay North Rd - @ Ensay (Little River Inn)

Ensay to Reedy Flat Rd - @ the bridge where
Reedy Flat Rd joins Great Alpine Rd

Reedy Creek Rd - 0.5km along from the bridge

Sandy Creek Rd - @ Sandy Creek

Sandy Creek Rd - @ Tambo River

Poyntons Access - @ Tambo River

Dukes Rd - @ Tambo River (Haywards access)

Old Coach Rd - @ Tambo River (Tambo Crossing)

BRUTHEN

Curtis Lane

Hoffmans Lane

SWAN REACH

Stephenson Road - @ Tambo Upper Bridge

Scriveners Rd - @ Mississippi Creek

BUNGA CREEK

Old Bunga Rd - @ Bunga Creek at the bore

Bunga Creek Rd – various (can be effected by tide)

NICHOLSON RIVER

BOGGY CREEK

Cassilis Road - to Swifts Creek (run off from
areas near tip, & the old mill site)

Brookville Rd - @ Riley Creek

Old Brookville Rd - @ Riley Creek

GAUGE LOCATIONS

Gauge Name	Location	Gauge Zero m AHD	No.
MITTA MITTA RIVER			
Mitta Mitta R @ Hinnomunjie			
TAMBO RIVER			
Tambo R @ Bindi	50m d/s of Bindi Rd bridge		223206
Timbarra R @ d/s Wilkinson Creek			223212
Timbarra R @ d/s Duggan Creek			223213
Haunted Stream @ Hells Gate			223215
Tambo R @ u/s Smith Creek			223214
Tambo R @ Swifts Creek	800m d/s of Swifts Creek	280.863	223202
Tambo R @ Ensay South			223201

Gauge Name	Location	Gauge Zero m AHD	No.
Tambo R @ d/s Ramrod Creek	700m d/s of the Ramrod Ck Junction	15.452	223205
Tambo R @ Battens Landing	Records from Feb 77–Nov 79 & Jun 04–now		223209
NICHOLSON RIVER			
Nicholson R @ Deptford			223204
Nicholson R @ Sarsfield			223210

GAUGE LEVEL INFORMATION

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)
MITTA MITTA RIVER				
Mitta Mitta R @ Hinnomunjie				
TAMBO RIVER				
Tambo R @ Bindi * flood class levels not current 223206	1998 Jun	4.75	20,600	
		4.71	19,900	100
		4.48	16,300	50
		4.21	13,000	25
	1993 Oct	3.88	9,720	
		3.79	8,820	10
	1975 Sep	3.42	6,100	
		3.40	5,930	5
Major		3.30	5,320	4
Moderate		2.90	3,420	3
Minor		2.40	1,800	<2
Timbarra R @ d/s Wilkinson Creek 223212	2012 Jun	7.57		
	1998 Jun	6.71		
	1988 Nov	6.48		
	1985 Oct	5.77		
	1984 Jul	5.52		
	2007 Jun	5.49		
	2011 Jul	5.20		
	2012 Mar	4.99		
	2008 Nov	4.82		
	2002 Apr	4.16		
Timbarra R @ d/s Duggan Creek 223213	1993 Oct	1.46		
	2012 Jun	1.40		
	2005 Sep	1.39		
	2010 Oct	1.32		
	1998 Jun	1.30		
	1995 Oct	1.25		
	2003 May	1.16		
	1989 Nov	1.13		
	2003 Aug	1.10		
	1998 Jul	1.09		
Haunted Stream @ Hells Gate 223215	1998 Jun	4.96		
	2012 Jun	3.92		
	2007 Jun	3.70		

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)
	1977 Jul	5.60		
	2008 Nov	5.40		
NICHOLSON RIVER				
Nicholson R @ Deptford 223204	1998 Jun	6.27		
	2012 Jun	5.12		
	2007 Jun	4.97		
	2011 Aug	4.92		
	1990 Apr	4.88		
	1988 Nov	4.84		
	1971 Jan	4.13		
	1985 Dec	3.94		
	1978 Jun	3.90		
	1984 Jul	3.54		
Nicholson R @ Sarsfield 223210	2012 Jun	6.51		
	2007 Jun	6.41		
	2011 Aug	5.82		
	1978 Jun	5.80		
	1978 Apr	4.39		
	2012 Mar	3.93		
	2008 Nov	3.70		
	1980 Jan	3.69		
	1981 May	3.32		
	2011 Jul	3.22		

* Flood Class Levels at Ramrod Creek are indicative only at this stage

APPENDIX B.01 – FLOOD PEAK TRAVEL TIMES

- | Travel times are calculated as the time the peak of the event takes to move from one gauge to the next. Note the onset of flooding can occur before the peak water level occurs.
- | It is possible for flooding to commence at downstream locations prior to peak heights being reached in the upper parts of the catchment due to both locally heavy rainfall and the backwater effects mentioned earlier.
- | Due to the high level of variability in antecedent catchment conditions, flood travel times can vary significantly, as demonstrated in previous floods.
- | Travel times listed here are **INDICATIVE ONLY** and are **HIGHLY VARIABLE**.

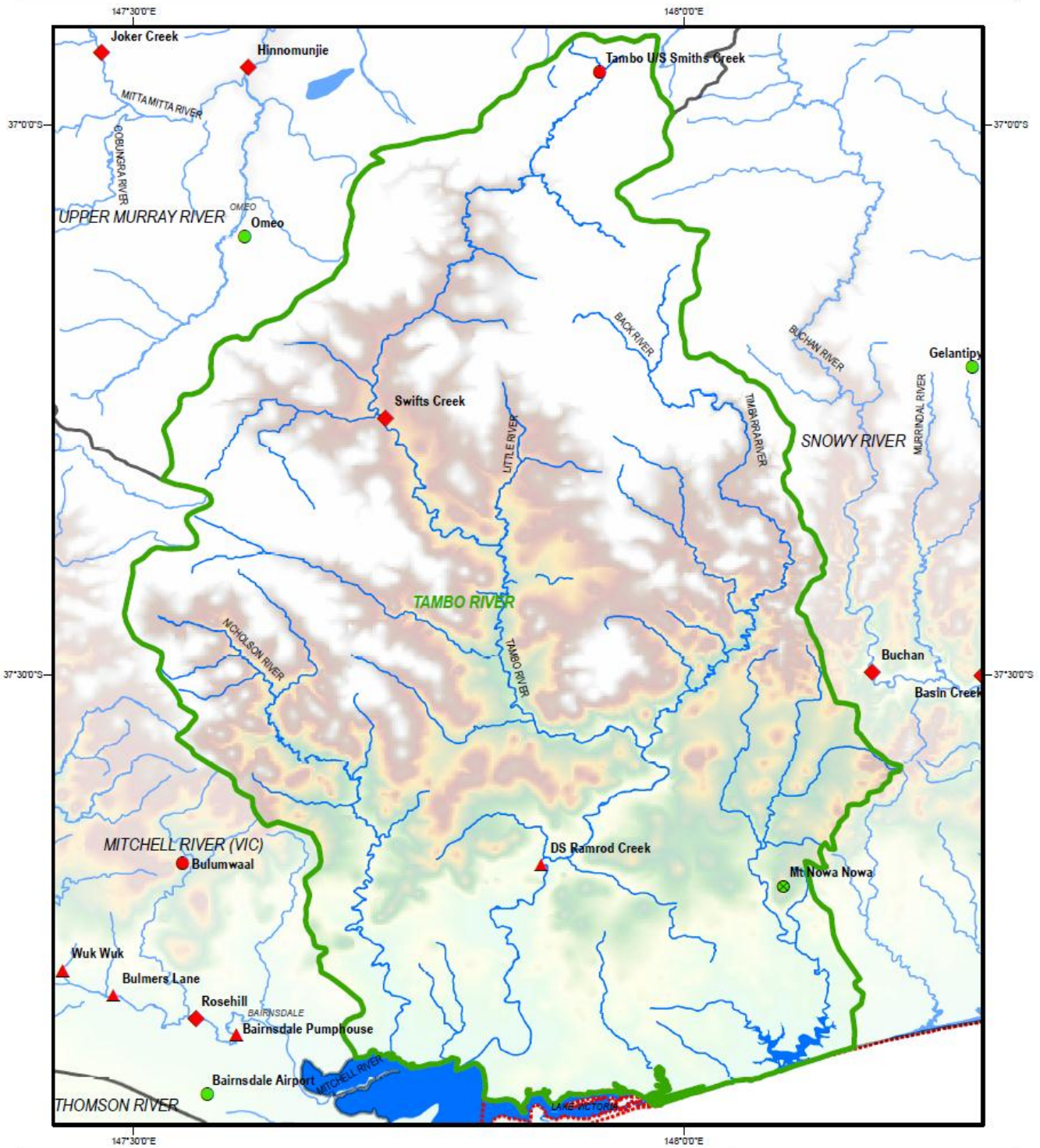
Gauge Name					

TAMBO RIVER

Flood Warning Data Collection Network



Australian Government
Bureau of Meteorology



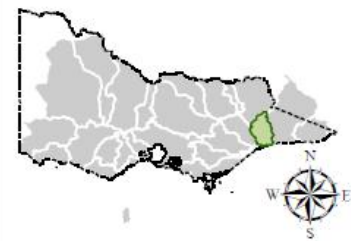
LEGEND (Stations):

- ▲ River Level
- Rainfall (TBRG)
- Rainfall (AWS)
- ◆ River and Rain
- Repeater
- Repeater (incl. Rain)
- Repeater (incl. River)
- ⊕ Repeater (AWS)

LEGEND (General):

- ▭ Catchment Boundaries
- Rivers
- Canals
- Water Bodies

0 2 4 8 12 16 Kilometers



Hydrology and Flood Warning Section, VICTORIA, May 2011

APPENDIX C.01 – FLOOD EMERGENCY PLAN

BRUTHEN/TWIN RIVERS DISTRICT

Tambo River @ d/s Ramrod Creek
Minor 4.0m
Moderate 5.5m

LOCATION

Bruthen is a small rural village on the Great Alpine Road between Bairnsdale and Ensay, situated 24 kilometres north-east of Bairnsdale .

Bruthen features an attractive commercial centre, consisting of a number of speciality shops, a general store (built in 1860) and the historic post office (built in 1890). Shady gardens with a rotunda and picnic areas are situated beside the town's main street.

The Tambo River is located just to the south of town.

The Twin Rivers Region includes the townships of Nicholson, Johnsonville and Swan Reach located along the Princes Highway between Bairnsdale and Lakes Entrance.

The Nicholson River flows through the township of Nicholson before entering Lake King at Jones Bay.

The Tambo River flows through Swan Reach before skirting to the south of Johnsonville and then into Lake King north of the village of Metung.

FLOOD BEHAVIOUR

The township of Bruthen is not normally susceptible to flooding, but is bounded to the south by the Tambo River flats which become inundated isolating a small number of rural properties.

River levels during flooding on the Tambo River at Tambo Upper will rise to just below the Fred Albert bridge in Stephenson Road without overtopping the bridge, but Stephenson Road on the western side of the bridge may be cut.

The Tambo River frequently breaks its banks at a number of places along its length between Bruthen and Metung during flood events.

Flooding on the Nicholson River causes minimal impact with the most significant inundation being along the unoccupied low lying reaches of the river between Nicholson and Jones Bay.

During a large flood event, the Princes Highway at Nicholson may be cut if water levels in Bosses Swamp rise and overtop the road.

CONSEQUENCES AND IMPACTS SUMMARY

....

FLOOD MITIGATION SYSTEMS

There are no flood mitigation systems in Bruthen.

FLOOD WARNINGS

There is a flood warning system under development for the Tambo River. There is no flood warning system for the Nicholson River.

ROAD CLOSURES

Riverine Flooding

Great Alpine Rd - between Bruthen & Wiseleigh.

Mossiface Rd - @ Wharf Corner

Mossiface-Swan Reach Rd - @ Wharf Corner.

Tambo Upper Rd - 2km south of Stephenson Rd & various other places

Curtis Lane - at Mossiface

Hoffmans Lane - at Mossiface

Stephenson Road - at Tambo Upper

Bruthen- Swan Reach Rd - at various places along its length.

Swan Reach-Metung Rd - at Swan Reach.

Flash Flooding

COMMUNITY PROFILE

Twin Rivers - Bruthen & District is a mainly rural area, with several small townships. Rural land is used mainly for grazing, timber milling, vegetable farming and honey production.

As a consequence of the proximity of the rivers and lakes, tourism is prominent throughout the region.

At the 2011 census, Bruthen / Twin Rivers Region had a population of 4314.

Pop'n	Dwellings	Language	Needs Assistance	Age Profile
4314	2013	English 93.7%	Disability 5.1% Living Alone 21.9% No Car 3.4%	Avg yrs <15 16.5% 15-54 44.4% 55-64 18.6% >65 20.5%

GAUGE LEVEL INFORMATION

Flood Class	Flood Event	Gauge Height
	1998 Jun	11.96
	2012 Jun	9.71
	1998 Nov	9.53
	2012 Jun	9.71
	1988 Nov	9.53
	1978 Jun	9.19
	1984 Jul	8.55
	1985 Dec	8.26
	1978 Apr	8.14
	2007 Jun	7.37
	1974 Jun	7.24
	1966 Oct	6.98
	2011 Aug	6.65
	1985 Oct	6.5
	1971 Jan	6.23
	1969 Jun	6.02
	1969 Nov	5.92
	2012 Mar	5.91
	2011 Jul	5.75
	1971 Feb	5.59
	2008 Nov	5.59
	1973 Nov	5.58
Moderate		5.50
	1974 Jul	5.19
	1985 Sep	5.16
	1970 Jun	5.05
	1974 May	5.05
	1990 Apr	5.00
	2002 Apr	4.80
	1974 Oct	4.76
	1974 Aug	4.74
	1969 May	4.62
	1966 Dec	4.56
	1993 Oct	4.45
	1977 Jul	4.39
	1991 Jul	4.21
	1990 Oct	4.03
Minor		4.00

These flood class levels are indicative only.

DETAILED CONSEQUENCES & IMPACTS - FLOOD INTELLIGENCE CARD

Gauge	No.	Location	Datum Type
Tambo River @ d/s Ramrod Creek	223205		

NB Depths quoted are above ground level. Properties are considered isolated when 20cm of water is across the road

Height (m)	Consequences	Operational Considerations
4.00	<p>MINOR FLOOD LEVEL</p> <hr/> <p>PROPERTIES</p> <ul style="list-style-type: none"> ▷ Low lying agricultural land beside the river ▷ Caravan Park <p>ROADS</p> <ul style="list-style-type: none"> ▷ Swan Reach- Mossiface Road @ Wharf Corner is closed ▷ Evans Track bridge - used as access to Spankers Knob 	<p>Bruthen Caravan Park may need evacuation.</p> <p>Boats at Jetties on Nicholson & Tambo may need their mooring lines extended.</p>
5.50	<p>MODERATE FLOOD LEVEL</p> <hr/> <p>ROADS</p> <ul style="list-style-type: none"> ▷ Tambo Upper Rd - 2km south of Stephenson Rd & various other places ▷ Curtis Lane - at Mossiface ▷ Hoffmans Lane - at Mossiface ▷ Stephenson Road - at Tambo Upper ▷ Bruthen- Swan Reach Rd - at various places along its length. 	
9.71	<p>JUNE 2012 FLOOD LEVEL</p> <ul style="list-style-type: none"> ▷ Swan Reach-Metung Rd - at Swan Reach 	
11.96	<p>JUNE 1998 FLOOD LEVEL</p>	

This flood intelligence card is currently being developed

APPENDIX D.07 – EVACUATION ARRANGEMENTS

The Incident Controller may make the decision to evacuate an at-risk community. Evacuation is the responsibility of VICPOL and will be conducted as per the EMMV and the MEMP.

APPENDIX E.07 - FLOOD WARNING SYSTEM

There is no flood gauge or Flood Warning System for Livingstone Creek and Omeo. There are gauges but no flood warning system for the Tambo River.

LOCAL FLOOD WARNING SYSTEM ARRANGEMENTS

There are no local arrangements

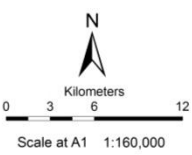
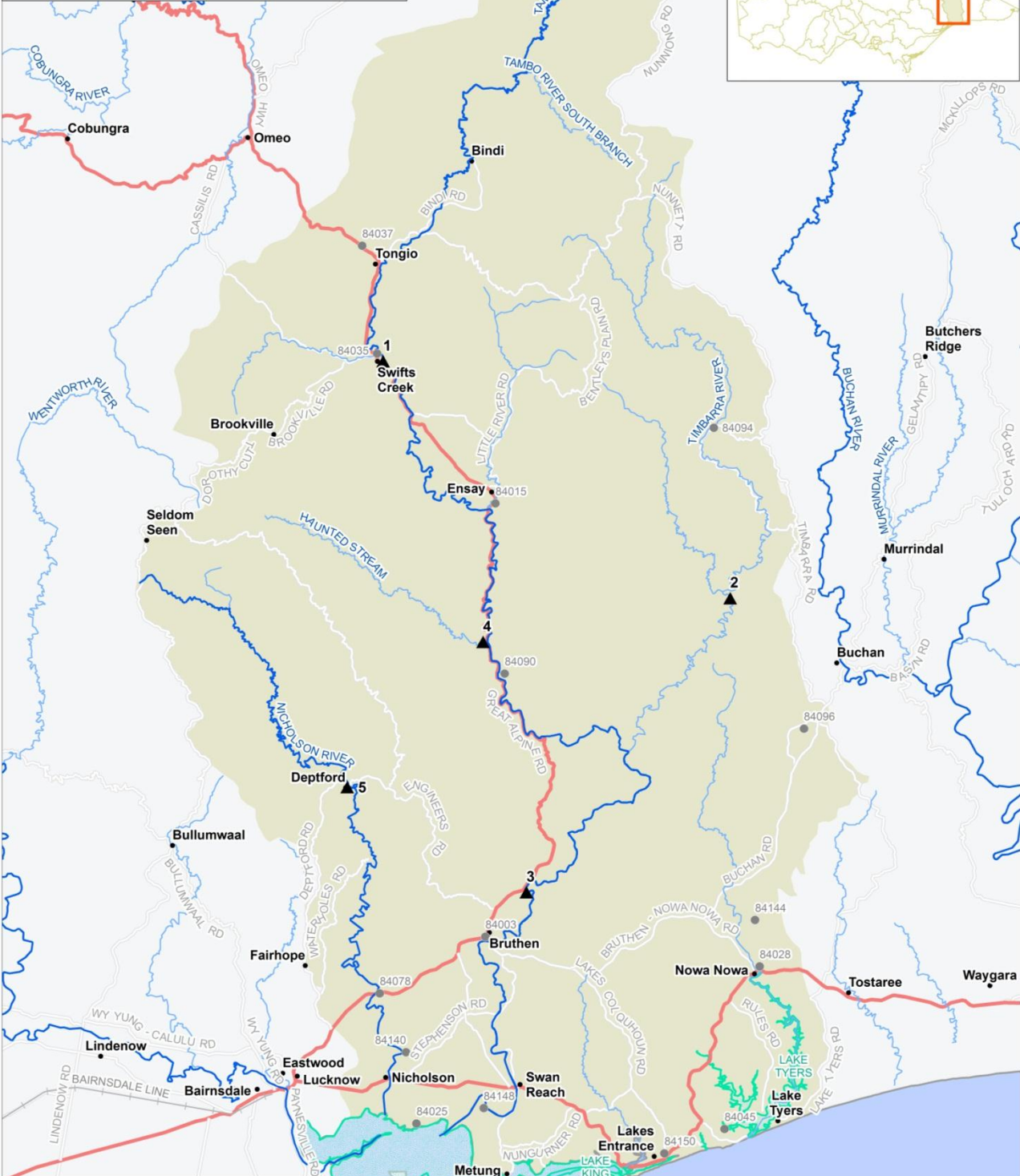
APPENDIX F.07 – MAPS

- | Tambo River Catchment Map
- | Tambo River downstream of Ramrod Creek Map

TAMBO RIVER CATCHMENT MAP

List of Gauges

- 1 Tambo River at Swifts Creek 223202
- 2 Timbarra River at D/S of Wilkinson Creek 223212
- 3 Tambo River at D/S of Ramrod Creek 223205
- 4 Haunted Stream at Hells Gate 223215
- 5 Nicholson River at Deptford 223204



- River Gauge
- Rain Gauge
- Township
- Rail Line
- Major Road
- Major River
- River/Creek
- Coastline
- Tambo and Nicholson River Catchments
- Lake/Swamp
- Ocean

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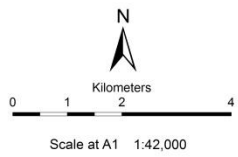
EAST GIPPSLAND CATCHMENT MANAGEMENT AUTHORITY

TAMBO RIVER DOWNSTREAM OF RAMROD CREEK MAP

Tambo River Catchment: Downstream of Ramrod Creek



- List of Gauges**
1 Tambo River DS Ramrod Ck 223205



- ▲ River Gauge
- Rain Gauge
- Township
- Major Road
- Secondary Road
- - - Extent of Flood Data
- Major River
- River/Creek
- 1% AEP Flood
- June 2012 Flood Event
- Tambo River Catchment
- Lake/Swamp

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EAST GIPPSLAND CATCHMENT MANAGEMENT AUTHORITY

East Gippsland Shire Flood Emergency Plan - Version 1.1

ATTACHMENT 04

MITCHELL RIVER



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ASSOCIATED REPORTS

- | Mitchell Basin, Water Resources division? DSE?
- | Report on Gippsland April, 1990 Floods, Rural Water Commission of Victoria, Sept 1991
- | 1998 Flood – The Road to Recovery in East Gippsland, East Gippsland Shire, DHS, NRE, EGCMA, Dec 1999
- | The Gippsland Floods of June / July 2007, East Gippsland Catchment Management Authority, DRAFT 2011

ACCURACY & CONFIDENTIALITY

Use this information as a guide to the possible effects of a flood. This card is based on estimates of flood behaviour and particular effects may occur at heights different from those indicated here. They may also occur at slightly different heights in different floods. This card may contain sensitive information about the effects of flooding on private property. Specific reference to private addresses or businesses must be made directly to owners or other emergency services but not via broadcast or print media.



APPENDIX A.04 – FLOOD THREATS

OVERVIEW OF RIVER SYSTEM

WEATHER PATTERNS

Low pressure weather systems off the NSW south coast (east coast lows) often cause heavy rain in the Mitchell River catchment resulting in significant river rises. So, too, do low pressure weather systems entering the catchment from central Australia and rainfall on the Great Divide and adjoining catchments.

Intense rain from tributaries can cause considerable local flooding in the lower reaches of the Mitchell River prior to the arrival of water from the upper catchment area. Heavy rain can also fall in the upper catchment whilst the weather remains fine in the lower catchment.

THE ORIGIN OF THE MITCHELL RIVER

The **Mitchell River** has a large catchment of approximately 4,500 km² and flows south from the Great Dividing Range near **Mt Hotham** to the Gippsland Lakes downstream of **Bairnsdale**. The main tributaries in the upper reaches of the basin are the **Wonnangatta** River originating near **Mt Howitt**; the **Dargo, Crooked & Wongungarra** Rivers originating at **Mt Hotham**; & the **Moroka** River originating at **Mt Wellington**.

UPPER CATCHMENT

Areas above the confluence of the Wonnangatta & Dargo Rivers are generally public land, steep and mountainous with water travelling long distances with a good flow rate. Apart from the township of **Dargo** (2006 pop. 144) on the Dargo River, the area is sparsely populated.

There are no river gauges upstream of the township of Dargo (on the Dargo R) or the locality of Crooked River (on the Wonnangatta R) and there is no warning of impending flooding available to the people in and around Dargo. A heads up for Dargo flooding is based entirely on rainfall at Mt Hotham, much of which may fall into the catchment of the Ovens, Kiewa or Mitta Mitta Rivers, rather than the Mitchell River catchment.

MID CATCHMENT

There is a further unmonitored tributary, the **Wentworth River**, which joins the Mitchell upstream of **Glenaladale** and a number of unmonitored sizable creeks downstream from **Glenaladale** (eg **Iguana, Boggy, Clifton, Flaggy, Prospect & Stony**). In widespread severe rain events, or when heavy rain affects the floodplain, these can rise quickly causing localised flooding & considerable contribution to Mitchell R flows.

Just north of **Glenaladale**, the river breaks out into the expansive floodplain spreading out into river flats around **Lindenow** (2006 pop. 338) (236 properties at risk in 1% event). Floodwaters travel slowly with large gullies traversing the floodplain having a major influence on the distribution of floodwaters. The township of Lindenow is raised above the floodplain but there are many rural landholdings and houses on the floodplain itself. For upper catchment rain, there is capacity to provide around 15 hrs warning time to these areas although farmers are generally well versed in when to move their irrigation infrastructure and stock. Any warning of flooding caused by rainfall in the mid-catchment tributaries can only be achieved by monitoring the Bullumwaal rainfall gauge.

LOWER CATCHMENT

Downstream of **Lindenow**, through to **Bairnsdale** the edge of the floodplain is very clearly defined by a steep escarpment and in significant events, floodwaters inundate **the majority** of the floodplain.

At **Bairnsdale** (2006 pop. 11,282) (470 properties at risk in a 1% event) the floodplain contracts and the river winds around the town and flows under the **Princes Hwy** near **Howitt Park**, covering many low lying roads and paths. The natural narrowing of the floodplain, together with the Princes Hwy and railway bridge embankments form a major constriction to the floodplain. There is **very high velocity** floodwaters around this area during flood events, which causes substantial infrastructure damage during significant floods.

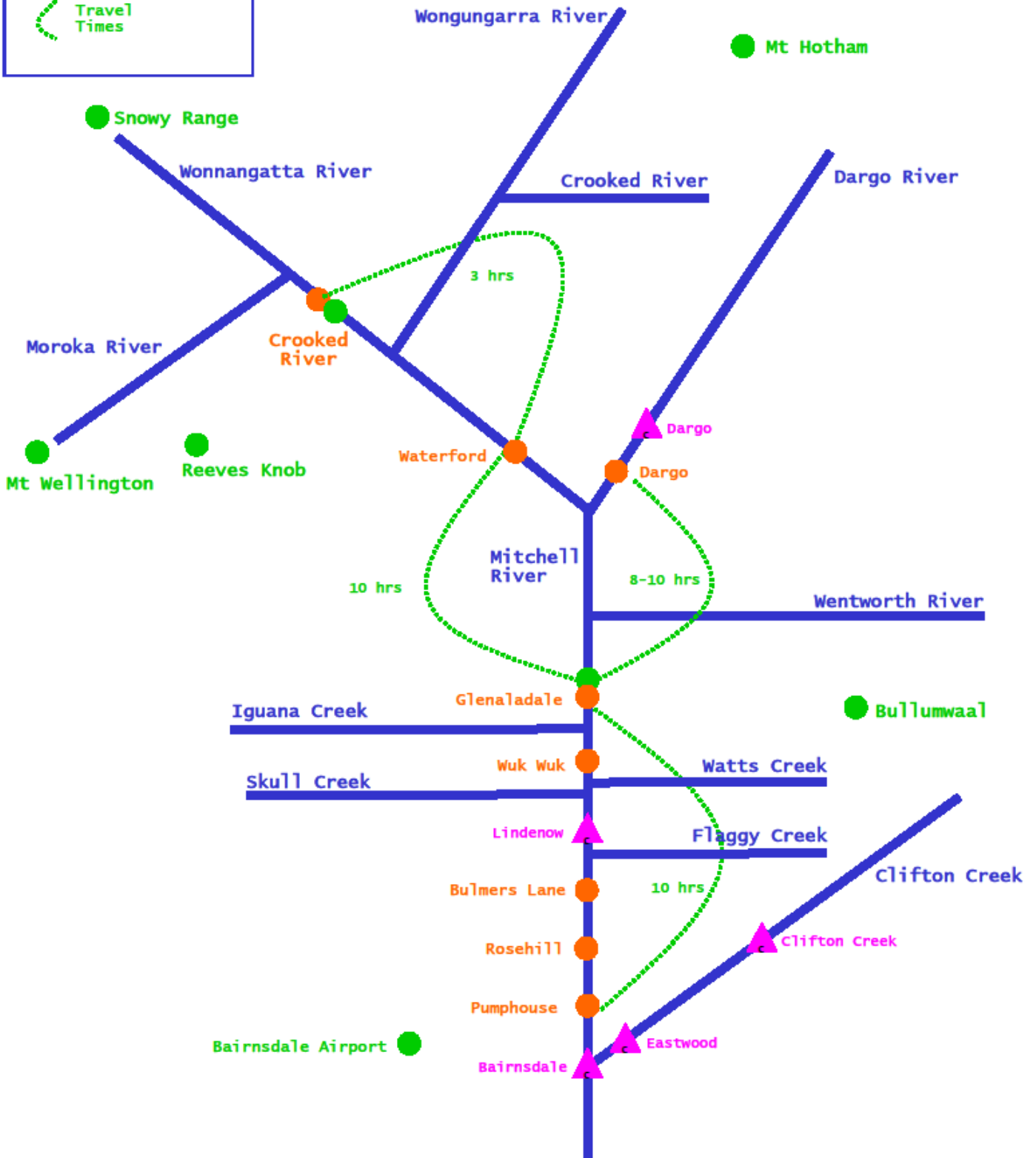
Immediately downstream of **Bairnsdale**, the flow patterns are controlled by high natural levees with adjacent natural surface levels being considerably lower. When the river capacity is exceeded, flows break out at **high velocity** across the natural levees to the low ground beyond – being **Macleods Morass** to the west and the headwaters of **Jones Bay** to the east.

SCHEMATIC DIAGRAM

MITCHELL RIVER

LEGEND

- Rainfall Gauge
- River Gauge
- ▲ Town / Locality
- ⋯ Travel Times



FLOOD RISKS

FLOODING FREQUENCY

Floods are a regular occurrence on the Mitchell River flats, with minor events occurring every year or so but sometimes as often as three or four times in the one year. During these minor events, a large part of the low-lying area surrounding the river is inundated with flood water either from the main stream or one of its tributaries.

Major events usually result from heavy rain across the whole catchment and are less frequent but have been recorded during 1893, 1936, 1952, 1974, 1978, 1985, 1990, 1991, 1998 & 2007. Events in 1893, 1936, 1990, 1998 & 2007 were very significant events.

FLASH FLOODING

Bairnsdale is prone to flash flooding when large rain events overwhelm the storm water drains impacting internal roadways and some major roadways where the storm water outfalls are located near the river eg Pound Swamp Hill Rd.

Eastwood, Wy Yung, Lucknow and Broadlands to the north and north east of Bairnsdale are impacted by flash flooding where local creeks are overloaded eg Goose Gully & Clifton Creek, Middle Creek and overland flows, which drains directly to Jones' Bay.

Rural areas to the south and south west of Bairnsdale around Forge Creek Rd, Glenaladale Rd, Humphreys Rd and the airport are also subject to flash flooding and overland flows.

Areas around Lindenow and Hillside are prone to flash flooding as the deep gullies that transverse the floodplain are overwhelmed with local run off and channelled by rail and road infrastructure.

RURAL FLOOD RISK

Throughout the Mitchell River catchment there a number of areas that have significant rural flood risk. Though these areas are not highly populated, rural properties are susceptible to isolation or inundation.

| **Wonnangatta River** - Wonnangatta, Crooked River

| **Dargo River** - Dargo

| **Mitchell River** – Iguana Creek, Wuk Wuk, Calulu, Ellaswood and the full length of the lower Mitchell River floodplain, Hillside, Broadlands, East Bairnsdale, Eastwood, Lindenow

| **Skull Creek** – Walpa, Lindenow

HEALTH & ENVIRONMENTAL RISKS

There are many septic tanks in the rural areas that may be inundated by floodwaters and farm chemicals stored in farm sheds on the floodplain.

PROPERTIES AT RISK

The table below is a breakdown of the number of properties impacted in a 1% AEP riverine event. These figures are **indicative only** and based on a mixture of actual impacts during historical events which were less than the 1% event and mapping. There is currently no information available for Dargo. Any revisions will **increase** the number of properties.

River	Community	# properties flooded in 1% AEP				
		Residential	Business	Industrial	Rural	Total
Dargo	Not yet mapped					
Mitchell	Glenaladale	0	0	0	3	3
	Iguana Creek	0	0	0	16	16
	Bengworden	0	0	0	9	9
	Goon Nure	0	0	0	7	7
	Broadlands	0	0	0	8	8
	Wuk Wuk	0	0	0	18	18
	Calulu	0	0	0	11	11
	Woodglen	0	0	0	31	31
	Forge Creek	0	0	0	36	36
	Lindenow	5	0	0	33	38
	Walpa	11	0	0	46	57
	Hillside	1	0	0	61	62
	Bairnsdale Area	326	13	34	172	545
TOTAL		335	13	34	415	765

HISTORICAL FLOODS

Significant floods have occurred in the Mitchell Catchment as shown in the table below. Impacts of significant events are discussed below the table. NB there are other Minor and Moderate flood events that are not listed in the spread sheet attachment.

EVENT	WONNANGATTA R @ WATERFORD	WONNANGATTA R @ CROOKED RIVER	DARGO R @ DARGO	GLENALADALE	ROSEHILL	B/DALE PUMPHOUSE
1893	-	-	-	-	-	8.23
1936	-	-	-	-	-	7.84
1952 Dec	-	-	-	6.44	-	-
1970 May	3.70	2.89	-	5.93	-	-
1970 Jun	3.58	2.70	-	5.90	-	-
1971 Jan	3.23	2.48	-	6.32	-	-
1974 Jun	2.28	1.83	3.59	4.36	-	6.25
1974 Jul	3.77	2.99	4.61	4.21	-	6.60
1974 Aug	3.62	2.70	3.90	5.26	-	5.30
1975 Sep	2.82	2.19	3.22	3.14	-	5.40
1976 Oct	4.73	2.48	3.28	4.54	-	6.30
1978 Jun	5.52	4.26	3.73	5.64	8.29	6.80
1981 Jul	4.93	3.97	3.32	3.57	-	5.35
1985 Oct	5.52	4.10	4.05	5.43	-	6.50
1990 Apr	8.55	5.99	5.26	7.62	-	7.84
1991 Jul	4.47	3.51	3.70	5.07	-	6.50
1992 Sep	4.67	3.72	3.41	4.20	-	5.20
1993 Oct	5.85	4.61	4.63	5.16	-	6.40
1996 Oct	4.55	3.69	3.14	3.58	-	5.16
1998 Jun	5.50	3.92	4.68	7.92	-	7.75
1998 Jul	4.05	3.22	3.74	3.31	-	4.47
1998 Sep	7.15	5.55	4.89	5.69	-	6.54
2005 Sep	5.33	4.13	3.35	4.34	7.62	5.52+
2007 Jun	8.18	5.84	4.93	8.26	9.02	7.66
2010 Sep	6.16	4.44	4.53	5.16	8.13	6.36
2010 Dec	4.32	3.44	2.87	-	6.79	-
2011 Jul	3.43	2.96	2.65	3.34	7.09	-
2011 Aug	5.98	4.38	3.89	5.94	8.39	6.70
2012 Mar 9	4.02	3.19	3.86	4.53	8.13	6.24
2012 Jun	6.58	4.79	5.13	7.36	8.78	7.30~
Major	6.50*		-	5.50	8.30	6.50
Moderate	4.50		-	4.50	7.40	5.50
Minor	3.50		-	3.00	5.70	4.00

■ < Minor
 ■ Minor
 ■ Moderate
 ■ Major

* Suggested FCL in current review 2012

1990 FLOOD EVENT

WEATHER SYSTEM

By early morning Friday 20th April, a low pressure centre had developed over western NSW which intensified and moved to the southeast locating just off the far south NSW coast by early morning Saturday 21st April. At this stage a strengthening and extremely moist south easterly airstream had extended across Gippsland to the Great Dividing Range and intense rainfall had commenced. The intense rainfall persisted for a period of 35 to 48 hours over a substantial part of the area.

FORECASTS

Indications on Friday 20th April were that prolonged and heavy rain would be required to overcome the dry state of Gippsland catchments. In addition, the low flows observed in Gippsland streams over the preceding weeks suggested substantial runoff would be needed to cause rivers to rise to flood level.

Although rain with local heavy falls was the main theme of meteorological forecasts and outlooks issued for Gippsland on the Friday, it was considered the dryness of catchments would lessen the likelihood of immediate flooding from even moderately heavy rain.

The Mitchell River flood warning system was designed to provide warnings for the river flats between Glenaladale and Bairnsdale. However, during the April 1990 event it was not possible to provide quantitative warnings because of a lack of rainfall data and failure of the Glenaladale stream gauge.

EVENT

Runoff commenced shortly after the heavy rainfall because the ground was unable to take up the intense rainfall quickly enough rather than because moisture deficits were satisfied.

The flood on the Mitchell resulted from rainfall across the whole catchment with a concentration of heavier falls in the mid to lower reaches. This caused flood flow contributions from all watercourses in the basin. The relative timing of these contributions had a significant impact on the timing and character of the resulting flood along the Lindenow flats and around Bairnsdale.

The rivers in the upper reaches of the catchment which combine to form the Mitchell River flooded late on Saturday April 21st.

At Glenaladale, the river rose rapidly to high levels during Saturday afternoon in response to local runoff, this was followed by a further rise overnight Sat and during Sun as high flows arrived from the upper reaches.

Heavy rain over the catchments of the creeks which flow through the Mitchell River floodplain caused them to flood during Saturday. These creeks are not instrumented but flow into the Mitchell downstream of the Glenaladale gauging station. Their contribution to the Mitchell River on this occasion was very significant. The effect is seen in the severe flooding which occurred on the Lindenow flats overnight Sat, the unusually rapid rise experienced at Bairnsdale early on Sun morning (followed by a further gradual rise to the peak some 14 hours later) and the relative timing of the Glenaladale and Bairnsdale peaks.

IMPACTS

Flows to the upper catchment streams of the Dargo, Wongungarra, Wentworth and Wonnangatta Rivers were the highest measured within the period of gauge record. Mitchell River flows in the lower catchment were also the highest measured on record.

The whole floodplain between Glenaladale and Bairnsdale was inundated and extensive damage to vegetable crops and property occurred along the Mitchell River flats.

A fatality occurred on the Mitchell River below Bairnsdale when a boat owner was trapped in his capsized boat at the old road bridge near Lake King. In the Bairnsdale area 46 houses were flooded and 7 at Lindenow.

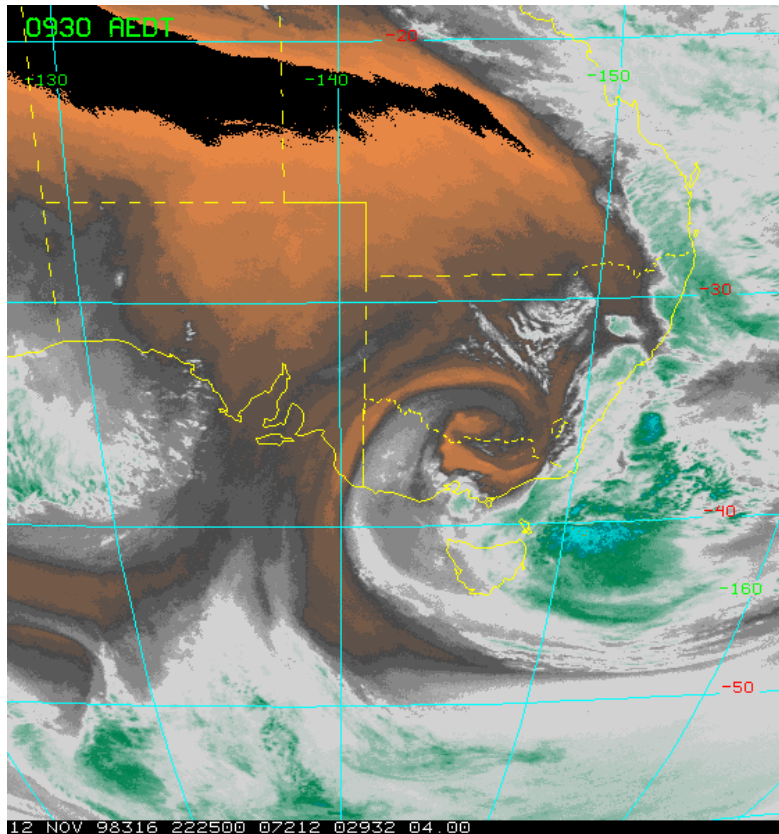
Agricultural damages for the Mitchell River floodplain were \$4.8M and road damages – City and Shire of Bairnsdale – \$450k.

1998 FLOOD EVENT

WEATHER SYSTEM

There had been 2.5 years of drought in the lead up to the 1998 flood event.

On June 23-24 the BoM reported a severe weather event with an intense low pressure system building across the east coast of Victoria.



East Coast Low June 1998

EVENT

An initial Minor Flood Warning for the Mitchell River was issued mid morning on Tue 23rd June. Indications were that rainfall for the 24hrs to 0900 was 75mm @ Crooked River and 70mm @ Waterford. A further 50mm of rain was predicted for the next 24-36hrs.

A Major Flood Warning was issued for the lower reaches of the Mitchell River early afternoon on Tue 23rd June, with a further estimated 20-50mm of rain expected in the 12 hours from 2200hrs.

IMPACTS

Princes Highway at the Mitchell River Bridge was closed to all traffic.

Mitchell Gardens and Wuk Wuk Caravan parks evacuated.

State Government financial response reached \$62.5m

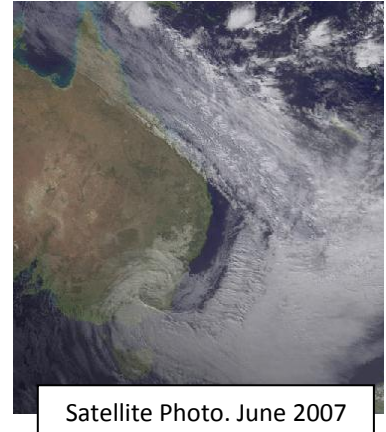
Estimated total damage across East Gippsland - \$77.5 million

One life was lost, \$10.5m of roads and bridges were destroyed, almost 40,000 sheep and cattle perished and more than 300 houses were damaged by flood water across East Gippsland

2007 FLOOD EVENT

WEATHER SYSTEM

During June 2007 four major east coast lows formed off the coast of NSW and east of Victoria. Each east coast low produced varying amounts of heavy rain. In the week commencing 17th June, BoM weather forecasts began to mention an east coast low that was likely to bring considerable rain to Gippsland. On Tue 19th June it began to rain and over the following three days, parts of the Mitchell catchment received falls in excess of 180mm. This effectively saturated already wet catchments and led to areas of Minor flooding in the upper reaches and Moderate flooding below Glenaladale.



Satellite Photo. June 2007

As this low pressure system weakened and moved away from the east coast, BoM weather forecasts began to refer to another east coast low, scheduled for the following week. It is this east coast low that produced the heavy rainfall that resulted in the significant flood event.

A low pressure trough over South Australia on Mon 25th moved eastwards over Victoria on Tues 26th to form an intense low pressure system in eastern Bass Strait near the south coast of NSW. The low deepened rapidly overnight on the 27th and became complex and moved close to eastern Victoria early on Thu 28th.

FORECASTS

BoM weather forecasts predicted a number of days in advance the commencement of heavy rain on Wed 27th and for the rain to continue until the early part of Thu 28th before easing. Rainfall totals for the 48 hours commencing 9am on the Wednesday were expected to range mostly between 100-175mm over the eastern and mountain parts of Gippsland with some isolated falls above 200mm possible.

EVENT

Rain from the east coast low commenced on Tue 26th and continued for the next 4 days. The Wonnangatta and Moroka rivers drain the western side of the Mitchell catchment in the vicinity of Mt Wellington which was the area that received the highest and most intense rainfall during this event. Further to the south, Iguana Creek which joins the main stem of the Mitchell River just upstream of Glenaladale, drains the area abutting the Avon catchment in the vicinity of Mt Moornappa, an area that also received significant rainfall totals and intensities. In the 48 hrs to 28th June, Mt Wellington received 334mm, Mt Moornappa 195mm, Glenaladale 123mm and Reeves Knob 270mm. Rainfall totals exceeded previous highest recorded values in Bairnsdale. Rainfall rates were well in excess of infiltration capacities.

Water velocities were high and river rises rapid along parts of the Mitchell River. The 2003 and the 2006/07 bushfires in Gippsland had severely depleted vegetation and ground cover in the catchment which increased the volume and speed of run-off. Debris loads were also high as the run-off moved significant amounts of debris from the fire burnt areas.

Flood peaks were significant and in some locations exceeded the April 1990 and June 1998 levels with the event being assessed as a 77yr ARI event at Glenaladale. Access to a number of gauging stations in the upper and lower reaches of the catchment were lost during the event which added a further degree of difficulty to flood warning activities. While there are no stream gauging stations along Iguana Creek, the Mitchell River at Glenaladale peaked only a few hours after peaks were recorded at the upstream gauging stations.

The floodplain downstream from Glenaladale flooded extensively, flooding was also experienced at Bairnsdale, where the river peaked at the Pumphouse gauging station above 7.66m overnight on the 28th, the 3rd highest on record.

IMPACTS

The main water supply pipe to Lindenow and Lindenow South was fractured under the river.

Forge Creek Road was washed out, Eastwood Bridge was under more than a metre of water and the Wy Yung football clubhouse all but disappeared. Crops lost = \$3.4m. Infrastructure loss = \$1.1m.

MAJOR WATER STORAGES

There are no water storages over 1,000ML within this catchment.

LEVEES

Name	River	Location	Condition	Operator
Bulmers Levee	Mitchell	Lindenow		
Ingrams Levee	Mitchell	Lindenow		

MAJOR ROAD CLOSURES

Riverine Flooding	Flash Flooding
<p>Bullumwaal Rd - Bairnsdale & Wy Yung - Lind Bridge approaches</p> <p>Lindenow Dargo Rd - @ the floodway between Lindenow and Walpa (Skull Cr & Mitchell R)</p> <p>Lindenow Glenaladale Rd - Wuk Wuk Bridge</p> <p>Paynesville Rd - @ Bairnsdale under the Highway Bridge, near Macleod St & at the Morass</p> <p>Princes Hwy - @ Bairnsdale - Mitchell River Bridge approaches</p> <p>Settlement Rd (Calulu Bridge)</p>	<p>Humphreys Rd - between Bengworden & Forge Ck Rds</p> <p>Morrisons Rd - @ Princes Highway end</p> <p>Princes Hwy - @ Broadlands near Phillips Lane</p>

RURAL ROAD CLOSURES

Most of the roads crossing the Mitchell floodplain between Glenaladale & Bairnsdale

WEST & SOUTH OF BAIRNSDALE	
Riverine Flooding	Flash Flooding
<p>Alexanders Ln</p> <p>Bashfords Ln</p> <p>Bon Accord Ln</p> <p>Bulmers Ln</p> <p>Dargo Rd</p> <p>Dockertys Rd</p> <p>Friday Ck Rd (Iguana Ck)</p> <p>Hansfords Ln</p> <p>Lindenow Dargo Rd</p> <p>Lindenow Glenaladale Rd – Wuk Wuk bridge</p> <p>Lubys Ln</p> <p>Marshalls Rd</p> <p>Rathlens Ln</p> <p>Ross Ln</p> <p>Settlement Rd</p> <p>Soldiers Rd</p> <p>Thatchers Rd</p> <p>Windmill Ln</p> <p>Woodglen Ln</p>	<p>Aerodrome Rd - above aerodrome top end</p> <p>Calulu Rd - @ Counihans</p> <p>Comleys Rd - various sections</p> <p>Fernbank Glenaladale Rd - various between Fingerboards & Princes Highway, severe at Fingerboards</p> <p>Fernbank Stockdale Rd - 1km down Stockdale Rd</p> <p>Forge Creek Rd</p> <p>Hillside Ln</p> <p>Hodges Estate Rd (Prospect Ck)</p> <p>Humphreys Rd - bet Bengworden Rd & Forge Ck Rd</p> <p>Ives Ln - west of Scotts Lane – severe</p> <p>Lindenow Meerlieu Rd - sth of Princes Hwy near Emu Ck & near Toms Ck</p> <p>Lower Goon Nure Rd - east of Clebyarra Rd</p> <p>Melwood Rd (Prospect Ck)</p> <p>Romawi Rd - sth of Peecks Rd</p> <p>Settlement Rd - nth of Calulu Bridge</p> <p>Snobbs Ln - (Skull Ck)</p> <p>Weir Lane - Lamberts flat crossing</p>

NORTH & EAST OF BAIRNSDALE

Riverine Flooding

Turners Rd - @ Clifton Ck
Bouchers Rd - @ Clifton Ck
Boyds Rd - @ Clifton Ck
Boyds Rd - @ Gambelon sign
Boyds Rd - @ Mt Taylor crossing
Laytons Rd - @ Waterholes Ck
Holes Rd - @ Waterholes Ck
Clifton West Rd - @ Waterholes Ck
Waterholes Rd - @ Browns Ck

Flash Flooding

DISRUPTION TO SERVICES

- | In the 2007 event, the water main at Lindenow was damaged reducing water supply capability. This isn't expected to happen in future events.
- | Main transport routes are generally impacted during large events. School buses generally cease to operate during major events.

GAUGE LOCATIONS

Gauge Name	Location	Gauge Zero m AHD	No.
Wonnangatta R @ Crooked River	2.9km u/s of the Wongungarra River junction	240.829	244206
Wonnangatta R @ Waterford	5.8km u/s of Waterford Bridge	175.337	224201
Dargo R @ Lower Dargo Rd	4.8km d/s of the bridge @ Dargo	172.824	224213
Mitchell R @ Glenaladale	d/s of road bridge @ Glenaladale	28.951	224203
Mitchell R @ Wuk Wuk	d/s Wuk Wuk bridge		224218
Mitchell R @ Lindenow (Bulmers Ln)	Bulmers Lane Lindenow		224219
Mitchell R @ Rosehill	1.4km d/s Prospect Ck confluence		224217
Mitchell R @ Bairnsdale Pumphouse	Jennings St Bairnsdale	-0.323	224200

GAUGE LEVEL INFORMATION

A full listing of historical gauge heights is attached.

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)	
Wonnangatta R @ Crooked R 244206		6.02	51,300	100	
	1990 Apr	5.99	50,700	95	
	2007 Jun	5.84	46,000		
			5.69	44,200	50
	1998 Sep	5.55	40,300	35	
			5.32	37,100	25
	1959 Sep	4.92	30,500	13	
	1958 Aug	4.80	28,500	11	
	2012 Jun	4.79			
			4.75	27,700	10
	1955 Aug	4.70	26,900	9	
	1956 Jan	4.62	25,700	8	
	1993 Oct	4.61			
	2010 Sep	4.44			
	2011 Aug	4.38			
	2005 Aug	4.34			
			4.28	20,600	5
	1978 Jun	4.26			
	2005 Sep	4.13			
	1985 Oct	4.10			
	1993 Sep	4.01			
	1986 Oct	3.99			
	1981 Jul	3.97			
	1998 Jun	3.92			
	1992 Sep	3.72			
	1996 Oct	3.69			
	1995 Jun	3.68			
	2000 Oct	3.56			
	2003 Jul	3.54			
	1985 Sep	3.53			
	1991 Jul	3.51			
	2010 Dec	3.44			
	2012 Mar	3.20			
Wonnangatta R @ Waterford 224201		8.77	71,600	100	
	1990 Apr	8.55	68,600	80	
	2007 Jun	8.18			
		8.06	62,000	50	
		7.29	52,400	25	
	1998 Sep	7.15	50,700	24	
	2012 Jun	6.58			
	(recommended) Major	6.50			
	2010 Sep	6.16	39,600	10	
	2011 Aug	5.98			
	1993 Oct	5.85	36,100	9	
	1985 Oct	5.52	32,100	6	
	1978 Jun	5.50	31,900	6	
	1998 Jun	5.50	31,600	6	
	2005 Aug	5.38			
	2005 Sep	5.33			
	1971 Nov	5.36	29,900	6	
		5.34	29,800	5	
	1986 Oct	4.97			
	1981 Jul	4.93			
1976 Oct	4.73				
1992 Sep	4.67				
1996 Oct	4.55				
Moderate	4.50	20,000	3		
	1991 Jul	4.47			
	1993 Sep & 2003 Jul	4.40			

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)
	2010 Dec	4.32		
	1995 Jun	4.29		
	1985 Sep	4.20		
	2000 Oct	4.18		
	1996 Aug	4.09		
	1995 Oct	4.08		
	1998 Jul	4.05		
	2012 Mar 9	4.02		
	1986 Jul	3.95		
	1984 Jul	3.94		
	2012 Mar 2	3.89		
Minor		3.50	10,800	<2
Dargo R @ Lower Dargo Rd 224213		6.47	30,400	100
		5.84	24,600	50
		5.24	19,400	25
	2007 Jun	4.93	17,044	
	1998 Sep	4.89		
	1990 Apr	4.88	19,700	
	1998 Jun	4.68		
	1993 Oct	4.63		
	1974 Jul	4.61	16,600	
	2010 Sep	4.53		
		4.49	13,500	10
	1985 Oct	4.05		
	1974 Aug	3.93	9,640	5
	2011 Aug	3.89		
	2012 Mar 2	3.86		
	1998 Jul	3.74		
	1978 Jun	3.73		
	1991 Jul	3.70		
	2005 Aug	3.68		
	1974 Jun	3.59		
	1974 May	3.58		
	1992 Sep	3.41		
	1992 Oct	3.35		
	2005 Sep	3.35		
Wentworth R @ Tabberabbera	1998 Jun	6.41		
	2007 Jun	6.28		
	1990 Apr	6.05		
	2012 Jun	5.93		
	2011 Aug	5.21		
	1984 Jul	4.84		
	1985 Oct	4.77		
	1991 Jul	4.68		
	1988 Nov	4.45		
	2012 Mar	4.37		
	1985 Sep	4.25		
	1978 Jun	4.13		
	1993 Oct	3.71		
	1985 Dec	3.56		
	1990 Sep	3.54		
	1992 Oct	3.50		
	1976 Oct	3.40		
	1992 Sep	3.29		
	2008 Nov	3.26		
	1978 Apr	3.25		
	1992 Jun	2.98		
	1990 Oct	2.95		
	2011 Jul	2.92		
	1977 Jul	2.88		

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)
Mitchell R @ Glenaladale 224203		8.39	169,000	100
	2007 Jun	8.26	132,721	
	1998 Jun	7.92	144,000	58
		7.80	138,000	50
	1990 Apr	7.62	130,000	45
	2012 Jun	7.36		
		7.10	109,000	25
	1952 Dec	6.44	100,000	20
	1971 Jan	6.32	96,200	18
	2011 Aug	5.95		
	1970 May	5.93		
	1970 Jun	5.90		
	1952 Jun	5.84		
	1998 Sep	5.69		
	1978 Jun	5.64		
	1959 Sep	5.51		
Major		5.50	63,100	7
	1985 Oct	5.43		
	1949 Jul	5.27		
	1974 Aug	5.26		
	2010 Sep	5.16		
		5.03	53,300	5
	1970 Aug	5.23		
	1993 Oct	5.16		
	2010 Sep	5.16		
	1991 Jul	5.07		
	1950 Apr	5.00		
	1942 Nov	4.88		
	1949 Jun	4.80		
	1951 Aug	4.79		
	1976 Oct	4.54		
	2012 Mar 9	4.52		
Moderate		4.50	43,000	4
Minor		3.00	19,900	<2
Mitchell R @ Wuk Wuk 224218	2011 Aug	6.49		
	1991 Jul	5.43	990	
	1993 Oct	5.41	987	
	1992 Sep	4.58		
	2011 Jul	4.22		
	1993 Sep	4.06		
	1996 Oct	4.05	822	
	1995 Oct	3.93		
	1992 Dec	3.79		
	1995 Jun	3.75		
	1996 Aug	3.69		
	1996 Sep	3.56		
	1992 Jun	3.06		
	1991 Aug	3.03		
Mitchell R @ Lindenow (Bulmers Lane) 224219	1993 Oct	5.90	9,788	
	1991 Jul	5.83	9,625	
	1992 Sep	5.05		
	1993 Sep	4.39		
	1996 Oct	4.15		
	1995 Oct	4.08		
	1992 Oct	4.04		
	1992 Dec	3.99		
	1995 Jun	3.85		
	1996 Aug	3.68		
	1996 Sep	3.57		
	1992 Jun	3.16		
	1991 Aug	3.03		
	1995 May	2.97		
1991 Sep	2.77			

Gauge Name	Event	Gauge Height (m)	Flow (ML/d)	ARI (1 in X years)	
Mitchell R @ Rosehill 224217	2007 Jun	9.02			
	2012 Jun	8.78			
	2011 Aug	8.39			
	Major	Major	8.30		
	1978 Jun	8.29			
	**Flood Class Levels shown are Interim levels correlated to the Pumphouse Gauge	2010 Sep	8.13		
	2012 Mar	8.13			
	1978 Apr	7.65			
	2005 Sep	7.62			
	Moderate	Moderate	7.40		
	2011 Jul	7.09			
	2004 Apr	6.80			
	2010 Dec	6.79			
2003 Jul	6.50				
1978 May	5.87				
Minor	Minor	5.70			
1978 Jul	5.16				
2003 Aug	5.12				
Mitchell R @ Bairnsdale Pumphouse 224200	1893	8.23			
	1990 Apr	7.84			
	1936	7.84			
	1998 Jun	7.75			
	2007 Jun	7.66			
	2012 Jun	7.30~			
	1978 Jun	6.80			
	2011 Aug	6.70			
	1985/1974	6.60			
	1998 Sep	6.54			
	Major		6.50		
	1991	6.50			
	1993	6.40			
	2010 Sep	6.36			
	1976 Oct	6.30			
	1974 Jun	6.25			
	* estimated	2012 Mar	6.24*		
	Moderate		5.50		
	1975	5.40			
1981/1993	5.35				
1974	5.30				
1992	5.20				
Minor		4.00			

APPENDIX B.04 –FLOOD PEAK TRAVEL TIMES

- | Travel times are calculated as the time the peak of the event takes to move from one gauge to the next. Note the onset of flooding can occur before the peak water level occurs.
- | It is possible for flooding to commence at downstream locations prior to peak heights being reached in the upper parts of the catchment due to both locally heavy rainfall and the backwater effects mentioned earlier.
- | Due to the high level of variability in antecedent catchment conditions, flood travel times can vary significantly, as demonstrated in previous floods.
- | Travel times listed here are **INDICATIVE ONLY** and are **HIGHLY VARIABLE**.

Gauge Name	June 2007	June 1998	Sept 1998	Oct 1996	April 1990
Wonnangatta R @ Crooked River	0	0	0	0	0
Wonnangatta R @ Waterford	15 hrs	3 hrs	4 hrs	2.5 hrs	5 hrs
Gauge Name	July 1991	Oct 1993	Oct 1996	Jul 1998	Sep 1998
Mitchell R @ Glenaladale	0	0	0	0	0
Mitchell R @ Wuk Wuk	1 hrs	2 hrs	3 hrs		
Mitchell R @ Bulmers Lane	2 hrs	6 hrs	3.5 hrs		
Mitchell R @ B'dale Pumphouse			18 hrs	11 hrs	9 hrs



Pumphouse Gauge
Minor 4.00m
Moderate 5.50m
Major 6.50m

LOCATION

Bairnsdale is a major town of approx 8000 residents as well as a regional shopping, industrial and medical centre for north and east Gippsland residents. The Princes Highway passes through the town and may be cut at the Mitchell River during significant floods, which splits the town in two and cuts all east/west traffic for the duration with no alternative access.

FLOOD BEHAVIOUR

Flooding in Bairnsdale is along the Mitchell River and Clifton Creek (aka The Backwater), particularly where it intersects with the Princes Highway. Water first enters the urban areas via low lying storm water drains and then breaches the river bank near the Hwy bridge.

Areas of significant depth and velocity are experienced downstream of the princes Hwy Bridge as floodwaters break through the Macleod Street area and move towards Macleods Morass.

There are also isolated pockets of flash flooding and pooling where storm water drains are unable to cope with heavy rains and/or where topography means that water puddles in low-lying areas or rushes quickly through steep areas.

There are approximately 655 residential, commercial, industrial and rural properties in Bairnsdale at threat of flooding in a 1% AEP event.

FLOOD MITIGATION SYSTEMS

There are no flood mitigation systems in Bairnsdale.

CONSEQUENCES AND IMPACTS SUMMARY

The table below is a breakdown of the number of properties impacted in a 1% AEP riverine event. These figures are **indicative only** and based on a mixture of actual impacts during historical events and mapping.

Community	# properties flooded in 1% AEP				
	Residential	Business	Industrial	Rural	Total
Bairnsdale	105	13	34	66	218
Broadlands	-	-	-	9	9
East Bairnsdale	60	-	-	31	91
Eastwood	106	-	-	-	106
Lucknow	40	-	-	-	40
Wy Yung	15	-	-	66	81
Bairnsdale Total	326	13	34	172	545

FLOOD WARNINGS

The Bureau of Meteorology provides warnings for the Mitchell River and is able to provide warnings and flood height predictions approximately 12 hours ahead of peaks caused by upper catchment rainfall. There is no flood warning system for flooding caused by local catchment runoff in the lower Mitchell River.

ROAD CLOSURES

BAIRNSDALE

Riverine Flooding

- | **Bredt St** - north of Pope St
- | **Bridge St** - @ the Butter Factory
- | **Bullumwaal Rd** - Lind Bridge approaches
- | **Coles Rd** – on the flats near Picnic Point
- | **Kay Ln** - – on the flats near Picnic Point
- | **Macleod St** - east of Park St
- | **Macleod Crt**
- | **Mitchell Port Rd**
- | **Mitchell River** walking track
- | **Park St**
- | **Paynesville Rd** - under the Hwy Bridge
- | **Paynesville Rd** - near Macleod St
- | **Paynesville Rd** - @ the Morass
- | **Pound Swamp Hill Rd**
- | **Princes Hwy** - Mitchell River Bridge approaches
- | **Riley St & Drevermann Sts** - bet Llewelyn Crt & Yeates Dve
- | **Rupert St** – between Macleod & Bailey Sts
- | **Yeates Dve**
- | **Saleyards Rd** – next to Morass
- | **Suding Rd** – east of Bailey St
- | **Webbs Rd** - north of Williams Pde

Flash Flooding

- | **Alvin Crt**
- | **Arco Crt**
- | **Bosworth Rd**
- | **Dalmahoy St** - western end
- | **Humphreys Rd** - bet Bengworden Rd & Forge Ck Rds
- | **John Crt**
- | **Kelsey Crt**
- | **Kollmorgan Pl**
- | **Macleod St** - @ the Skate Park
- | **Morrisons St** - @ Princes Hwy end
- | **Peart St** - western end
- | **Princes Hwy** - east & west bound between Goold & Hodgson St
- | **Princes Hwy** - @ Forge Ck / Victoria St roundabout
- | **Saleyards Rd** - next to Morass

EASTWOOD & WY YUNG

- | **Bullumwaal Rd** - Lind Bridge approaches
- | **Howitt Ave** - Clifton Creek @ **Eastwood Bridge**
- | **Mitchell River Flats Rd** – Lind Bridge to footbridge
- | **Counihan St** – bet Suding Cl & Dwyer St
- | **Flinns Rd** – bet Morton Dve & The Grange
- | **Howitt Ave** – west of Balmoral Cres
- | **McAuleys Rd**
- | **Tierney St**

EAST BAIRNSALE, LUCKNOW & BROADLANDS

Broadlands Rd – west of Bankins Ln	Crooke St - bet Hoddinott & Macrae Sts
Howitt Park access roads	Hoddinott St – near Crooke St
Riverbank Rd East – lower end	Hoddinott St – bet Norton & Humphrey Sts
Robb St – lower end	Lanes Rd – bet Jennings & Phillips Lns
	Lanes Rd – bet Commins & Sandords Lns
	Rail Trail
	McEacharn St - southern end
	Morrison St – bet Princes Hwy & Broadlands Rd
	Phillips Ln – bet Princes Hwy & Lanes Rd
	Princes Hwy - bet Phillips Ln & Commins Ln
	Robb St - southern end

COMMUNITY PROFILE

Bairnsdale is the largest community in East Gippsland Shire and is a mixture of people who have experienced several flooding events in Bairnsdale and those who have not experienced flooding here or not at all.

It is a larger community and assisting neighbours is not as prevalent as in other smaller towns.

There are many schools, government departments, large commercial and manufacturing premises and a regional hospital. It is also home to the Corporate Centre of East Gippsland Shire Council, and the main regional offices of East Gippsland Water, CFA, DPI, DSE and SES to name a few.

GAUGE LEVEL INFORMATION

Flood Class	Flood Event	Pumphouse	Rosehill
	1893	8.23	
	1990 Apr	7.84	
	1936	7.84	
	1998 Jun	7.75	
	2007 Jun	7.66	9.02
	2012 Jun	7.30	8.78
	1978 Jun	6.80	
	2011 Aug	6.70	8.40
	1985 & 1974	6.60	
	1998 Sep	6.52	
Major		6.50	8.30
	1991	6.50	
	1993	6.40	
	2010 Sep	6.36	8.13
	1976 Oct	6.30	
	1974 Jun	6.25	
	2012 Mar	6.24?	8.13
	2005 Sep	-	7.61
Moderate		5.50	7.40
	1975	5.40	
	2011 Jul		7.09
	1981/1993	5.35	
	1974	5.30	
	1992	5.20	
	2004 Sep	-	6.80
Minor		4.00	5.70

The Pumphouse gauge is manually read and not all peaks are able to be read if the river peaks during night hours. Rosehill is a new electronic gauge currently being correlated to the Pumphouse gauge. The Flood Class Levels shown for Rosehill are interim levels correlated to the Pumphouse Gauge

DETAILED CONSEQUENCES & IMPACTS - FLOOD INTELLIGENCE CARD

Gauge	No.	Location	Datum Type
Mitchell R @ Pumphouse			
Mitchell R @ Rosehill			

NB Depths quoted are above ground level. Properties are considered isolated when 20cm of water is across the road

Height (m)		Consequences	Operational Considerations
Rosehill	P/House		
5.70	4.00	MINOR FLOOD LEVEL <hr/> PROPERTIES <ul style="list-style-type: none"> ▷ Low lying agricultural land beside the river ROADS <ul style="list-style-type: none"> ▷ Nil 	
7.40	5.50	MODERATE FLOOD LEVEL	
8.13	6.24	MARCH 2012 FLOOD LEVEL <hr/> PROPERTIES <ul style="list-style-type: none"> ▷ Nil ROADS <ul style="list-style-type: none"> ▷ Macleod St - near skate ramp, one lane closed ▷ Yeates Drive - below Picnic Point closed ▷ ALL other roads remained open 	
8.13	6.36	SEPTEMBER 2010 FLOOD LEVEL	
8.30	6.50	MAJOR FLOOD LEVEL	
8.40	6.70	AUGUST 2011 FLOOD LEVEL <hr/> PROPERTIES <ul style="list-style-type: none"> ▷ Yeates Drive - Picnic Point Farm ▷ Low lying agricultural land on Bullumwaal Rd, Webbs Rd, Yeates Rd, Bankins Lane ▷ Bottom of properties along the Backwater Eastwood ROADS <p>Water over Road</p> <ul style="list-style-type: none"> ▷ Suding St near Macleod St 	

Height (m) Rosehill	P/House	Consequences	Operational Considerations
------------------------	---------	--------------	----------------------------

Road Closed

- ▷ **Bredt St** - north of Pope St
- ▷ **Bullumwaal Rd** - approaches to Lind Bridge
- ▷ **Coles Rd** – on the flats near Picnic Point
- ▷ **Howitt Ave** - Clifton Creek @ Eastwood Bridge
- ▷ **Howitt Park** access roads
- ▷ **Kay Ln** - – on the flats near Picnic Point
- ▷ **Macleod St** - Skate Park to Suding Rd
- ▷ **Mitchell Port Rd**
- ▷ **Mitchell River Flats Rd** – Lind Bridge to footbridge
- ▷ **Paynesville Rd** - under Hwy bridge
- ▷ **Pound Swamp Hill Rd**
- ▷ **Riley St & Drevermann Sts** - bet Llewelyn Crt & Yeates Dve
- ▷ **Webbs Rd** - north of Williams Pde
- ▷ **Yeates Drive**
- ▷ And previously listed

PUBLIC INFRASTRUCTURE

- ▷ Howitt Park sports fields
- ▷ Wy Yung Football Oval and grounds (Club rooms just clear of water)
- ▷ Davison Oval
- ▷ Howitt Park Boat Ramp & car park
- ▷ Farmland between Mitchell R & Clifton Creek (backwater)
- ▷ Eastwood walking track along The Backwater
- ▷ Mitchell River walking track
- ▷ Port of Bairnsdale (including toilets??)

8.78	7.30	<p>JUNE 2012 FLOOD LEVEL</p> <hr/> <p>PROPERTIES</p> <p>Flooded & Isolated</p> <ul style="list-style-type: none"> ▷ Robb St – southern end ▷ McEacharn St – southern end ▷ Broadlands Rd – west of Banks Ln <p>ROADS</p> <ul style="list-style-type: none"> ▷ Robb St – southern end ▷ Broadlands Rd – west of Banks Ln ▷ McEacharn St ▷ Riverbank Rd East – lower end <p>PUBLIC INFRASTRUCTURE</p> <ul style="list-style-type: none"> ▷ Wy Yung Football Oval Sheds 	
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Height (m) Rosehill	P/House	Consequences	Operational Considerations
9.02	7.66	<p>2007 FLOOD LEVEL</p> <hr/> <p>PROPERTIES</p> <p>Flooded & Isolated</p> <ul style="list-style-type: none"> ▷ Princes Hwy <ul style="list-style-type: none"> ▷ Mitchell Gardens Caravan Park ▷ Imperial Hotel ▷ Macleod St <ul style="list-style-type: none"> ▪ Houses – 2, 4, 12 ▪ Butter Factory complex ▪ David Luckes Fresh Food Market ▷ Paynesville Rd - Residences between Macleod St & Eagle Point bluff <p>ROADS</p> <ul style="list-style-type: none"> ▷ Bridge St - @ the Butter Factory <u>VERY HIGH VELOCITY</u> ▷ Macleod St - Park St to Paynesville Rd (<u>VERY HIGH VELOCITY</u> near Bridge St) ▷ Macleod Crt ▷ Park St ▷ Paynesville Rd - near Macleod St ▷ Paynesville Rd - @ the Morass ▷ Princes Hwy - Mitchell River Bridge approaches ▷ Rupert St – between Macleod & Bailey Sts ▷ Saleyards Rd – next to Morass ▷ Suding Rd – east of Bailey St ▷ And listed previously 	
	7.75	1998 FLOOD LEVEL	

DETAILED PROPERTY LISTINGS

NB – Individual residence floor heights are unknown, the information provided represents flooding impact at ground levels only

Height (m)	Group Name	No of Properties	Property Address
2007			
			Number of actual properties affected = 15-20
			Properties affected
			McLeod St, Bairnsdale [8]
			Suding St, Bairnsdale [1]
			Paynesville Rd, Bairnsdale [3]
			Princes Hwy, Bairnsdale [1]
			Robb St, Bairnsdale [several]
			Riverbank Rd, Bairnsdale [1]
			Wonnangatta Rd, Crooked River [1443, 2818, 4338, 4494]
			Talbotville Rd, Crooked River [579]
			Lower Dargo Rd, Dargo [1156, 1500]
			Upper Dargo Rd, Dargo [56, 368]
			Omeo Rd, Dargo [163]
			Dargo Rd, Dargo [7611]
			Kings Rd, Dargo [129]
			Dalmore Rd, Dargo [67]
			Wonnangatta Caravan park, 2315 Dargo Rd, Dargo 5140 1265
			Costume Manufacturing, RMB 2347 Upper Dargo Rd, Dargo 5140 1255
			Dargo Caravan Park, Main Rd, Dargo 5140 1265

POSSIBLE IMPACTS			
	Main St		[2 - Bairnsdale Mitchell Gardens Caravan Park]
	Main St		[3 – Imperial Hotel]
	Macleod St		[2, 4, 12]

APPENDIX D.04 – EVACUATION ARRANGEMENTS

The Incident Controller may make the decision to evacuate an at-risk community. Evacuation is the responsibility of VICPOL and will be conducted as per the EMMV and the MEMP.

APPENDIX E.04 - FLOOD WARNING SYSTEM

The Bureau of Meteorology provides a Flood Warning Service for the Mitchell River. They will provide estimated peaks for Bairnsdale once upstream gauges have peaked.

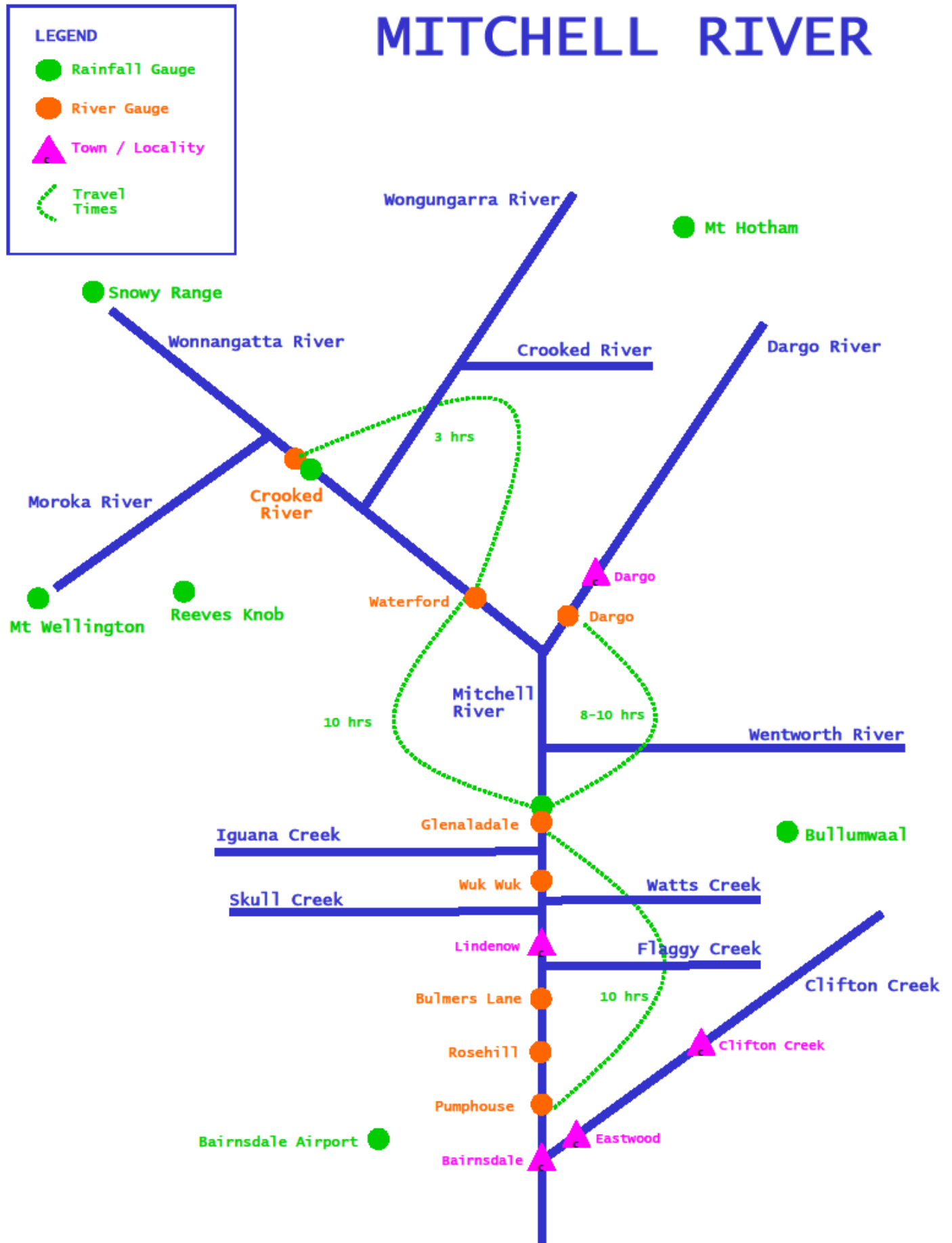
LOCAL FLOOD WARNING SYSTEM ARRANGEMENTS

- | Upper catchment communities (Crooked River, Waterford) – nothing.
- | Lower catchment communities (Lindenow, Bairnsdale) – BoM warnings

APPENDIX F.04 – MAPS

- | Schematic Diagram Mitchell River
- | Bureau of Meteorology Flood Warning Data Network
- | Estimated 1% AEP Riverine Flood Extent Bairnsdale
- | Estimated 1% AEP Riverine Flood Extent East Bairnsdale
- | Estimated 1% AEP Riverine Flood Extent Lindenow

Schematic Diagram Mitchell River



Bureau of Meteorology Flood Warning Data Network

MITCHELL RIVER

Flood Warning Data Collection Network



Australian Government
Bureau of Meteorology



LEGEND (Stations):

- ▲ River Level
- Rainfall (TBRG)
- Rainfall (AWS)
- ◆ River and Rain
- Repeater
- Repeater (incl. Rain)
- Repeater (incl. River)
- ⊕ Repeater (AWS)

LEGEND (General):

- ▭ Catchment Boundaries
- Rivers
- Canals
- Water Bodies

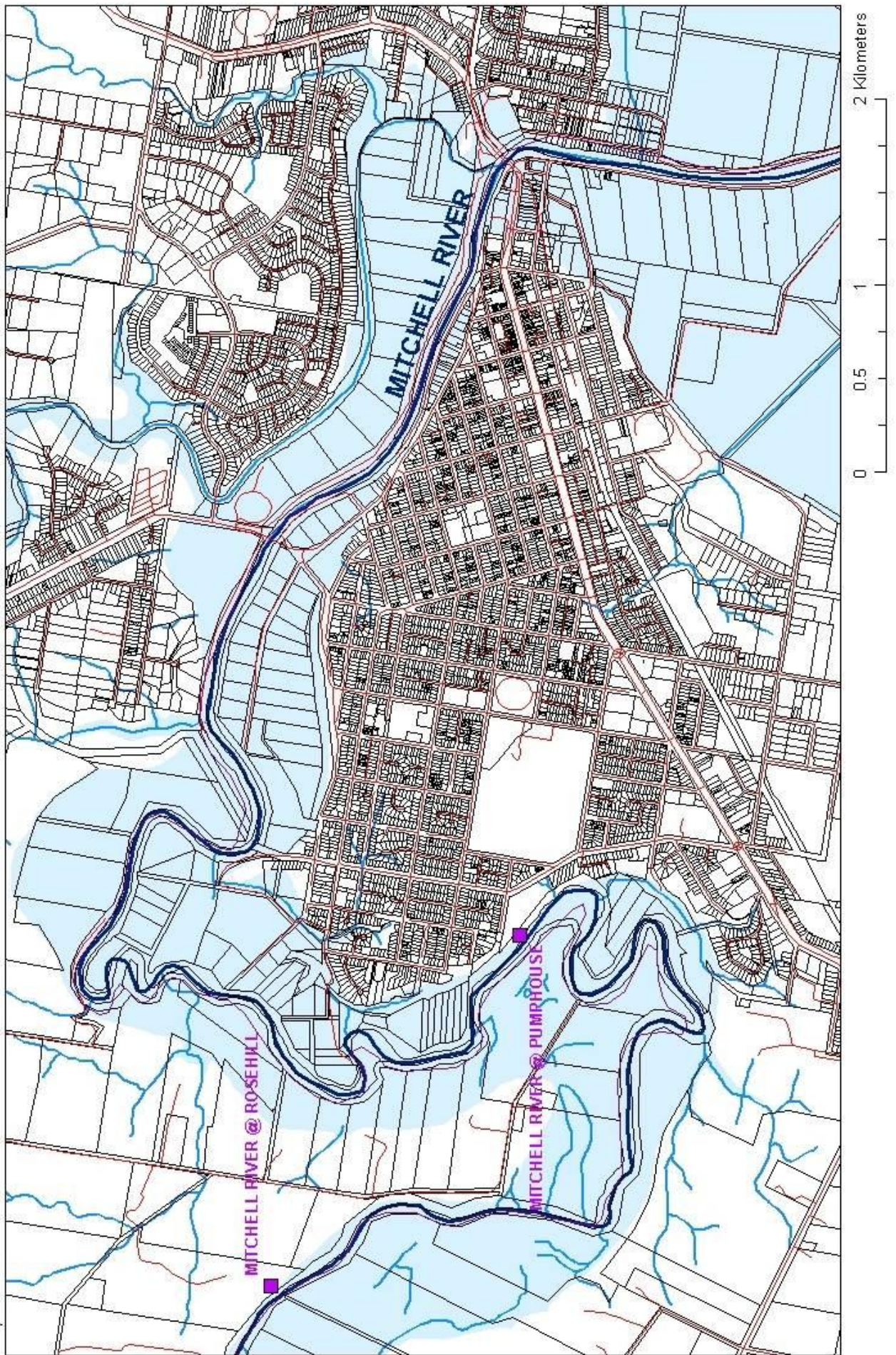
0 3 6 12 18 24 Kilometers



Hydrology and Flood Warning Section, VICTORIA, May 2011

Estimated 1% AEP Riverine Flood Extent Bairnsdale

Estimated 1% AEP riverine flood extent - East Bairnsdale

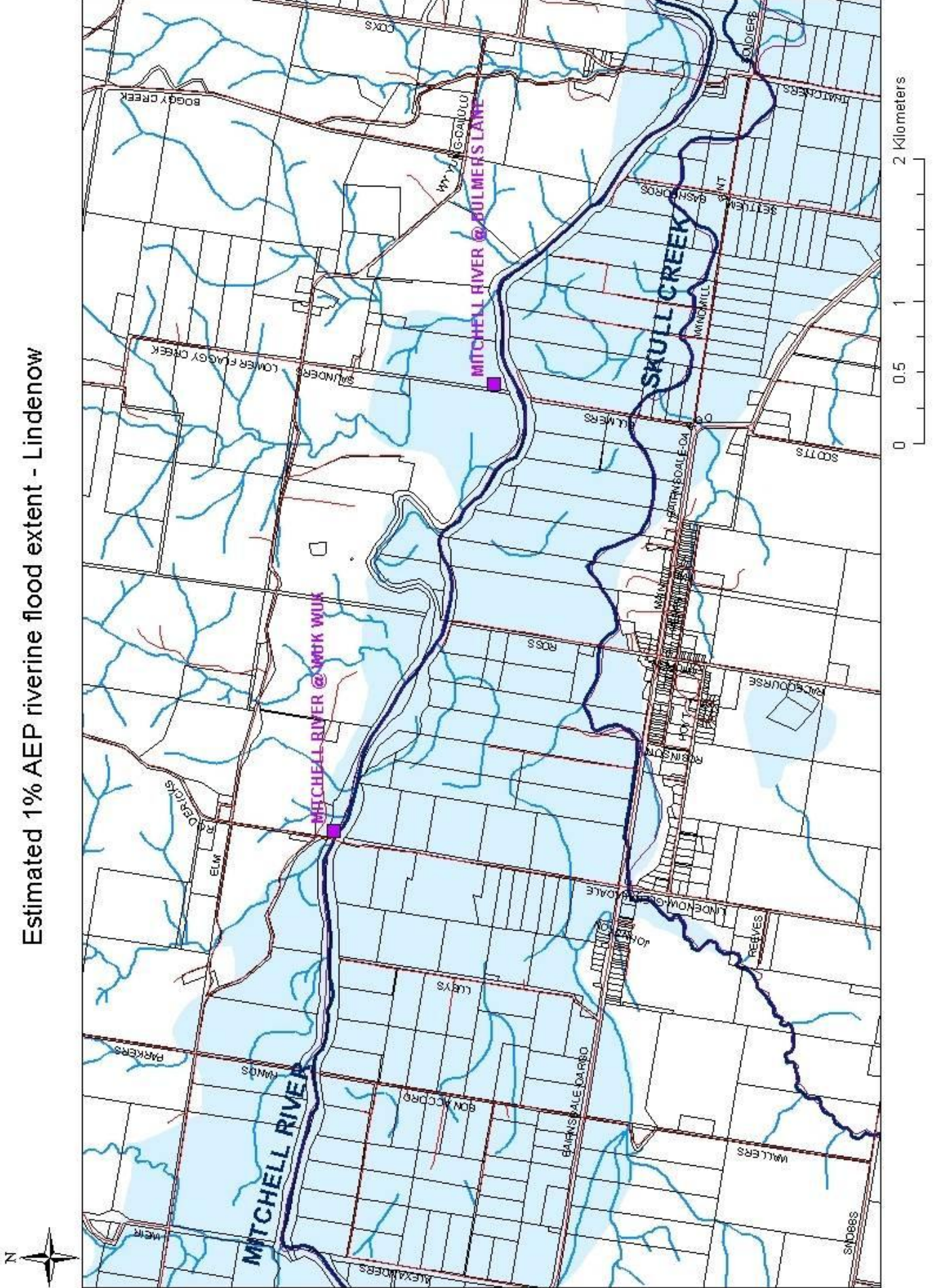


Estimated 1% AEP Riverine Flood Extent East Bairnsdale

Estimated 1% AEP riverine flood extent - East Bairnsdale



Estimated 1% AEP Riverine Flood Extent Lindenow



Estimated 1% AEP riverine flood extent - Lindenow