

Loddon Shire Council

FLOOD EMERGENCY PLAN

A Sub-Plan of the Municipal Emergency Management Plan

For Loddon Shire Council
and
VICSES Unit Wedderburn

Version 1, June 2019



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Distribution of MFEP

Once endorsed and signed the, MFEP should be distributed to all MFEP committee members, MEMPC Chair, council, MERO, Deputy MERO, Representatives from; BoM, CMA, DELWP, Parks Victoria, Ambulance Victoria, VicRoads, DHHS, relevant utilities, MFB, MERC, RERC, Police station, VICSES Units, VICSES Regional office, CFA Brigades and CFA Regional office.

Document Transmittal Form / Amendment Certificate

This Municipal Flood Emergency Plan (MFEP) will be amended, maintained and distributed as required or every 3 years facilitated by VICSES in consultation with the Municipal Emergency Management Planning Committee (MEMPC).

Suggestions for amendments to this Plan should be forwarded to VICSES Regional Office via email: northwest@ses.vic.gov.au

Amendments listed below have been included in this Plan and updated as a new version.

Amendment Number	Date of Amendment	Amendment Entered By	Summary of Amendment
1	June 2019	Mal Ross	Full Plan Issue

This Plan will be maintained on the VICSES website at <https://www.ses.vic.gov.au/plan-and-stay-safe/flood-guides> with a link shown on the municipality website.

List of Abbreviations & Acronyms

The following abbreviations and acronyms are used in the Plan

AAR	After Action Review	IIA	Initial Impact Assessment
AEP	Annual Exceedance Probability	IEMT	Incident Emergency Management Team
AHD	Australian Height Datum (the height of a location above mean sea level in metres)	JSOP	Joint Standard Operations Procedure
AIDR	Australian Institute of Disaster Resilience	IMS	Incident Management System
AIIMS	Australasian Inter-service Incident Management System	LSIO	Land Subject to Inundation Overlay
AoCC	Area of Operations Control Centre / Command Centre	MEMO	Municipal Emergency Management Officer
ARI	Average Recurrence Interval	IMEMP	Integrated Municipal Emergency Management Plan
ARMCANZ	Agricultural & Resource Management Council of Australia & New Zealand	IMEMPC	Integrated Municipal Emergency Management Planning Committee
AV	Ambulance Victoria	MERC	Municipal Emergency Response Coordinator
BoM	Bureau of Meteorology	MERO	Municipal Emergency Resource Officer
CEO	Chief Executive Officer	MFB	Metropolitan Fire Brigade
CERA	Community Emergency Risk Assessment	MFEP	Municipal Flood Emergency Plan
CFA	Country Fire Authority	MFEPCC	Municipal Flood Emergency Planning Committee
CMA	Catchment Management Authority	MRM	Municipal Recovery Manager
RERC	Regional Emergency Response Coordinator	PMF	Probable Maximum Flood
RERCC	Regional Emergency Response Coordination Centre	RAC	Regional Agency Commander
DHHS	Department of Health and Human Services	RCC	Regional Control Centre
DJPR	Department of Jobs, Precincts & Regions	RDO	Regional Duty Officer
DELWP	Department of Environment, Land, Water and Planning	SAC	State Agency Commander
EMLO	Emergency Management Liaison Officer	SBO	Special Building Overlay
EMMV	Emergency Management Manual Victoria	SCC	State Control Centre
EMT	Emergency Management Team	SDO	State Duty Officer
ERC	Emergency Relief Centre	SERP	State Emergency Response Plan
EO	Executive Officer	SEWS	Standard Emergency Warning Signal
FO	Floodway Overlay		

Part 1. Introduction

1.1 Approval and Endorsement

This Municipal Flood Emergency Plan (MFEP) has been prepared by the Municipal Flood Planning Committee (MFPC) and with the authority of the Loddon Shire MEMPC –pursuant to Section 20 of the Emergency Management Act 1986 (as amended).

This MFEP is a sub plan to the Loddon Shire Emergency Management Plan (MEMP), is consistent with the Emergency Management Manual Victoria (EMMV) and the Victorian Floodplain Management Strategy (2016), and takes into account the outcomes of the Community Emergency Risk Assessment (CERA) process undertaken by the Municipal Emergency Management Planning Committee (MEMPC).

The MFEP is consistent with the Regional Flood Emergency Plan (RFEP) and the State Emergency Response Plan (SERP) – Flood sub-plan.

This MFEP is a result of the cooperative efforts of the MFPC and its member agencies.

This Plan is approved by the VICSES Regional Manager.

This Plan is endorsed by the Loddon Shire MEMPC as a sub-plan to the MEMP.

1.2 Purpose and Scope of this Flood Emergency Plan

The purpose of this MFEP is to detail arrangements agreed for the managing a flood emergency before, during and after it occurs or potentially occurs within Loddon Shire.

As such, the scope of the Plan is to:

- Identify the local flood risk;
- Support the implementation of mitigation and planning measures to minimise the causes and impacts of flooding;
- Detail emergency management arrangements;
- Identify linkages with Local, Regional and State emergency and wider planning arrangements with a specific emphasis on those relevant to flood.

1.3 Municipal Flood Planning Committee (MFPC)

Membership of the Loddon Shire Municipal Flood Planning Committee (MFPC) comprises of the following representatives from the following agencies and organisations:

- VICSES – Loddon Mallee Region (Regional Officer – Emergency Management) **(Chair)**,
- VICSES Wedderburn Unit,
- Country Fire Authority,
- Council (Municipal Emergency Resource Officer & EM Coordinator),
- Victoria Police (Municipal Emergency Response Co-ordinator) (MERC),
- North Central Catchment Management Authority (NCCMA),
- Department of Health and Human Services (DHHS) as required,
- Department of Environment, Land, Water and Planning (DELWP) as required,
- Water Authorities as required,

- Bureau of Meteorology as required,
- Local community representatives and
- Other agencies as required.

1.4 Responsibility for Planning, Review & Maintenance of this Plan

This MFEP must be maintained in order to remain effective.

VICSES through the MFPC has responsibility for facilitating the preparation, review, maintenance and distribution of this plan.

The MFPC will meet at least once per year. The plan should be reviewed following:

- A new flood study;
- A significant change in flood mitigation measures;
- After the occurrence of a significant flood event within the Municipality;
- Or if none of the above occur, every 3 years.

Part 2. BEFORE: Prevention / preparedness arrangements

2.1 Community Engagement and Awareness

Details of this MFEP will be released to the community through; local media, any FloodSafe engagement initiatives and websites (VICSES and the Municipality) upon formal adoption by VICSES and the Municipality.

VICSES with the support of Loddon Shire and NCCMA will coordinate targeted community flood engagement programs within the council area.

2.2 Structural Flood Mitigation Measures

The following summary of structural flood mitigation measures exist within the Council area:

- Serpentine Creek, west side of Serpentine township. Owned by Loddon Shire Council.
- Boort lakes can be utilised to reduce impacts.
- Laanecoorie Reservoir

Refer to appendix C for detailed information of structural flood mitigation measures.

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. It is recommended that the MFEP is exercised on annual basis and reviewed in line with Section 1.4.

2.3.2 Flood Warning

Arrangements for Bureau issued Flood Watch and Flood Warning products are contained within the SERP Sub Plan – Flood (www.ses.vic.gov.au/em-sector/vicses-emergency-plans) and on the Bureau of Meteorology (BoM) website www.bom.gov.au.

Details on Warnings issued by VICSES through VicEmergency and VICSES channels are outlined in **Appendix D**.

2.3.3 Local Knowledge

Community Observers provide local knowledge to VICSES and the Incident Control Centre regarding local insights and the potential impacts and consequences of an incident and may assist with the dissemination of information to community members.

Specific details of arrangements to capture local knowledge are provided in **Appendix G**.

Part 3. DURING: Response arrangements

3.1 Introduction

3.1.1 Activation of Response

Flood response arrangements may be activated by the Regional Duty Officer (RDO) VICSES Loddon Mallee Region or Regional Agency Commander (RAC).

The VICSES Incident Controller (IC) / RDO will activate agencies as required as documented in the State Emergency Response Plan - Flood.

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 Loddon Shire. These agencies will be engaged through the EMT.

The general roles and responsibilities of supporting agencies are as agreed within the: MEMP, EMMV (Part 7 'Emergency Management Agency Roles') and SERP Sub Plan - Flood and Regional Flood Emergency Plan.

3.1.3 Emergency Coordination Centre or equivalent

A Municipal Operations Centre (MOC) is available and If established, will be through the established Division/Sector Command and through Municipal involvement in the IEMT, in particular the Municipal Emergency Response Coordinator (MERC). The VICSES RDO / ICC will liaise with the centre directly if no Division/Sector Command is established.

The function, location, establishment and operation of a municipal operations centre if relevant will be as detailed in the MEMP.

3.1.4 Escalation

Many 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 Part 3 of the EMMV.

3.2 The six C's

Arrangements in this MFEP must be consistent with the 6 C's detailed in State and Regional Flood Emergency Plans and the MEMP. For further information, refer to Part 3 of the EMMV.

- **Command:** Overall direction of response activity in an emergency.
- **Control:** Internal direction of personnel and resources within an agency.
- **Coordination:** Bringing together agencies and resources to ensure effective preparation for response and recovery.
- **Consequence:** Management of the effect of emergencies on individuals, communities, infrastructure and the environment.
- **Communication:** Engagement and provision of information across agencies and proactively with the community around preparation, response and recovery in emergencies.
- **Community Connection:** Understanding and connecting with trusted networks, leaders and communities around resilience and decision making.

Specific details of arrangements for this plan are to be provided in **Appendix C**.

3.2.1 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 of the EMMV prepared under the *Emergency Management Act 1986 (as amended)*, identifies VICSES as the Control Agency for flood. It identifies DELWP as the Control Agency responsible for “dam safety, water and sewerage asset related incidents” and other emergencies. A more detailed explanation of roles and responsibilities is provided in later sections of Part 7 of the EMMV.

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

3.2.2 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 IC responsibilities are as defined in Part 3 of the EMMV.

3.2.3 Incident Control Centre (ICC)

As required, the IC 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 ICC locations are listed in the following table.

Incident Level	Location	ICC Location	Facility owner	Key contact
3	Epsom	Midland Highway Epsom	DELWP	
3	Mildura	Cnr Eleventh Street and Koorlong Ave	DELWP	

3.2.4 Divisions and Sectors

To ensure that effective Command and Control arrangements are in place, the IC may establish Divisions and sectors depending upon the complexity of the event and resource capacities.

The following Divisions and Sectors may be established to where applicable to assist with the management of flooding within the Municipality:

Division	Sector
Bendigo SES Unit	Newbridge (CFA)
Bendigo CFA Group HQ (secondary)	Bridgewater (CFA)
	Serpentine (CFA)
	Wedderburn (SES)
	Logan (CFA)
	Pyramid Hill (CFA)
	Serpentine (CFA)
	Durham Ox (CFA)
	Boort (CFA)

NOTE: Although the above sectors have been specified to work under the Bendigo Divisional Command, this may vary or change depending on the circumstances of the flooding event and will be determined by the appointed Incident Controller.

3.2.5 Incident Management Team (IMT)

The IC will form an Incident Management Team (IMT).

Refer to Part 3 of the EMMV for guidance on IMTs and Incident Management Systems (IMSS).

3.2.6 Emergency Management Team (IEMT)

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

Organisations, including Loddon Shire required within the IEMT 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 of the EMMV for guidance on IEMTs.

3.2.7 On Receipt of a Flood Watch / Severe Weather Warning

SOP008 and SOP009 outline in detail the actions to be undertaken upon receipt of a Flood Watch/Flood Warning or Severe Weather Warning. VICSES RDO (until an incident controller is appointed) or IC will undertake actions as defined within the flood intelligence cards (**Appendix C**). General considerations by the IC/VICSES RDO will be as follows:

- 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
- Notify and brief appropriate officers. This includes Regional Control Centre (RCC) (if established), State Control Centre (SCC) (if established), Council, other emergency services through the EMT.
- Assess ICC readiness (including staffing of IMT and IEMT) and open if required
- Ensure flood warnings and community information is prepared and issued to the community where required
 - Flood (Riverine and flash) Warnings are managed by the RDO/RAC
 - Severe Weather/ Thunderstorm warnings are managed by SDO/SAC
- Develop media and public information management strategy
- Monitor watercourses and undertake reconnaissance of low-lying areas
- Ensure flood mitigation works are being checked by owners
- Develop and issue incident action plan, if required
- Develop and issue situation report, if required

3.2.8 On Receipt of the First and Subsequent Flood Warnings

VICSES RDO (until an incident controller is appointed) or IC will undertake actions as defined within the flood intelligence cards (**Appendix C**). General considerations by the IC/VICSES RDO will be as follows:

- Develop an appreciation of current flood levels and predicted levels. Are floodwaters, rising, peaking or falling?
- Review flood intelligence to assess likely flood consequences.
- Consider:
 - What areas may be at risk of inundation?
 - What areas may be at risk of isolation?
 - What areas may be at risk of indirect affects as a consequence of power, gas, water, telephone, sewerage, health, transport or emergency service infrastructure interruption?
 - The characteristics of the populations at risk
- Determine what the at-risk community need to know and do as the flood develops.
- Warn the at-risk community including ensuring that an appropriate warning and community information strategy is implemented including details of:
 - The current flood situation
 - Flood predictions
 - What the consequences of predicted levels may be
 - Public safety advice
 - Who to contact for further information
 - Who to contact for emergency assistance
- 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/
- Continue to conduct reconnaissance of low-lying areas

3.3 Initial Impact assessment

Initial impact assessments will be conducted in accordance with Part 3 section 5.2.5 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 DHHS and recovery agencies.

3.4 Preliminary Deployments

When flooding is expected to be severe enough to cut access to towns, suburbs and/or communities the IC 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.

3.5 Response to Flash Flooding

Emergency management response to flash flooding should be consistent with the guideline for the emergency management of flash flooding contained within the State Emergency Response Plan - Flood.

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 and 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. Advice should be given to not attempt to flee by entering floodwater if they become trapped, it may be safer to seek the highest point within the building and to telephone 000 if they require rescue.
4. For buildings known to be structurally un-suitable 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.
6. Contact the Loddon Shire MERC and MERO at the earliest opportunity to allow for relief preparation to commence.

Due to the rapid development of flash flooding it will often be difficult, to establish relief centres ahead of actually triggering the evacuation. This is normal practice but this is insufficient justification for not adopting evacuation.

3.6 Evacuation

The IC decides whether to warn people to evacuate or if it is recommended to evacuate immediately.

Once the decision is made VicPol are responsible for the management of the evacuation process where possible. 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 EMMV Part 8, Appendix 9 and the Evacuation Guidelines for guidance of evacuations for flood emergencies.

Refer to **Appendix C** of this Plan and the MEMP for additional local evacuation considerations for the municipality.

3.7 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.

Victoria Police Rescue Coordination Centre should be notified of any rescues that occur: (03) 9399 7500

The following resources are available to assist with rescue operations:

- VICSES Rescue Boats – Nearest to Loddon Shire include: 1 x Kerang, 1 x Rochester and 1 x Marong
- 1 x VICSES Land Based Swift Water Rescue Crew (Loddon Mallee Region)

3.8 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 of the IC

The IC may request aircraft support through the State Air Desk located at the SCC will establish priorities.

Suitable Airbase facilities are located at:

- Bendigo Airport, Victa Rd East Bendigo (fuel available)

Other Airstrips/Aerodrome's are located at:

- Wedderburn (YWED), 65 Lysaght Rd
- Prairie (YPRA), cnr Echuca-Serpentine Rd & Pyramid-Yarraberb Rd
- Boort – Biggin Hill (YBBT), Silo-Woolshed Rd

3.9 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.

3.10 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.

The Loddon Shire maintains a small stock of sandbags See appendix H, and back-up supplies are available through the VICSES Regional Headquarters. The IC 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.

Property may be protected by:

- Sandbagging to minimise entry of water into buildings
- Encouraging businesses and households to lift or move contents
- Construction of temporary levees in consultation with the CMA, LGA and VICPOL and within appropriate approval frameworks.

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

Contact your local VICSES representative for the most current Sandbag Guidelines or download it from IMT Toolbox in EMCOP- Operations.

Refer to **Appendix C** for further specific details of essential infrastructure requiring protection and **Appendix H** for locations of sandbag collection point(s).

3.11 Disruption to Services

Disruption to services other than essential community infrastructure and property can occur in flood events. Refer to **Appendix C** for specific details of likely disruption to services and proposed arrangements to respond to service disruptions in Loddon Shire.

3.12 Road Closures

Loddon 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. Loddon Shire staff should also liaise with and advise VicRoads as to the need or advisability of erecting warning signs and / or of closing roads and bridges under its jurisdiction. VicRoads are responsible for designated main roads and highways and councils are responsible for the designated local and regional road network.

VICROADS (as informed by Loddon Shire) will communicate community information regarding road closures. Information will be updated on the VIC Traffic website: <https://traffic.vicroads.vic.gov.au/>

Refer to **Appendix C** for specific details of potential road closures.

3.13 Dam Spilling/ Failure

DELWP 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.

DELWP have developed Dam Safety Emergency Plans for municipalities where it is applicable.

Major dams with potential to cause structural and community damage within the Municipality are contained in **Appendix A**.

3.14 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 the responsibility agency for the critical sewerage asset 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 Loddon Shire Environmental Health Officer to inspect and report to the MERO and the ICC on any water quality issues relating to flooding.

3.15 Access to Technical Specialists

VICSESSES Manages contracts with private technical specialists who can provide technical assistance in the event of flood operations or geotechnical expertise. Refer to VICSES SOP061 for the procedure to engage these specialists.

3.16 After Action Review

VICSESSES 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. AFTER: Emergency relief and recovery arrangements

4.1 General

Arrangements for recovery from a flood incident within the Loddon Shire are detailed in Loddon Shire MEMP and/or the Recovery Sub-plan.

4.2 Emergency Relief

The decision to recommend the opening of an emergency relief centre sits with the IC. The IC is 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 Part 4 of the EMMV for details of the range of emergency relief services that may be provided.

Suitable relief facilities identified for use during floods are detailed in the MEMP.

Details of the relief arrangements are available in the MEMP.

4.3 Animal Welfare

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

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

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

Refer to the Northern Victoria Emergency Animal Welfare Plan (a sub plan of the IMEMP) for animal details.

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 of the EMMV.

Appendix A: Flood threats for Loddon Shire

General

The Loddon Shire is located in central Victoria, about 175 kilometres north-west of Melbourne. It is bounded by Gannawarra Shire in the north, the Shire of Campaspe and the City of Greater Bendigo in the east, Mount Alexander and Central Goldfields Shires in the south, and Northern Grampians and Buloke Shires in the west. The Shire is predominantly rural, with many small towns and communities and a current population of 7,516 people. The largest towns are Boort (873), Bridgewater on Loddon (326), Inglewood (855), Pyramid Hill (558), Serpentine (192), Tarnagulla (133) and Wedderburn (941) *2016 census data. The Shire encompasses a total land area of about 6,700 square kilometres. Land is used mainly for agriculture and horticulture, particularly grain, sheep, wool, beef cattle, dairy, pigs and poultry. In recent years there has also been viticulture, olives and fodder crops.

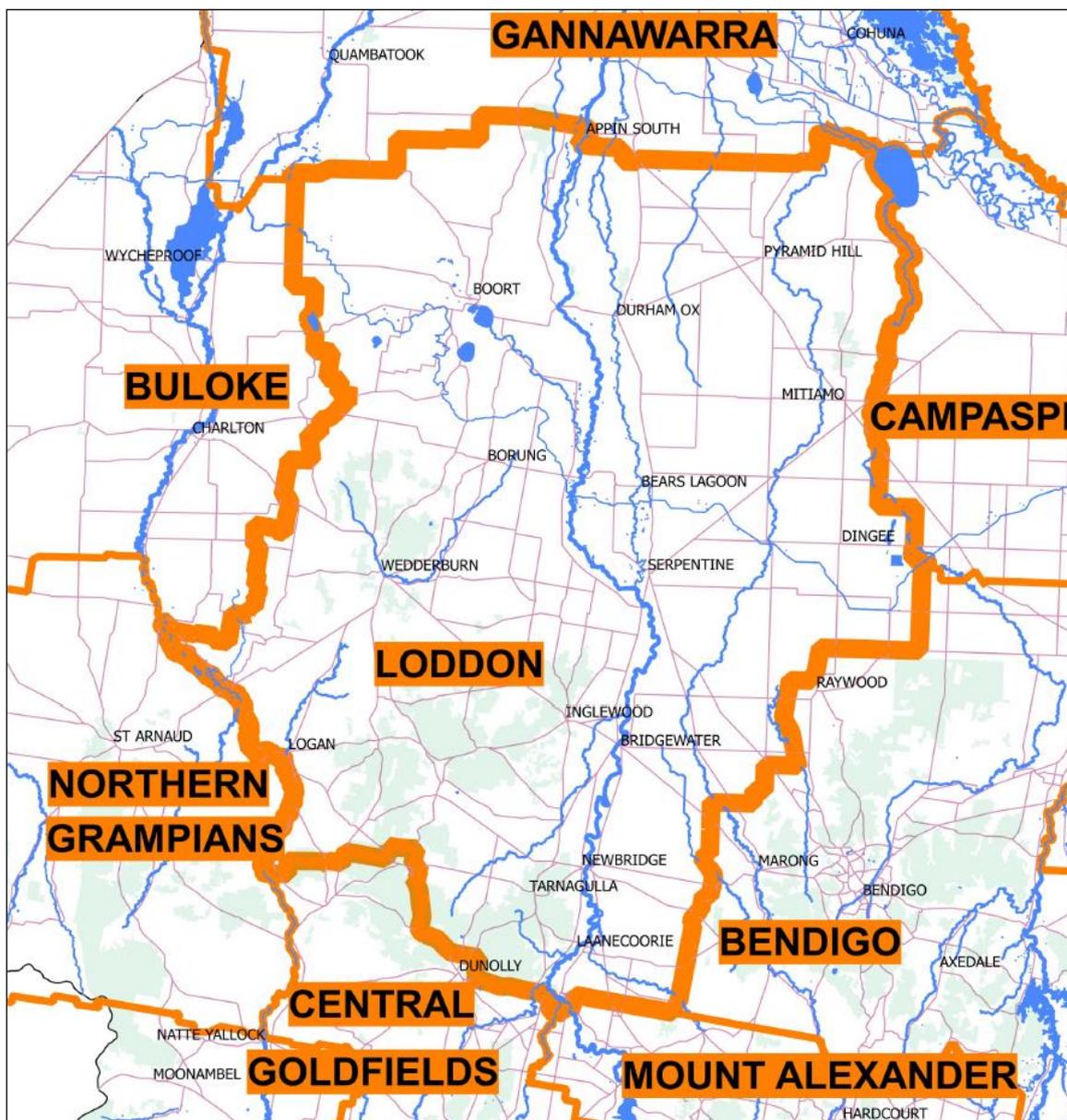


Figure showing the towns and waterways within the Loddon Shire Council Region.

Historic Floods

The vast Loddon River flood plain extends downstream of Bridgewater to well beyond the boundary of the Loddon Shire to Kerang and Swan Hill in the north. From Boort in the west, it extends past Mitiamo and Pyramid Hill into the Campaspe Shire in the East. In addition to the Loddon River the Loddon River flood plain includes several intermittent streams which become major water carriers during high rainfall events and major flood events. The 2011 flood directly affected 13 towns and communities in the Shire, and significantly interrupted rural enterprise, business and commerce across the vast majority of Loddon Shire.¹

The January 2011 flood event was the second largest in recorded history and significantly bigger than the September and December events in 2010. Its magnitude was exceeded only by the floods of 1909.

The fast flowing flood travelled north from the upper reaches of the Loddon River, the Bullock Creek and Bendigo Creek, from outside the Shire. Newbridge was the first town affected, followed by Bridgewater. The flood waters then moved further north along the Loddon River and dispersed into creeks and anabranches beyond Bridgewater. Over 30% (approx 2,200 sq km) of the Shire was impacted. At its peak, the flood was reported to be 90 km long and 50 km wide.

Many farms and towns were directly impacted. Subsequent damage assessment confirmed approximately \$30 million damage was caused to Council managed infrastructure alone.

The flood progressively caused dislocation and isolation of many parts of the Shire with the flood waters cutting roads (including the Calder Highway and the Loddon Valley Highway for several days).

Failure of the mobile phone system also occurred during the event, along with widespread power outages for periods between 12 – 36 hours.

At the flood's peak, water volumes recorded at the Laanecoorie Reservoir spillway reached 194 gegalitres per day. To put this volume into context, Melbourne uses 460 gegalitres of water per year.

1880 – Serpentine

August 1909 – The largest flood recorded at Laanecoorie Reservoir since it was constructed. Similar in magnitude to the January 2011 flood event but caused the failure of the Laanecoorie Reservoir dam wall. Durham Ox on Serpentine Creek recorded one of the highest peak flows.



Laanecoorie Reservoir Dam Wall Failure,

¹ http://www.parliament.vic.gov.au/images/stories/FLOOD/58_Loddon_Shire_Council.pdf

December 1933 – Second largest event known at Laanecoorie, it is suggested to be a 159.4m AHD event. The reservoir was raised in 1935 and full supply level is currently 160.20 m AHD.

August 1956 - This event was the fourth largest along the Murray at Echuca since 1870 (4% AEP). It was also the largest flood (in terms of volume) along the Avoca River.

May 1974 - Widespread flooding occurred in May and October 1974. The May flood was more significant along the Murray (~6% AEP at Echuca) than the October event.

November 1975 - The 1975 flood was the third largest in the Murray at Echuca since 1870 (~3% AEP). It was also the third biggest (in terms of volume) along the Avoca River. Flood water in excess of 11,200 ML/d were recorded at Sheepwash Creek and 4,900. More than 90,000 ha of land was flooded the total value of identified flood Damage exceeded \$6.0 million

September 1983 - This event was the second largest flood along the Avoca (in terms of volume) and has a return period of around 50 years.

September and October 1993 floods - In September 1993 a major flood substantially reduced flood storage along the lower reaches of the Goulburn River floodplain. Consequently, a larger flood occurred in October 1993 along the Goulburn (3% AEP at Shepparton) and Murray rivers (~4% AEP at Echuca).

January 2011 flood

This flood followed an extended period of wet weather with major flooding through the lower Loddon and Avoca Rivers in September and December 2010. Heavy rain over the Avoca, Loddon and Campaspe catchments in January 2011 caused severe record flooding in both catchments and record outflows from the Loddon storages. Communities including Kerang were isolated for a considerable period. Many roads and levees were damaged but the Kerang electricity substation remained dry. Flood water was trapped behind levees on the floodplain.

February 2011

A further moderate flood event occurred in Feb 2011 as a result of flash flooding and the flooding of the Bullock Creek. This event caused further damage to the road infrastructure, rural property inundation and brought down further fencing.

October 2016

A major flood event was experienced in October 2016. This flood did not have any significant impacts on townships however inundated extensive areas of farmland and resulted in the closure of many roads. Due to the flat topography of the landscape inundation of the flood runners lasted for a prolonged period. For example, near Lake Yando local roads were still inundated in February 2017.

Description of Major Waterways and Drains

The Loddon River and its many tributaries flow out of relatively steep terrain on the northern slopes of the Great Dividing Range in well-defined valleys and gullies. These tributaries merge with the main body of the Loddon River and the river flows north through Newbridge and Bridgewater, and on to Serpentine. Between Bridgewater and Serpentine, the terrain of the Loddon Valley flattens significantly and the river enters a riverine flood plain, through which it traverses until it reaches the Murray River at Swan Hill.

When a river flows through flat terrain, it is prone to many changes of course over the history of the river's development. As one course is abandoned and another is created by flood flows, prior streams are left behind on the flood plain as dry depressions which only carry water in flood times.

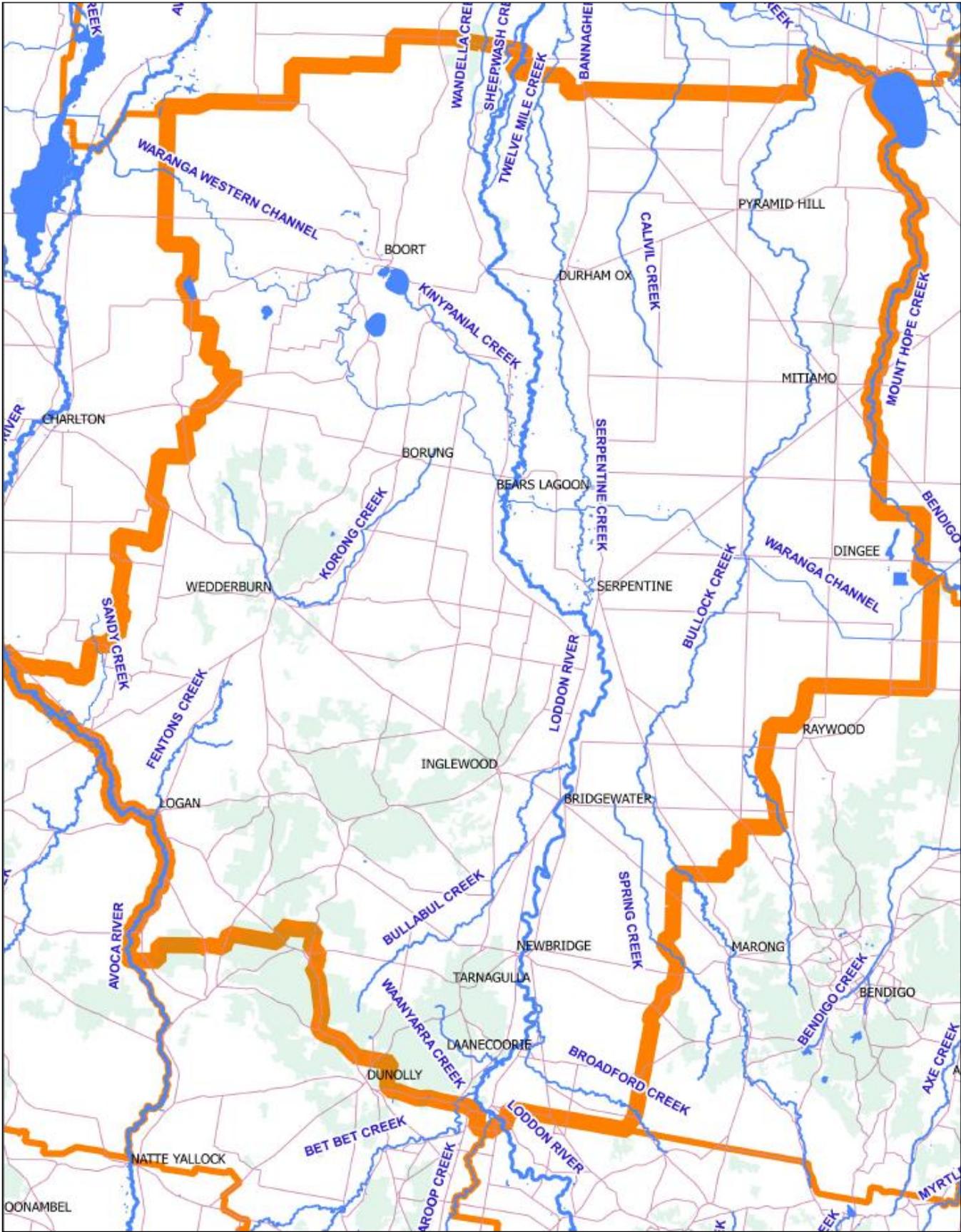
The first of these “anabranches” occurs approximately three kilometres south of Serpentine and is known as the Serpentine Creek.²

The Bet Bet Creek is a significant contributor to flood flows in the Loddon River. Almost half the flows that passed the Laanecoorie Reservoir entered the river downstream of the Cairn Curran Reservoir during the January 2011 floods.

There are many other creeks within the Shire, many of which rise outside of the Shire boundary, including:

- Kinypanial Creek (a tributary of the lower Loddon River, exiting downstream of Loddon Weir and passing through the township of Fernihurst before draining to Lake Boort)
- Bet Bet Creek (rises from outside the Shire in the south, draining into Laanecoorie Reservoir)
- Waanyarra Creek (begins south of Tarnagulla and flows east into Laanecoorie Reservoir).
- Korong Creek (begins in the Mount Kerang Range, flows through Wedderburn to Borung)
- Tullaroop Creek (begins in Clunes, flows through Tullaroop Reservoir, ending in Laanecoorie Reservoir).
- Bullabul Creek (rises in the south-east of the Shire, joining the Loddon River just downstream of the township of Bridgewater)
- Twelve Mile Creek (a tributary of the lower Loddon River, running parallel to the river on the east side, east of Lake Leaghur and re-joining approximately 11 km downstream)
- Wandella Creek (starts in the north of the Shire, a tributary of the Loddon River on the west side, beginning at Lake Leaghur and terminating north of Dingwall.)
- Serpentine Creek (splits from the Loddon River just upstream of the township of Serpentine, continues through Durham Ox and reconnects with the Loddon River south of Lake Murphy.)
- Sheepwash Creek (is a tributary of Loddon River, begins at Canary Island, and re-joins the Loddon River at Appin).
- Calivil Creek (traverses the north-east of the shire, draining to the north, between Durham Ox and Pyramid Hill)
- Bullock Creek (traverses the east of the Shire, passing to the west of Mitiamo, east of Pyramid Hill and draining to Pyramid Creek)
- Bendigo Creek and Myers Creek (traverse the east of the Shire, merging to the east of Mitiamo and draining to Kow Swamp)
- Seven Months Creek (drains land northeast of Serpentine and passes through Pyramid Hill before merging with Bullock Creek)

² http://www.parliament.vic.gov.au/images/stories/FLOOD/58_Loddon_Shire_Council.pdf



Riverine Flooding

Riverine flooding is generated from rainfall outside the Municipality in the catchment areas of the Murray River and its north central Victorian tributaries and in the Avoca and Loddon catchments.

Large severe floods within the Municipality generally result from a moist warm airflow from northern Australia bringing moderate to heavy rainfall over a period of 12 hours or more following a prolonged period of general rainfall and / or a series of smaller floods. The rainfall and earlier floods “wet up” the catchments and (partially) fill both the on-stream dams and the natural floodplain storage. These combine to increase the runoff generated during the subsequent period of heavy rainfall.

Large but less severe floods result from sequences of cold fronts during winter and spring that progressively wet up the catchments and fill the on-stream dams and the natural floodplain storage. Prolonged moderate to heavy rain leads to major flooding.

A significant majority of large floods have occurred in the winter / spring period. However, large floods can also occur in the summer as evidenced in December 1933 and January 2011.

Water level rises through the Municipality usually occur sometime after the rain that caused the flooding has passed. Typically, initial rises occur 3 or more days after rain with the peak following a few days later.

Severe floods generally overtop many of the rural levees. Flood waters remain for extended periods. For example, parts of the lower Loddon floodplain remained flooded for several months following the January 2011 event.

Towns impacted by riverine flooding include: Bridgewater, Serpentine, Pyramid Hill, Boort, Newbridge, and in extreme cases, Mitiamo, Dingee.

Flash Flooding and Overland Flows

Short duration, high intensity rainfall (usually associated with thunderstorms) can also cause localised flooding within the urbanised areas, some rural areas of the Municipality and along overland flow paths when the local urban drainage system surcharges. Such events, which are mainly confined to the summer months, do not generally create widespread flooding since they only last for a short time and affect limited areas. Flooding from these storms occurs with little warning and localised damage can be severe.

High intensity rainfall, such as associated with thunderstorms giving average rainfall rates of typically more than 20 mm/hour for an hour or more is likely to lead to flash flooding and / or overland flows, particularly in the more urbanised parts of the Municipality.

Blocked or capacity impaired stormwater drains can also lead to overland flows and associated flooding: the drain surcharges and excess water flows above ground. The likely location of such flooding is hard to predict other than in cases where a drain has a past history of surcharging. Council maintenance records may provide some guidance in such cases. Towns impacted include: Inglewood, Korong Vale and Wedderburn.

Dam Failure

Flooding resulting from failure of the following dams is likely to cause significant structural and community damage within the Loddon Shire.

All dams have a risk of failure. Loddon Shire has one major dam, owned by Goulburn-Murray Water, which forms Laanecoorie Reservoir on the Loddon River. This dam is subject to rigorous dam safety management programs implemented by the managing entity and are the subject of individual Dam Safety Emergency Management Plans (DSEPs). DSEPs identify possible dam failure scenarios and provide direction on the order and detail of the necessary communications and incident management tasks to be initiated. They also refer to intelligence and maximum inundation extent mapping arising from detailed dam break analyses. Intelligence can include travel times to key locations, maximum depths and velocities and the time to reach those maxima at those key locations, as well as other information that would inform the response effort. Close communication with the dam manager is essential in the event of a dam safety incident.

The following supporting documentation is provided:

Location	Owner	Dam Height	Dam Capacity	Comments
Cairn Curran Reservoir	GMWater		147,000	Gated structure
Tullaroop Reservoir	GMWater		73,000	Fixed crest
Newlyn Reservoir	GMWater		3,300	Fixed crest
Spring Gully Reservoir	Coliban Water		2,500	Effectively an off-stream reservoir. Cut-off drains divert runoff from the natural catchment to bypass the reservoir
Hepburns Lagoon	GMWater		3,000	Fixed crest
Kow Swamp	GMWater		51,000	At the northern (downstream) boundary of the Shire
Laanecoorie Reservoir	GMWater	22	8,000	Fixed crest thus at FSL inflow = outflow
Loddon Weir (Bears Lagoon)	GMWater	6		Gated structure

Loddon Shire Council has seven old water supply reservoirs for which they are responsible. Each dam has a safety emergency management plan. These dams are located at: Inglewood, Wedderburn, Korong Vale, Tarnagulla & north of Dunolly. In the event of a failure, localised flooding is likely.

In addition, large dams can significantly mitigate downstream flooding if their initial storage levels are low. Dams upstream of Bridgewater include Laanecoorie Reservoir, Cairn Curran Reservoir and Tullaroop Reservoir. Given the small size of Laanecoorie (8,000 ML), it's not likely to impact flooding in Bridgewater (Water Technology 2016).

However if storage levels of Cairn Curran Reservoir (storage capacity is 147,130 ML) are low at the onset of a flood event, this dam will significantly reduce the magnitude of the flood event downstream, at Newbridge, Bridgewater and Serpentine.

Average Recurrence Interval (ARI)	Loddon River at Laanecoorie Design Flows (ML/d) Water Tech 2018	If Cairn Curran Reservoir starting water level was at 32 %
1,000	317,000	217,000
500	278,300	178,300
200	227,600	127,600 less than a 50 year flood
January 2011	194,700	94,700 approx 20 year flood
100	190,000	90,000 approx 20 year flood
50	153,500	53,500 more than a 5 year flood
20	108,000	no flooding
10	76,300	no flooding
September 1983	73,300	no flooding
September 2010	65,200	no flooding
5	48,000	no flooding
Major	40,148	no flooding
		no flooding
Moderate	8,600	no flooding
Minor	1,936	no flooding

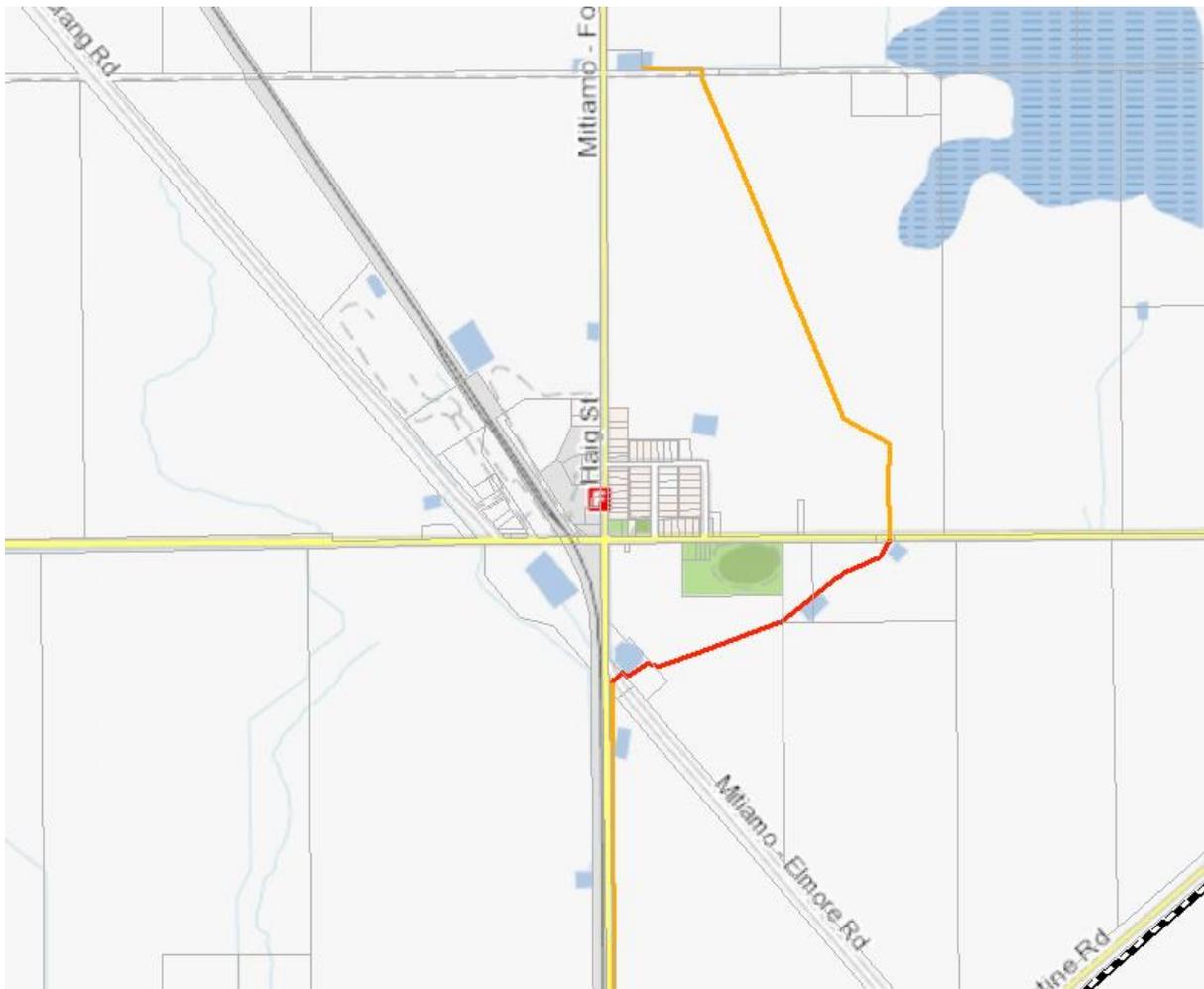
Major Levees -

The following describes a number of known major levees in the Loddon catchment. This includes numerous minor private levees and structures such as roads, railway lines and irrigation channel banks that may act as levees during floods.

Location	Ownership	Condition	Design Standard	Construction Date	Comments
Serpentine Creek, West side of Serpentine Township	Loddon Shire Council				
Mitiamo – Irrigation channel on south and east side of the town	GMW		Irrigation supply channel		
Pyramid Hill	Loddon Shire Council (Parts are GMW channel)				Council has received funding to construct permanent levee to replicate temporary levee that was constructed in 2011
Boort	Loddon Shire Council				Council has received funding to construct earthen levee to protect properties in Templeton Crescent



Serpentine Levee



Pyramid Hill – a temporary levee was built in Jan 2011 using part of a GMW channel.

Appendix B: Typical flood peak travel times

Loddon River

The following peak travel times are estimates only; based on a major event similar to January 2011.

	Cairn Curran	Laanecoorie	Newbridge	Bridgewater	Serpentine	Loddon Weir	Durham Ox	Appin South
Laanecoorie Reservoir	8 hours							
Newbridge	14 hours	6 hours						
Bridgewater	22 hours	14 hours	8 hours					
Serpentine	37 hours	29 hours	23 hours	15 hours				
Loddon Weir	47 hours	39 hours	33 hours	25 hours	10 hours			
Durham Ox	64 hours	56 hours	50 hours	42 hours	27 hours	17 hours		
Appin South	78 hours	70 hours	64 hours	56 hours	41 hours	31 hours	14 hours	
Kerang	114 hours	106 hours	100 hours	92 hours	77 hours	67 hours	50 hours	36 hours

Appendix C: Loddon Shire Flood Emergency Plan

NEWBRIDGE

Overview

Newbridge has a population of 192 (source: 2016 census) and is located on the Loddon River approximately 15 kilometres downstream of Laanecoorie Reservoir.

The majority of the township of Newbridge is located on high ground and not impacted by flood inundation. The Newbridge Recreation Reserve (including the football oval) located on the eastern lower side of the river does flood regularly.

Newbridge is a popular camping and fishing location with campsites available along the river.

During January 2011, water surged down the Loddon River causing major damage to the Newbridge Recreation Reserve. (September & November 2010 events referenced below)

In January 2011, the peak flow rate at Laanecoorie Reservoir has been estimated at 195,000ML/day. The highest flood on record at Laanecoorie Reservoir was the 1909 flood event, similar in magnitude to the January 2011 flood event, however during the 1909 flood event the dam wall of Laanecoorie Reservoir failed.

In the January 2011 flood event approximately 5 properties flooded, flood waters peaked in the order of 6 hours after Laanecoorie Reservoir peaked.

Overview of Flooding Consequences

Warning Time

The BoM do not provide any formal warnings or predictions for Newbridge. The potential impacts can be determined based on the flow passing through the upstream Laanecoorie reservoir. Peak travel time from Laanecoorie Reservoir is approx. 6 hours.

Properties Affected

During the Jan 2011 flood event, in the order of 5 homes and businesses were impacted by flood inundation. This included most notably the Newbridge Recreation Reserve. The Recreation Reserve is affected by flood inundation frequently, including both the flood events of September 2010 and November 2010. No other homes and businesses were impacted during either of these smaller events.

The general area most severely impacted is bordered by Twiggs Lane, Lyons St and the Loddon River, which involves the Recreation Reserve, residential properties and St John's Anglican Church. The Town Hall in Burke St had water to floor level. The General Store on the corner of Lyons & Burke St was under threat, however, was not affected.

Recreation Reserve and Clubrooms affected as follows:

- **Sep 2010** – Part of Recreation Reserve land affected, however, clubroom building remained unaffected
- **Nov 2010** – Recreation Reserve land and building affected. Clubroom building not accessible. These clubrooms have been rebuilt with the floor level 1.5 metres higher, following the 2011 event
- **Jan 2011** - Recreation Reserve land & clubrooms severely affected with flooding to roof level.

Caravan Parks and Camping:

There is a camping area in the Recreation Reserve which is impacted by flood...

Isolation

The following is a list of major roads that may be inundated in a flood, dependant on the magnitude. Note that many minor roads may also be inundated in a flood event.

- Wimmera Highway – Between Newbridge and Marong
- Bridgewater-Dunolly Rd, between Wimmera & Calder Highways
- Bridgewater-Maldon Rd, between Wimmera & Calder Highways
- Laanecoorie-Newbridge Rd
- Eddington-Laanecoorie Rd
- Newbridge-Bridgewater Rd

Essential Infrastructure

Nil

Flood Mitigation

No flood mitigation measures currently exist.

Flood Impacts and Required Actions

Refer to the following action table. Note that no river gauge exists within Newbridge. Actions are linked to the peak flow rate from Laanecoorie Reservoir. Due to the relatively fast travel times between Laanecoorie Reservoir and Newbridge, action should be undertaken based on the predicted flow for Laanecoorie Reservoir, not waiting until flows in Laanecoorie have peaked.

The gauge at Cairn Curran Reservoir provides useful data for predicting flow at Laanecoorie Reservoir. During the peak flows of the January 2011 flood, more than half the water that passed through Laanecoorie Reservoir entered the river downstream of Cairn Curran Reservoir. The significant tributaries to the Loddon River between Cairn Curran and Laanecoorie are:

- Bet Bet Creek
- Tullaroop Creek (gauged at Tullaroop Reservoir)
- McCallums Creek

Loddon River at Laanecoorie Reservoir

River Height (m) And or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Action Actions may include (but not limited to) Evacuation, closure of road, sandbagging, issue warning and who is responsible
1.50m (2,000ML/day)	Minor Flood Level (1963)		
3.00m (9,400 ML/day)	Moderate Flood Level (1945)		
5.50m (43,700 ML/day)	Major Flood Level (1988)		Council & SES consider establishing sandbag collection point
5.82m (55,000 ML/day)	Sep 1993 Flood Event		
6.13 m (57,885 ML/day)	September 2010 Flood Event	Parts of Football oval and recreation reserve inundated (Clubrooms not impacted)	Council to close off access to recreation reserve
5.93m (65,000 ML/day)	1956 Flood Event		
6.35m (65,200 ML/day)	November & December 2010 Flood Event	Football Club rooms begin to become affected.	
6.34m (87,300 ML/day)	Sep 1975 Flood Event		
7.5 m (194,700 ML/day)	Jan 2011 Flood Event	5 homes and businesses impacted, in addition to football club and recreational reserve.	
7.8m (195,140 ML/day)	August 1909 Flood Event		

Note: flood intelligence records are approximations. This is because no two floods at a location, even if they peak at the same height, will have identical impacts. Flood intelligence cards detail the relationship between flood magnitude and flood consequence. More details about flood intelligence and its use can be found in the Australian Emergency Management Manuals flood series.

BRIDGEWATER

Overview

Bridgewater on Loddon has a population of 326 with 192 private dwellings (2016 census). The town is located on the Calder Highway, north west of Bendigo, astride the Loddon River approximately 40 kilometres downstream of Laanecoorie Reservoir.

Bridgewater has a history of flooding, prior to January 2011 the highest flood on record was 1909. Since this time there have been a number of smaller flood events (September 1983, September & December 2010) however the impacts have generally been limited to the Caravan Park and properties adjacent to the Loddon River.

In January 2011, the peak flow rate at Laanecoorie Reservoir has been estimated at 195,000ML/day. The highest flood on record at Laanecoorie Reservoir was the 1909 flood event, similar in magnitude to the January 2011 flood event, however during the 1909 flood event the dam wall of Laanecoorie Reservoir failed.

In the **January 2011** flood event approximately 35 homes and businesses were affected by flooding. Flood waters peaked in the order of 14 hours after Laanecoorie Reservoir peaked. Flood waters overtopped the banks of the Loddon River 2 km upstream of the Calder Highway and flowed around the east side of town and flowed down the main road.

North Central CMA has undertaken detailed flood modelling for the township. This study will improve future flood warnings for Bridgewater and investigate potential mitigation options to reduce flood risk.

In the 2011 event, two flood peaks were experienced, the first on 14 January and the second the following day. The floodwaters affected around 35 houses, as well as the police station, caravan park, hotel and other businesses

September 1983

The September 1983 flood event was a result of heavy rainfall in the catchment falling over a 4 day period, during which Bridgewater received 49 mm, with a maximum daily rainfall total of over 20 mm. The upper catchment received significantly more rainfall, with totals greater than 100 mm recorded. There is little anecdotal information regarding the flood; however gauge data is available at the Laanecoorie and Serpentine gauges. In addition, eight historic spot flood heights are available through the Victorian Flood Database.

September 2010

Flooding in September 2010 was a result of over 43 mm rainfall on the already wet catchment over a four day period, with the majority of rain (39 mm) falling on the 4th September. Discharge from the Laanecoorie Reservoir peaked at 700 ML/d on the 5th September after a rapid rise from zero flow the preceding day.

Eight flood heights within the township of Bridgewater were surveyed following the September 2010 floods.

Streamflow data for the event is available from the Laanecoorie Reservoir and Serpentine gauges.

Overview of Flooding Consequences

Warning Time

The BoM do not provide any formal warnings or predictions for Bridgewater. The potential impacts in Bridgewater can be determined based on the flow passing through the upstream Laanecoorie reservoir. Peak travel time from Laanecoorie for an event such as Jan 2011 is approx.14 hours

Properties Affected

During the 2011 flood event, in the order of 35 homes and businesses were impacted by flood inundation. This included the caravan park, motel, hotel and other shops along Main Street. The caravan park is affected by flood inundation frequently, including both the flood events of September 2010 and November 2010. No other homes and businesses were impacted during either of these smaller events.

The following table, taken from the recent Bridgewater Flood Study, shows possible affected properties:

	0.5% aep	1% aep	2% aep	5% aep	10% aep	20% aep
Buildings flooded above floor	81	52	39	17	1	0
Properties flooded below floor	75	78	65	47	27	6
Total Flood Affected	156	130	104	64	28	6

Bridgewater Caravan Park (temporary and residents):

- Sep 2010 – Parts of park flooded. Sites developed after this date are above this level
- Jan 2011 – Park severely affected. Evacuation required.
- Nov 2011 – Park will flood. Permanent cabins now set above this level

Note: A Detailed list of Properties affected is available as part of the Bridgewater Flood Study (not for public distribution) and can be obtained from NCCMA

Isolation

Calder Highway (Main Street) was inundated through town during the January 2011 flood event. Due to the intense and prolonged rainfall, the Calder Highway was also cut in a number of locations between Charlton and Bendigo.

Major road closures

The following is a list of major roads that may be inundated in a flood dependant on the magnitude of the flood. Note that many minor roads may also be inundated in a flood event.

- Bridgewater-Dunolly Rd – Between Wimmera and Calder Highways
- Bridgewater-Maldon Rd – Between Wimmera Highway and Calder Highway
- Bridgewater-Serpentine Rd – Between Bridgewater and Serpentine towns
- Bridgewater Raywood Rd – Between Calder Highway and Loddon Valley Highway
- Newbridge-Bridgewater Rd



Essential Infrastructure

CFA Station & Police Station can be affected

Flood Mitigation

No flood mitigation measures currently exist. The North Central CMA Bridgewater Flood Study is currently considering possible mitigation methods

Flood Impacts and Required Actions

Refer to the following action table. Note that no river gauge exists within Bridgewater. Actions are linked to the peak flow rate from Laanecoorie Reservoir. Due to the relatively fast travel times between Laanecoorie Reservoir and Bridgewater, action should be undertaken based on the predicted flow for Laanecoorie Reservoir, not waiting until flows in Laanecoorie have peaked.

The gauge at Cairn Curran Reservoir provides useful data for predicting flow at Laanecoorie Reservoir. During the peak flows of the January 2011 flood, more than half the water that passed through Laanecoorie Reservoir entered the river downstream of Cairn Curran Reservoir. The significant tributaries to the Loddon River between Cairn Curran and Laanecoorie are:

- Bet Bet Creek
- Tullaroop Creek (gauged at Tullaroop Reservoir)
- McCallums Creek

Flood intelligence card-

Gauge Location: Loddon River at Laanecoorie Reservoir

Bridgewater		Steep rise between Laanecoorie and Bridgewater 16 hours				
		Steep rise between Laanecoorie and Bridgewater properties impacted 32 hours				
		Time between Laanecoorie and Bridgewater peak 11 hours				
		Riverine flooding duration: 2 days				
Bet Bet Creek at Bet Bet gauge height 407211 (m)	Loddon River at Cairn Curran gauge height 407210 (m)	Loddon River at Laanecoorie gauge height 407203 (m)	Average Recurrence Interval (ARI)	Loddon River at Laanecoorie Design Flows (ML/d) Water Tech 2018	Bridgewater damages total number properties flooded (above floor)	Consequences/ Impact/ Actions (Water Tech 2015)
			1,000	317,000		
			500	278,300		
			200	227,600	156 (81)	Sloans Road on Bullabul Creek is overtopped by 0.28 m. Serpentine Road on Bullabul Creek is overtopped by 1.46 m. The majority of the township is inundated
6.72	5.4		January 2011 August 1909	194,700		Approximately 35 homes and businesses inundated, including caravan park, motel, hotel and other businesses in Main Street.
		9.30	100	190,000	130 (52)	Almost all properties on the Bridgewater-Dunolly Road are now inundated. The majority of the township is inundated. The current farm land with planning permit to subdivide between Peppercorn Lane and Sugar Gum Drive is inundated. The Bridgewater-Maldon Road is overtopped with flooding around the tennis courts and the football oval.
		8.57	50	153,500	104 (39)	Breakout from the Loddon River to the north-east isolates the poultry farm south of Bridgewater. Properties east of the Loddon River, between the railway and Calder highway (up to Erskine St) are inundated up to 0.5 m. Park Street inundated from Sugar Gum Drive to the Calder Highway. Large parts of the town is now isolated on both banks of the Loddon River.
		7.49	20	108,000	64 (17)	Floodwaters inundate Peppercorn Lane and flow directly through the caravan park. Park Street is inundated from Camp Street to the highway with water spilling over the highway and through to the railway line, inundating the Bridgewater Hotel. Properties along Bridgewater-Dunolly Road to the west of the Loddon River are entirely inundated by floodwaters.
		6.66	10	76,300	28 (1)	Bullabul Creek and Loddon River flows shallowly inundate farmland along the Bullabul Creek floodplain between the Bridgewater-Dunolly Road, Bridgewater-Newbridge Road and the Calder Highway. The caravan park is entirely inundated. House at the end of Peppercorn Lane becomes isolated by floodwaters. Breakouts from the Loddon River to the west begin to inundate properties along the Bridgewater-Dunolly Road.
		6.57	September 1983	72,975		Lower portion of Caravan Park affected

6.15		6.35	November 2010 September 1975	65,188		Approximately two thirds of the caravan Park inundated. No other buildings impacted
6.00 (major)		6.13	September 2010	57,992		Lower portion of Caravan Park affected
		5.93		51,897		
		5.82	September 1993	48,689		Lower portion of Caravan Park affected
5.00 (mod)		5.80	5	48,112	6 (0)	Floodwater breaks out from Loddon River into the palaeo-channel, but does not cross the floodplain. The south-western corner of the caravan park and the western end of Peppercorn Lane becomes inundated. Bullabul Creek breaks out onto the floodplain in low locations.
4.00 (minor)	4.00 (major)	5.5 (major)	Major 1988	40,148	156 (81)	Remove the earth roadway bund on Flood Lane at Scotts Creek - 20,000 ML/day at Laanecoorie for a flood within 2 weeks of the previous flood.
		5				Sloans Road on Bullabul Creek is overtopped by 0.28 m. Serpentine Road on Bullabul Creek is overtopped by 1.46 m. The majority of the township is inundated
	3.50 (moderate)	3 (moderate)	Moderate 1945	8,600		
	2.00 (minor)	1.5 (minor)	Minor 1963	1,936		Almost all properties on the Bridgewater-Dunolly Road are now inundated. The majority of the township is inundated. The current farm land with planning permit to subdivide between Peppercorn Lane and Sugar Gum Drive is inundated. The Bridgewater-Maldon Road is overtopped with flooding around the tennis courts and the football oval.
	5.4					Breakout from the Loddon River to the north-east isolates the poultry farm south of Bridgewater. Properties east of the Loddon River, between the railway and Calder highway (up to Erskine St) are inundated up to 0.5 m. Park Street inundated from Sugar Gum Drive to the Calder Highway. Large parts of the town is now isolated on both banks of the Loddon River.

Note: flood intelligence records are approximations. This is because no two floods at a location, even if they peak at the same height, will have identical impacts. Flood intelligence cards detail the relationship between flood magnitude and flood consequences. More details about flood intelligence and its use can be found in the Australian Emergency Management Manuals flood series.

20% AEP Event

- Water breaks out from Loddon River into the palaeo-channel, but does not spread out across the floodplain
- The south-western corner of the caravan park and approximately 70 m of the western end of Peppercorn Lane becomes inundated up to depths of 2.3 m
- Bullabul Creek breaks out onto the floodplain in low locations from the highway down to the confluence with the Loddon River, but is otherwise contained within bank
- **10% AEP Event**
- Flow from the paleo-channel breaks out and shallowly flows across the floodplain to Bullabul Creek, inundating the Bridgewater-Newbridge Road and the Bridgewater-Dunolly Road to a maximum of 300 mm
- Bullabul Creek and Loddon River flows shallowly inundate farmland along the Bullabul Creek floodplain between the Bridgewater-Dunolly Road and the Calder Highway (approximately 150 mm deep)
- The caravan park is entirely inundated, with depths between 0.4 and 3.5 m
- House at the end of Peppercorn Lane becomes isolated by floodwaters
- Breakouts from the Loddon River to the west begin to inundate properties along the Bridgewater-Dunolly Road, for approximately 300 m upstream of the Calder Highway.
- **5% AEP Event**
- Flood flows break from the Loddon River to the north-east approximately 4 km upstream of Bridgewater, flowing along Bridgewater-Maldon Road and then overland to the north-west, re-joining the Loddon near the caravan park
- Floodwaters inundate Peppercorn Lane and flow directly through the caravan park, to hazardous depths and velocities.
- The floodplain between Bullabul Creek and the Loddon River (near the palaeo-channel) is widely inundated with flows breaking out of the Loddon River, resulting in widespread flooding across both the Newbridge-Bridgewater road and Bridgewater-Dunolly Road (depths up to 0.6 m)
- Park Street is inundated from Camp Street to the highway with water spilling over the highway and through to the railway line, inundating the area from the Bridgewater Hotel to almost Lyndhurst Street
- Properties along Bridgewater-Dunolly Road to the west of the Loddon River are entirely inundated by floodwaters.
- North Central CMA Bridgewater Flood Study
- 3524-01 / R06 v01 - 29/01/2015 28

2% AEP Event

- Water from Bullabul Creek initially banks up behind the highway and railway and flows towards Bridgewater, with a breakout from the Loddon River to the north west at Pondage Road then pushing back toward Bullabul Creek
- Almost the entire floodplain between the Bridgewater-Dunolly Road and Bullabul Creek upstream of the highway is inundated
- Breakout from the Loddon River to the north-east isolates the poultry farm south of Bridgewater.
- Another breakout from the Loddon River to the north-east flows to the intersection of the Bridgewater-Maldon Road and the Calder Highway before flowing in a north westerly direction down the Calder Highway to Lyndhurst Street
- The Calder Highway is overtopped along an approximate 1.5 km length between the Loddon River and Bullabul Creek as well as between the Loddon River and the Bridgewater-Maldon Road
- Flood waters are level with the bridge deck at Sloans Road on Bullabul Creek
- The Serpentine Road crossing on Bullabul Creek is overtopped by 1.02 m
- Properties east of the Loddon River, between the railway and Calder highway (up to Erskine St) are inundated up to 0.5 m
- Park Street inundated from Sugar Gum Drive to the Calder Highway
- Large parts of the town is now isolated on both banks of the Loddon River

1% AEP Event

- Sloans Road on Bullabul Creek is overtopped by 0.1 m
- Serpentine Road on Bullabul Creek is overtopped by 1.43 m
- Similar flood behaviour as previous event only larger inundation area and deeper flooding
- Almost all properties on the Bridgewater-Dunolly Road are now inundated
- The majority of the township is inundated
- The current farm land with planning permit to subdivide between Peppercorn Lane and Sugar Gum Drive is inundated
- The Bridgewater-Maldon Road is overtopped with flooding around the tennis courts and the football oval

0.5% AEP Event

- Sloans Road on Bullabul Creek is overtopped by 0.28 m
- Serpentine Road on Bullabul Creek is overtopped by 1.46 m
- The majority of the township is inundated

0.1% AEP Event

- Sloans Road on Bullabul Creek is overtopped by 0.65 m
- Serpentine Road on Bullabul Creek is overtopped by 3.14 m
- The majority of the land south of the railway line from the football oval to Bullabul Creek is inundated

Pyramid Hill

Overview

Pyramid Hill, in Victoria, is a small town on the state's northern plains, which has a population of 558 (2016 census) and is named after the adjacent granite hill with its many interesting rock formations. The original survey for the township was on the south side of the hill but with the opening of the railway in 1885 the town was moved to its present site.

In January 2011, the peak flow rate at Laanecoorie Reservoir has been estimated at 195,000ML/day. The highest flood on record at Laanecoorie Reservoir was the 1909 flood event, similar in magnitude to the January 2011 flood event, however during the 1909 flood event the dam wall of Laanecoorie Reservoir failed.

In the January 2011 flood event the aged care facility housing 35 people was evacuated, flood waters peaked in the order of 60 hours after Laanecoorie Reservoir peaked.

Overview of Flooding Consequences

Warning Time

The BoM do not provide any formal warnings or predictions for Pyramid Hill. The potential impacts in Pyramid Hill can be determined based on the flow passing through the upstream Laanecoorie reservoir. Peak travel time from Laanecoorie for an event such as Jan 2011 is approx.60 hours

Properties Affected

- Caravan Park, Victoria Street
- Minimum residential impact. Some under floor inundation only.
- College can be minimally affected
- Swimming Pool can become inundated (2011)
- 2011 Flood surrounded the town
- Aged Care Facility evacuated in 2011 event

Isolation

The following major roads were closed during the 2011 flood:

- Bendigo-Pyramid Rd
- Leitchville-Pyramid Rd (Victoria St)
- Boort-Pyramid Rd
- Gladfield Rd
- Pyramid-Mincha Rd (Kelly St)

Essential Infrastructure

- Aged care facility
- CFA Station
- Police Station
- Mobile Phone Tower
- Water Treatment Plant

Flood Mitigation

During the 2011 flood, a temporary levee was constructed by the Loddon Shire to protect the town from the west. The levee progressed from approx. 200 metres South of Stone St on the Bendigo Pyramid Rd, around the recreation reserve, finishing just South of the College.

An irrigation channel to the East of the town acts as levee and in the 2011 event. A flood protection levee is being constructed on the perimeter of the township.

Flood Impacts and Required Actions

Refer to the following action table. Note that no river gauge exists within Pyramid Hill. Actions are linked to the peak flow rate from Laanecoorie Reservoir. Action should be undertaken based on the predicted flow for Laanecoorie Reservoir, not waiting until flows in Laanecoorie have peaked.

The gauge at Cairn Curran Reservoir provides useful data for predicting flow at Laanecoorie Reservoir. During the peak flows of the January 2011 flood, more than half the water that passed through Laanecoorie Reservoir entered the river downstream of Cairn Curran Reservoir. The significant tributaries to the Loddon River between Cairn Curran and Laanecoorie are:

- Bet Bet Creek
- Tullaroop Creek (gauged at Tullaroop Reservoir)
- McCallums Creek

Gauge Location: Loddon River at Laanecoorie Reservoir

River Height (m) And or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Action Actions may include (but not limited to) Evacuation, closure of road, sandbagging, issue warning and who is responsible
1.50m (2,000ML/day)	Minor Flood Level (1963)	Nil Impact	
3.00m (9,400 ML/day)	Moderate Flood Level (1945)	Nil Impact	
5.50m (43,700 ML/day)	Major Flood Level (1988)	Nil Impact	
5.80m* (48,000 ML/day)	20% AEP (5 year ARI)	Nil impact	
6.60 m* (76,000 ML/day)	10% AEP (10 year ARI)	Nil impact	
7.49 m* (108,000 ML/day)	5% AEP (20 year ARI)		
8.57 m* (153,000 ML/day)	2% AEP (50 year ARI)		
9.30 m* (190,000 ML/day)	1% AEP (100 year ARI)	Similar (slightly lower) to January 2011 flood event and August 1909 flood event	
(227,600 ML/day)	0.5% AEP (200 year ARI)		

Note: flood intelligence records are approximations. This is because no two floods at a location, even if they peak at the same height, will have identical impacts. Flood intelligence cards detail the relationship between flood magnitude and flood consequences. More details about flood intelligence and its use can be found in the Australian Emergency Management Manuals flood series.

SERPENTINE

Overview

Serpentine is a town in north west Victoria. Located on the Loddon Valley Highway, 51 kilometres North West of, Bendigo, with a population of 192 (2016 census).

The town is named for Serpentine Creek, a tributary of the Loddon River. The creek in turn was named for explorer Thomas Mitchell's description of the River Red Gum trees lining the rivers and creeks of the area.

In January 2011, the peak flow rate at Laanecoorie Reservoir has been estimated at 195,000ML/day. The highest flood on record at Laanecoorie Reservoir was the 1909 flood event, similar in magnitude to the January 2011 flood event, however during the 1909 flood event the dam wall of Laanecoorie Reservoir failed

Flooding occurred in September & November 2010 in addition to the 2011 event - No reported residential property damage, however reports of damage to rural property including livestock

Overview of Flooding Consequences

- Town itself is not affected due to levee system. However some outlying rural areas impacted.
- Water Treatment Plant located on West side of township, protected by the levee.

Major road closures

- Loddon Valley Hwy, South of township
- Bridgewater-Serpentine Rd
- Old Boort Rd
- Echuca-Serpentine Rd
- Tandarra Rd

Flood Mitigation

- Levee protects South & West of town

Flood Impacts and Required Actions

Refer to the following action table. Note that no river gauge exists within Serpentine. Actions are linked to the peak flow rate from Laanecoorie Reservoir. Action should be undertaken based on the predicted flow for Laanecoorie Reservoir, not waiting until flows in Laanecoorie have peaked.

The gauge at Cairn Curran Reservoir provides useful data for predicting flow at Laanecoorie Reservoir. During the peak flows of the January 2011 flood, more than half the water that passed through Laanecoorie Reservoir entered the river downstream of Cairn Curran Reservoir. The significant tributaries to the Loddon River between Cairn Curran and Laanecoorie are:

- Bet Bet Creek
- Tullaroop Creek (gauged at Tullaroop Reservoir)

- McCallums Creek

Gauge Location: Loddon River at Laanecoorie Reservoir

During the peak flows of the January 2011 flood, more than half the water that passed through Laanecoorie Reservoir entered the river downstream of Cairn Curran Reservoir. The Bet Bet Creek and other significant tributaries contribute vast volumes of water to the Loddon River in flood times, yet these streams are not gauged.

River Height (m) And or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Action Actions may include (but not limited to) Evacuation, closure of road, sandbagging, issue warning and who is responsible
1.50m (2,000ML/day)	Minor Flood Level (1963)		
3.00m (9,400 ML/day)	Moderate Flood Level (1945)		
5.50m (43,700 ML/day)	Major Flood Level (1988)		
5.80m (48,000 ML/day)	20% AEP (5 year ARI)	Similar to Sep 1993 flood event	
6.13 m (57,885 ML/day)	September 2010 Flood Event		
6.35m (65,200 ML/day)	November 2010 Flood Event	Gaps in town levee	Council to consider closing gaps with earth levee
6.60 m* (76,000 ML/day)	10% AEP (10 year ARI)		
7.49 m* (108,000 ML/day)	5% AEP (20 year ARI)		
8.57 m* (153,000 ML/day)	2% AEP (50 year ARI)		
9.30 m* (190,000 ML/day)	1% AEP (100 year ARI)	Similar (slightly lower) to January 2011 flood event.	
(227,600 ML/day)	0.5% AEP (200 year ARI)		

Note: flood intelligence records are approximations. This is because no two floods at a location, even if they peak at the same height, will have identical impacts. Flood intelligence cards detail the relationship between flood magnitude and flood consequences. More details about flood intelligence and its use can be found in the Australian Emergency Management Manuals flood series.

DURHAM OX

Overview of Flooding Consequences

Durham Ox is a small rural locality in the [Shire of Loddon](#) in [Victoria, Australia](#).

It is situated on the Serpentine Creek, a tributary of the [Loddon River](#). This is a highly valuable natural and irrigation resource to both the local tourism and agriculture economies.

This community is widely known because of the 'OX' landmark that lies on the Loddon Valley Highway. The 'OX' stands next to the former Durham Ox Store which was destroyed by a fire in September 1996 and never rebuilt.

In the 2011 Victoria floods, the Serpentine Creek which runs through the town, overflowed and inundated several houses in the area, as well as the Durham Ox Memorial Hall, the Durham Ox Church, and the historic Durham Ox Inn

Flood Mitigation

The local residents funded and installed operating flood gates within the doors and openings of the Durham Ox Memorial Hall.

In past flood events, local residents have worked with emergency services to construct temporary sandbag levees to protect properties along the creek

Therefore, sufficient warning time and communication with the locals can help minimise the impacts of flooding in the smaller 'typical' flood events.

Flood Impacts and Required Actions

Refer to the following action table. Note that no river gauge exists within Durham Ox, actions are linked to the peak flow rate from Laanecoorie Reservoir. Due to the travel times between Laanecoorie Reservoir and Durham Ox, action should be undertaken based on the predicted flow for Laanecoorie Reservoir, not waiting until flows in Laanecoorie have peaked

2011 event

Serpentine Creek overflowed - inundating several homes, Memorial Hall, Church and the historic Durham Ox Inn

Boort – Pyramid Hill Road effected

Gauge Location: Loddon River at Laanecoorie Reservoir

During the peak flows of the January 2011 flood, more than half the water that passed through Laanecoorie Reservoir entered the river downstream of Cairn Curran Reservoir. The Bet Bet Creek and other significant tributaries

contribute vast volumes of water to the Loddon River in flood times, yet these streams are not gauged.

River Height (m) And or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Action Actions may include (but not limited to) Evacuation, closure of road, sandbagging, issue warning and who is responsible
1.50m (2,000ML/day)	Minor Flood Level (1963)	Minimal	
3.00m (9,400 ML/day)	Moderate Flood Level (1945)	Consider establishing a sandbag collection point (dependant on flood level predictions)	
5.50m (43,700 ML/day)	Major Flood Level (1988)	Consider installing the flood gates within the memorial hall NCCMA to deploy PALS gauge on Serpentine Creek	Residents NCCMA
5.80m (48,000 ML/day)	20% AEP (5 year ARI)	Similar to Sep 1993 flood event	
6.13 m (57,885 ML/day)	September 2010 Flood Event		
6.35m (65,200 ML/day)	November 2010 Flood Event		
6.60 m* (76,000 ML/day)	10% AEP (10 year ARI)		
7.49 m* (108,000 ML/day)	5% AEP (20 year ARI)		
8.57 m* (153,000 ML/day)	2% AEP (50 year ARI)		
9.30 m*	1% AEP (100)	Similar (slightly lower) to January	

(190,000	year ARI)	2011 flood event.	
227,600 ML/day	0.5% AEP (200 year ARI)		

Note: flood intelligence records are approximations. This is because no two floods at a location, even if they peak at the same height, will have identical impacts. Flood intelligence cards detail the relationship between flood magnitude and flood consequences. More details about flood intelligence and its use can be found in the Australian Emergency Management Manuals flood series.

BOORT

Overview of Flooding Consequences

The township of Boort is located within the Loddon River floodplain and is situated adjacent to a number of natural wetlands named the Boort District wetlands, the three closest wetlands being Lake Boort, Little Lake Boort and Lake Lyndger. The township is relatively free from flooding with only a small portion of the town around Templeton Crescent being inundated from riverine flooding in the January 2011 flood event.

Lake Boort holds particular significance from a cultural heritage perspective for the Dja Dja Wurrung traditional owners, and the wetland contains the highest density of Aboriginal scarred trees recorded in Victoria.

In past flood events, the town has experienced local drainage problems as local stormwater was unable to drain away due to the raised water levels in the lack and insufficient capacity of the drains under the irrigation channels. Council has subsequently undertaken drainage improvements to reduce this problem.

Water entering Lake Boort originates from the Kinypanial Creek, which is fed by two mechanisms. In very large flood events (e.g. Jan 2011), water from the Loddon River overtops the river banks and enters the Kinypanial Creek, while in smaller flood events (e.g. Sep 2010, Nov 2010, Oct 2016), rainfall from the Borung Hills enters the Kinypanial Creek. Both the Nov 2010 and Oct 2016 flood events, Lake Boort and Lake Lyndger filled

Due to the raising of natural levee banks along the Loddon River by landowners, it is only in very large flood events, such as January 2011, where floodwaters can escape the Loddon River on the western floodplain.

- Water approaches Caravan park from Little Lake Boort and overland flow from Lake Boort & Lake Lyndger
- Rural farmland effected
- Minor build up around Boort-Pyramid Rd and McMillans Rd, no homes affected
- In large events the township can be completely isolated

Major road closures

The following is a list of major roads that may be inundated in a flood dependant on the magnitude of the flood. Note that many minor roads may also be inundated in a flood event.

- Boort-Wedderburn Rd – Between Boort and Wedderburn
- Boort-Wycheproof Rd – Between Boort and Wycheproof

- Boort-Charlton Rd – Between Boort to Charlton
- Boort Kerang Rd – Between Kerang to Boort
- Boort-Pyramid Rd – Between Boort and Durham Ox

Flood Mitigation

No permanent mitigation exists, however a dirt bank has been built up between McMillans Rd and Boort-Pyramid Rd which protects properties in that area

In 2011, a sandbag levee was constructed between Lake Boort and Little Lake Boort, however, this did not hold, allowing water to interact and flow north toward Boort-Pyramid Rd

Loddon Shire set up pumping to move water from a drain to a channel on the north side of the caravan park to prevent overflow.

Flood Impacts and Required Actions

Refer to the following action table. Note that no river gauge exists within Boort, actions are linked to the peak flow rate from Laanecoorie Reservoir. Due to the travel times between Laanecoorie Reservoir and Pyramid Hill, action should be undertaken based on the predicted flow for Laanecoorie Reservoir, not waiting until flows in Laanecoorie have peaked

Gauge Location: Loddon River at Loddon Weir

During the peak flows of the January 2011 flood, more than half the water that passed through Laanecoorie Reservoir entered the river downstream of Cairn Curran Reservoir. The Bet Bet Creek and other significant tributaries contribute vast volumes of water to the Loddon River in flood times, yet these streams are not gauged.

Gauge Location: Loddon River at Loddon Weir

River Height (m) And or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Action Actions may include (but not limited to) Evacuation, closure of road, sandbagging, issue warning and who is responsible
3.30m	Minor Flood Level (1963)		
6.0m	Moderate Flood Level (1945)		
7.0m (43,700 ML/day)	Major Flood Level (1988)	Consider sandbagging the Boort-Pyramid Road where the Goulburn Murray Water Channel passes underneath the road (dependant on	

		<p>flood level prediction)..</p> <p>Consider pumping to move water from a drain to a channel on the north side of the caravan park to prevent overflow (dependant on flood level prediction).</p>	

Note: flood intelligence records are approximations. This is because no two floods at a location, even if they peak at the same height, will have identical impacts. Flood intelligence cards detail the relationship between flood magnitude and flood consequences. More details about flood intelligence and its use can be found in the Australian Emergency Management Manuals flood series.

Appendix D - Flood evacuation arrangements

Phase 1 - Decision to Evacuate

The decision to evacuate is to be made in consultation with the MERO, MERC, DHHS, Health Commander and other key agencies and expert advice (CMA's and Flood Intelligence specialists).

The Incident Controller may make the decision to evacuate an at-risk community under the following circumstances:

- Properties are likely to become inundated;
- Properties are likely to become isolated and occupants are not suitable for isolated conditions;
- Public health is at threat as a consequence of flooding and evacuation is considered the most effective risk treatment. This is the role of the Health Commander of the incident to assess and manage. Refer to the State Health Emergency Response Plan (SHERP) for details;
- Essential services have been damaged and are not available to a community and evacuation is considered the most effective risk treatment.

The following should be considered when planning for evacuation:

- Anticipated flood consequences and their timing and reliability of predictions;
- Size and location of the community to be evacuated;
- Likely duration of evacuation;
- Forecast weather;
- Flood Models;
- Predicted timing of flood consequences;
- Time required and available to conduct the evacuation;
- Evacuation priorities and evacuation planning arrangements;
- Access and egress routes available and their potential flood liability;
- Current and likely future status of essential infrastructure;
- Is cross border assistance required or evacuation to another municipality relief centre?;
- Resources required and available to conduct the evacuation;
- Shelter including Emergency Relief Centres, Assembly Areas etc.;
- Vulnerable people and facilities;
- Transportation;
- Registration
- People of CALD background and transient populations;
- Safety of emergency service personnel;
- Different stages of an evacuation process.

The ICC, working with flood specialists (NCCMA, Hydrologist etc.) will establish if predicted heights are triggers requiring consideration of evacuation.

Phase 2 – Warning

Warnings may include a warning to 'prepare to evacuate' and a warning to 'evacuate now'. Once the decision to evacuate has been made, the at-risk community will be warned to evacuate. Evacuation warnings should be disseminated via methods listed in section 3.3 of this plan.

Phase 3 – Withdrawal

VICPOL is the responsible agency for evacuation. VICSES will provide advice regarding most appropriate evacuation routes and locations for at-risk communities to evacuate to.

VICSES, CFA, AV and Local Government will provide resources where available to support VICPOL/VICROADS with route control and may assist VICPOL in arranging evacuation transportation.

VICPOL will control security of evacuated areas.

Evacuees will be encouraged to move using their own transport where possible. Transport for those without vehicles or other means will be arranged in consultation with the Incident Controller..

Special needs groups will be/are identified in Council's 'residents at risk' register. This can be done through community network organisations. Further information on Council's 'residents at risk' register can be obtained from the MEMP.

Phase 4 – Shelter

Relief Centres and/or assembly areas which cater for people's basic needs for floods may be established to meet the immediate needs of people affected by flooding. Details of relief centres are shown in the MEMP:

VICPOL in consultation with VICSES will liaise with Local Government and DHHS (where regional coordination is required) via the relevant control centre to plan for the opening and operation of relief centres. This can best be achieved through the Emergency Management Team (EMT).

Animal Shelter

Animal shelter will be established as per the Northern Victoria Councils Emergency Animal Welfare plan, which is a sub-plan to the IMEMP.

Phase 5 – Return

The Incident Controller in consultation with VICPOL will determine when it is safe for evacuees to return to their properties and will arrange for the notification of the community.

VicPol will manage the return of evacuated people with the assistance of other agencies as required.

Considerations for deciding whether to evacuate include:

- Current flood situation;
- Status of flood mitigation systems;
- Size and location of the community;
- Access and egress routes available and their status;

- Resources required to coordinate the return;
- Special needs groups;
- Forecast weather;
- Transportation particularly for people without access to transport

Disruption to Services

Disruption to a range of services can occur in the event of a flood. This may include road closures affecting school bus routes, truck routes, water treatment plant affecting potable water supplies etc.

Service	Impact	Trigger Point for action	Strategy/ Temporary Measures
Water	Potential for loss or contamination.		Potable water tankers to be deployed
Communications	Loss due to power failures.		Temporary Mobile Station Provide alternate power supplies in the interim.
Sewage	Flooding of sewage ponds, inability to process effluent.		Acquisition and provision of Mobile ablution blocks.
Waste	Build-up of rubbish, health concerns, vermin.		
Power Supply Sub Station	Power failure due to water/debris		

Essential Community Infrastructure and Property Protection

Essential Community Infrastructure and properties (e.g. residences, businesses, roads, power supply etc.) that require protection are:

While there are no major utility infrastructure assets located in the Loddon Shire that require protection by levee, the power supply to the Shire was interrupted due to the flooding of the Charlton substation. The failure of utility infrastructure assets outside the municipality critically impacted on the operation of the Municipal Emergency Coordination Centre causing the telephone system and internet to fail. Mobile phone tower battery backup systems could not cope with the duration of power outage. This major failure caused widespread communications outages across the Shire

Loddon Shire will establish a sandbag collection point as per appendix H.

Public Information and Warnings

VICSES uses EM-COP Public Publishing to distribute riverine and flash flood warnings in Victoria. The platform enables automatic publishing to the VicEmergency app, website and hotline (1800 226 226). Communities can also access this information through VICSES social media channels (Victoria State Emergency Service on Facebook and VICSES News on Twitter) and emergency broadcasters, such as Sky News TV and various radio stations (current list available via the [EMV website](#)).

VICSES Regions (or ICCs where established) lead the issuing of warnings for riverine flood events when pre-determined triggers are met (issuing of a BOM Flood Watch or Warning), and share locally tailored information via the standard VICSES communication channels (social media, traditional media, web and face to face). These activities are coordinated by the VICSES RDO and approved by the VICSES RAC, or the PIO and IC respectively (when an ICC is active).

If verified reports are received of flash flooding posing, or resulting in, a significant threat to life or property, VICSES Regions (or ICCs) will issue a flash flood warning product via EM-COP.

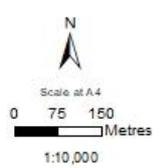
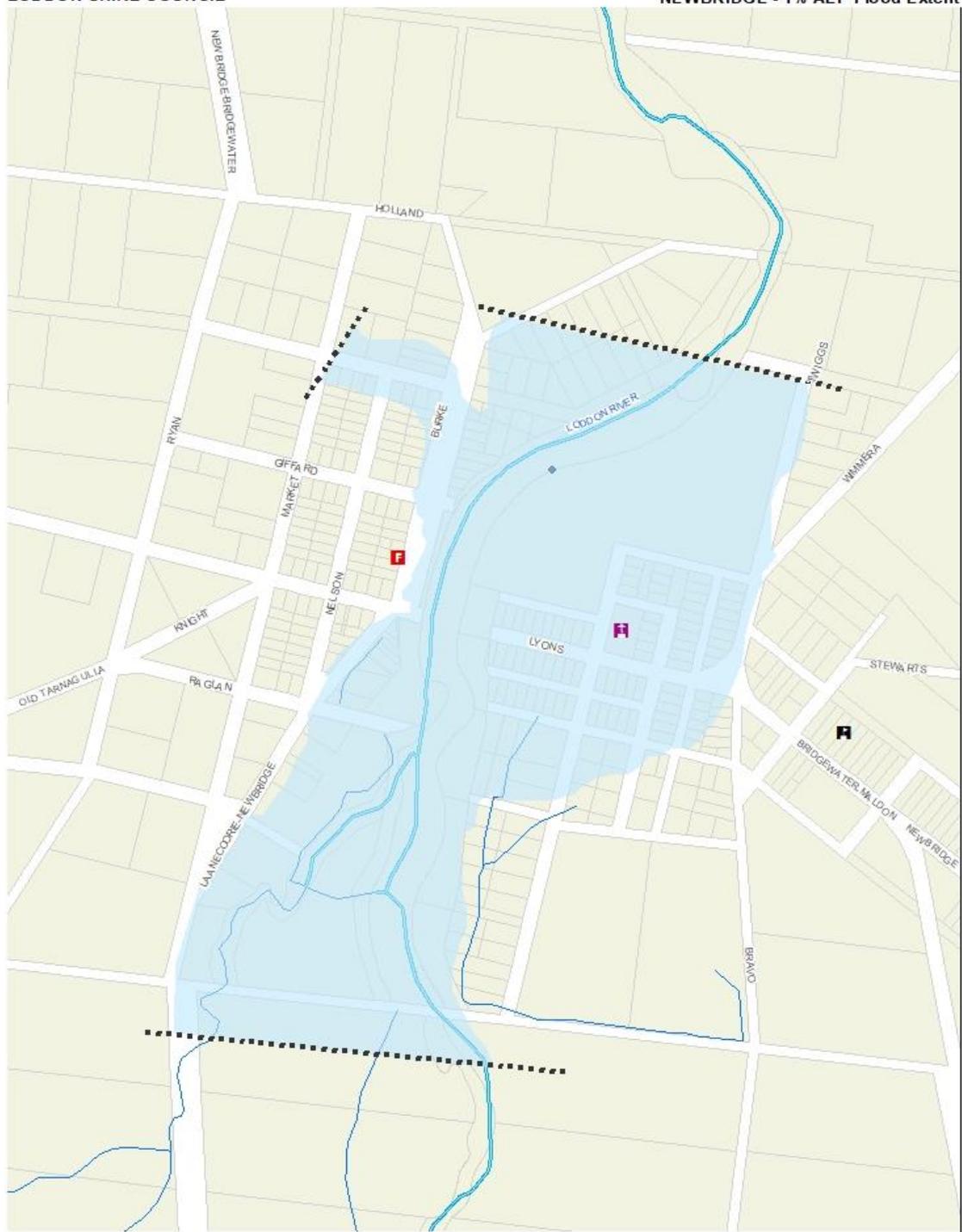
VICSES at the state tier (or SCC Public Information Section) plays an important role in sharing riverine and flash flood information via state-based standard communication channels.

During some emergencies, VICSES may alert communities by sounding a local siren, or by using the Emergency Alert (EA) platform to send an SMS to mobile phones or a voice message to landlines. The use of sirens for higher-end warnings has been pre-determined, and mapped to relevant warning templates in EM-COP.

EM-COP Public Publishing Business Rules for Riverine and Flash Flood are available in the **Public Information tab of the IMT Toolbox**, providing further guidance on specific triggers, roles and responsibilities. VICSES SOP057 and JSOP 04.01 provide further guidance.

Appendix E: Maps and Schematics

LODDON SHIRE COUNCIL NEWBRIDGE - 1% AEP Flood Extent

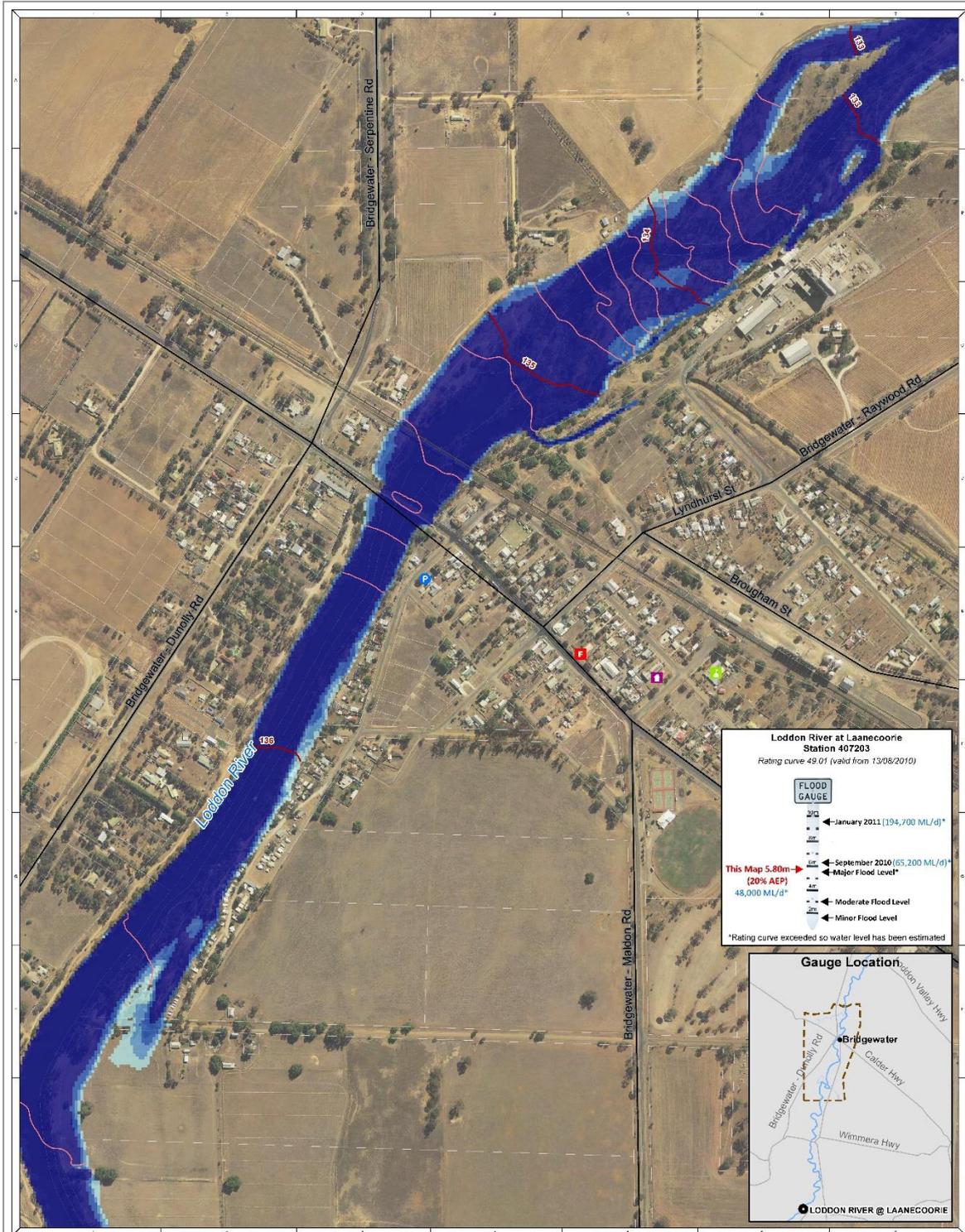


- | | | |
|------------------------|-------------------|-------------------------------|
| Ambulance Station | School/Child Care | Creek/Stream |
| Depot/Municipal Office | SES Unit | Cadastral |
| Church | Rail Trail | Estimated 1% AEP flood extent |
| Camp Ground | Road | Extent of Flood Data |
| Retirement/Aged Care | Levee | Gauges |
| Hospital | River/Creek | |
| Fire Station | | |
| Police Station | | |



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Map Produced: 29 Oct 2019

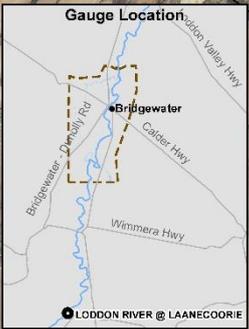


Loddon River at Laanecoorie Station 407203
 Rating curve 48.01 (valid from 13/08/2010)

FLOOD GAUGE

- 20m ← January 2011 (194,700 ML/d)*
- 10m ← September 2010 (65,200 ML/d)*
- This Map 5.80m (20% AEP) 48,000 ML/d*** ← Major Flood Level*
- 4m ← Moderate Flood Level
- 2m ← Minor Flood Level

*Rating curve exceeded so water level has been estimated



SOURCE:
 Aerial photography by AIRPHOTO

SCALE:
 Scale 1:6,082 at A3

SYMBOLS:
 Emergency Shelter
 Fire Station
 Police Station
 School
 Major Road

RAILWAY

TUFLOW Model Extent

AHD contour (1m)
AHD contour (0.2m)

0 100 200 metres

1:6,082 at A3

NORTH CENTRAL
 Catchment Management Authority
Caring Rivers, Landscapes, People

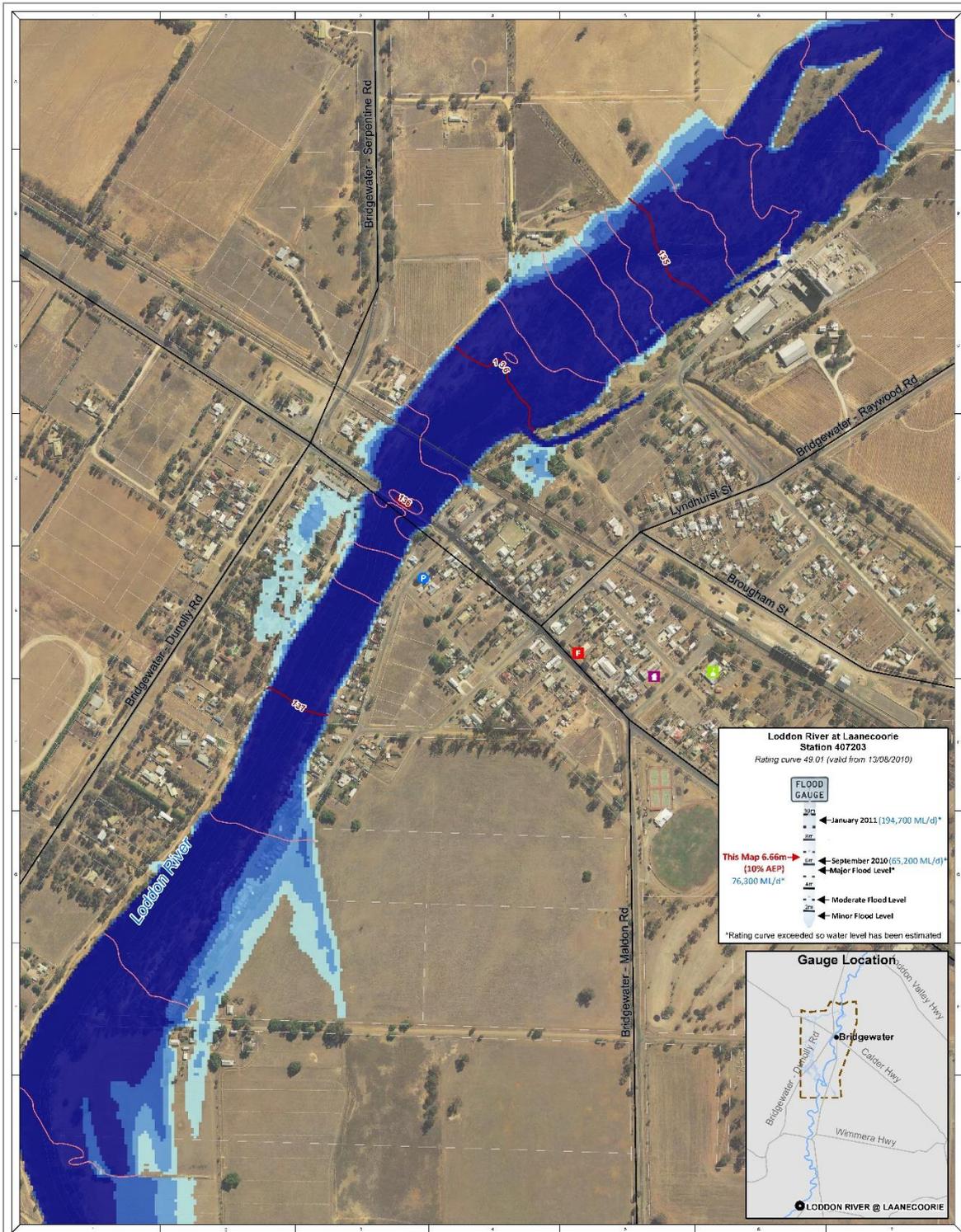
WATER TECHNOLOGY
 WATER & ENVIRONMENTAL SOLUTIONS

Bridgewater Flood Study
 20% AEP Flood Event - Depth Map
 Loddon River

DATE: 10/06/2019

SCALE: 1:6,082

PROJECT: BRIDGEWATER FLOOD STUDY

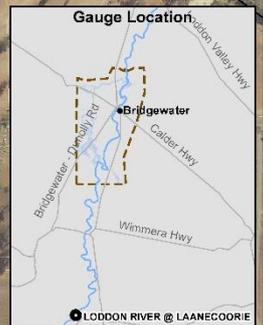


Loddon River at Laanecoorie Station 407203
Rating curve 48.01 (valid from 13/08/2010)

FLOOD GAUGE

- 20m ← January 2011 (194,700 ML/d)*
- 15m ← September 2010 (65,200 ML/d)*
- This Map 6.66m →** ← Major Flood Level* (10% AEP)
- 76,300 ML/d* ← Moderate Flood Level
- 5m ← Minor Flood Level

*Rating curve exceeded so water level has been estimated



SOURCE:
Map Technology by Esri/ARC

SCALE:
Scale 1:6,082 at A3

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Emergency Shelter	Railway	Flood depth (m)
Fire Station	AHD contour (1m)	0 - 0.25
Police Station	AHD contour (0.2m)	0.25 - 0.5
School	TUFLOW Model Extent	0.5 - 1
Major Road		Greater than 1

Scale: 0 100 200 metres

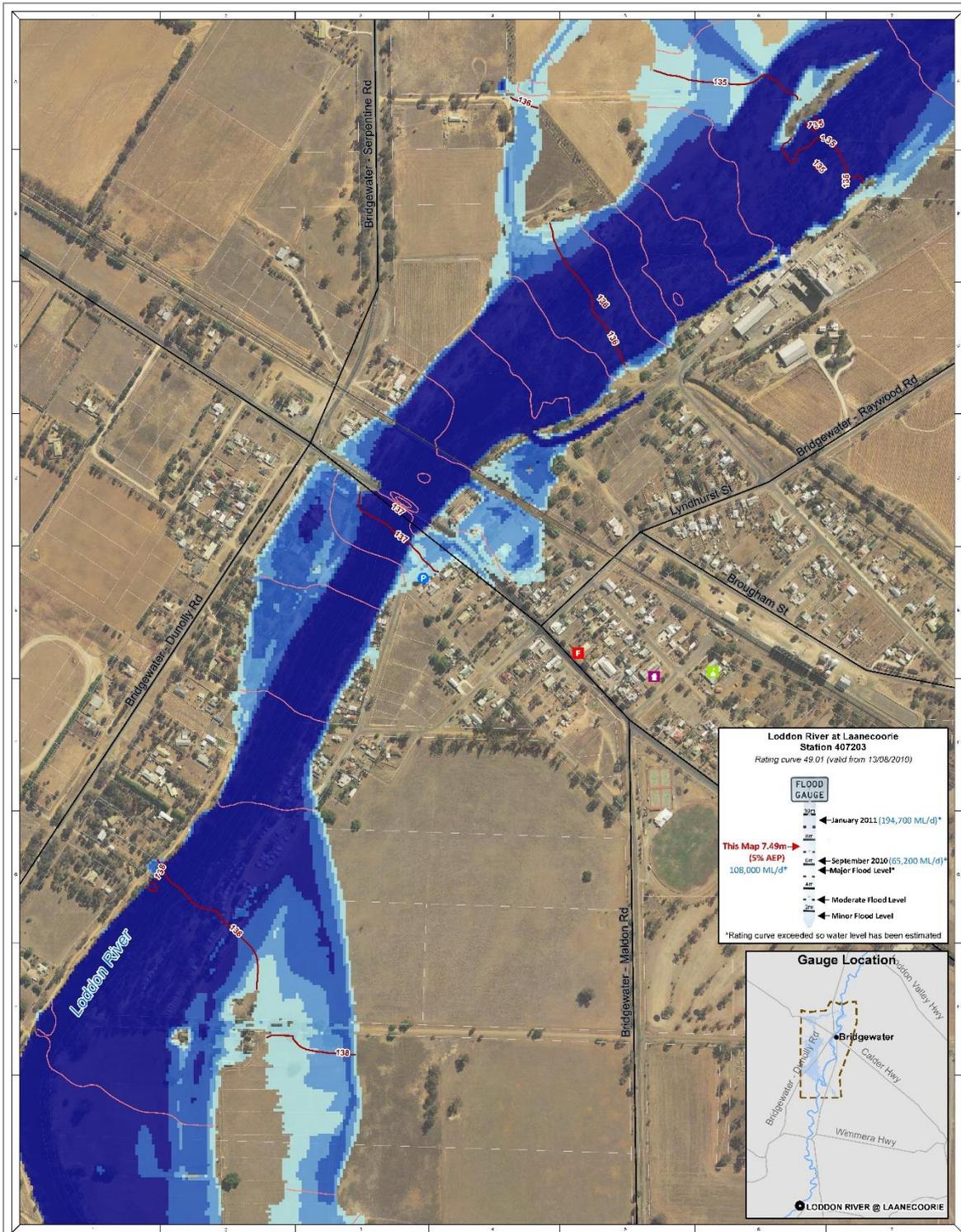
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WATER TECHNOLOGY
WATER & ENVIRONMENTAL SOLUTIONS

Bridgewater Flood Study
10% AEP Flood Event - Depth Map
Loddon River

DATE: 13/08/2010

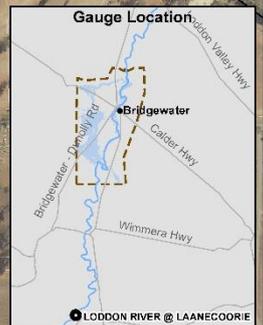


Loddon River at Laanecoorie Station 407203
 Rating curve 48.01 (valid from 13/08/2010)

FLOOD GAUGE

- 20m ← January 2011 (194,700 ML/d)*
- 18m ← **This Map 7.49m (5% AEP)**
- 16m ← September 2010 (65,200 ML/d)*
- 14m ← Major Flood Level*
- 12m ← Moderate Flood Level
- 10m ← Minor Flood Level

*Rating curve exceeded so water level has been estimated



SOURCE:
 Aerial photography by LANDSAT
 State Technical Drawing Office
 TUFLOW Model Extent

SYMBOLS:
 Emergency Shelter
 Fire Station
 Police Station
 School
 Major Road
 Railway
 AHD contour (1m)
 AHD contour (0.2m)
 TUFLOW Model Extent

Flood depth (m)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- Greater than 1

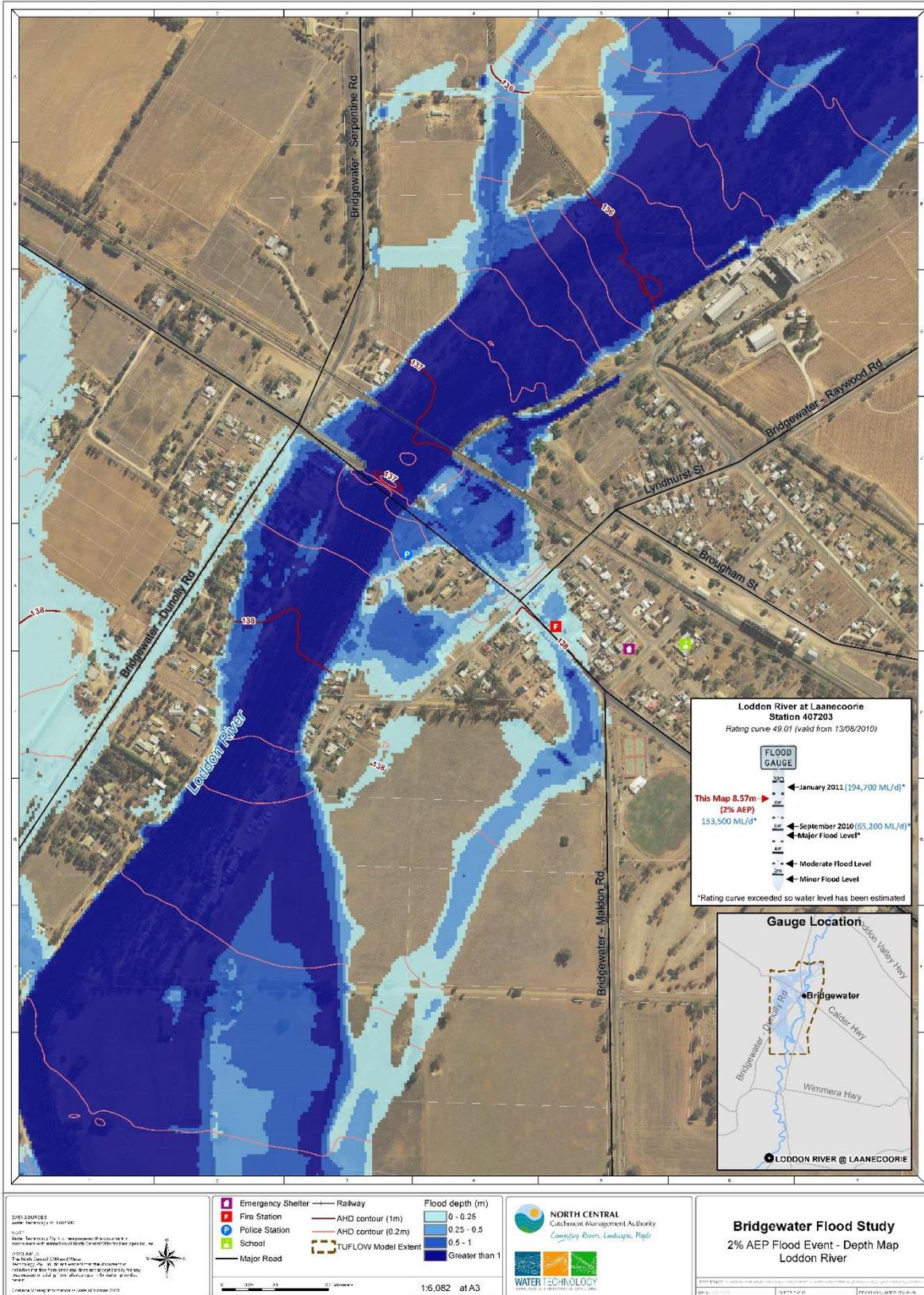
Scale: 1:6,082 at A3

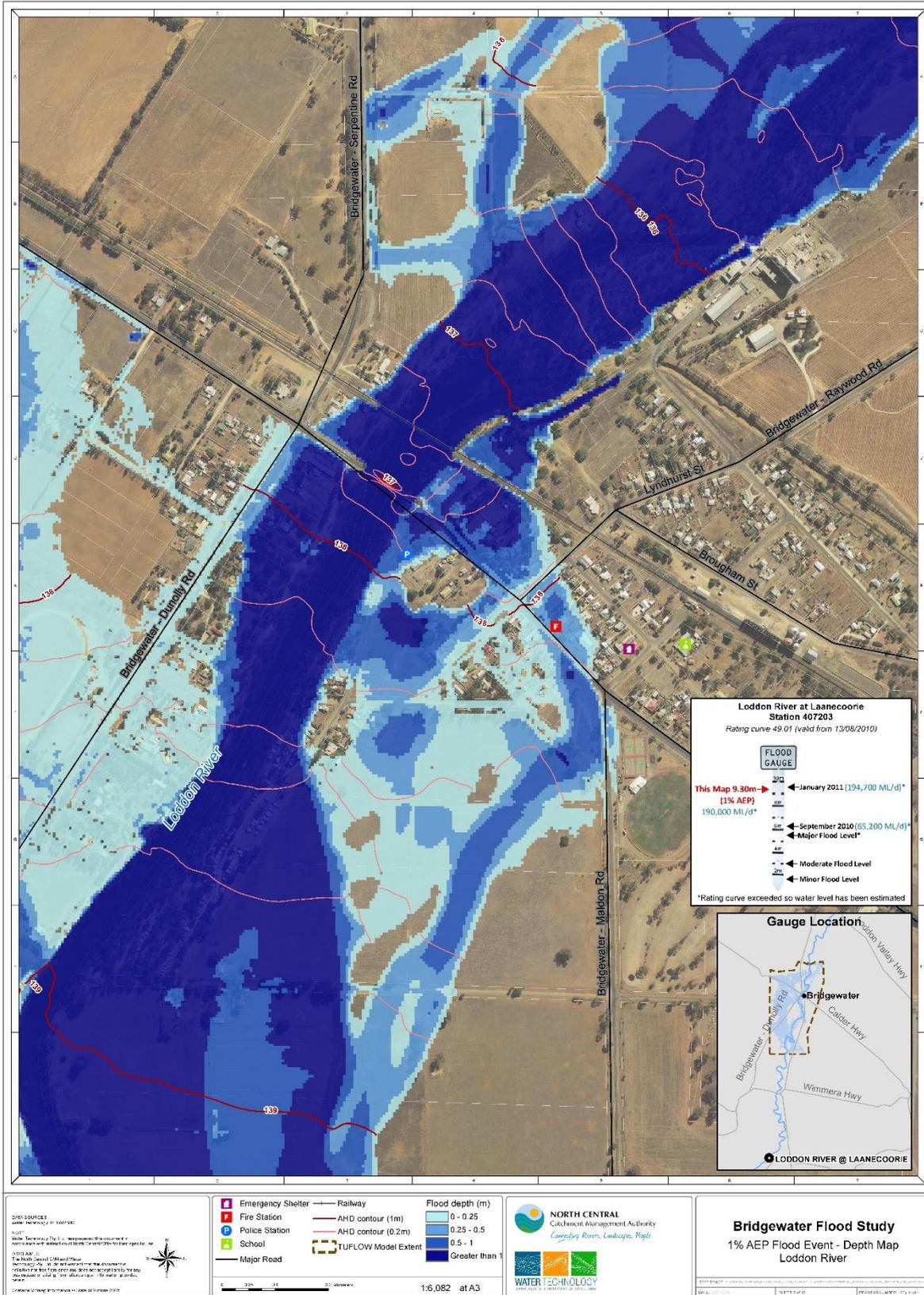
NORTH CENTRAL
 Catchment Management Authority
Connecting Rivers, Landscapes, People

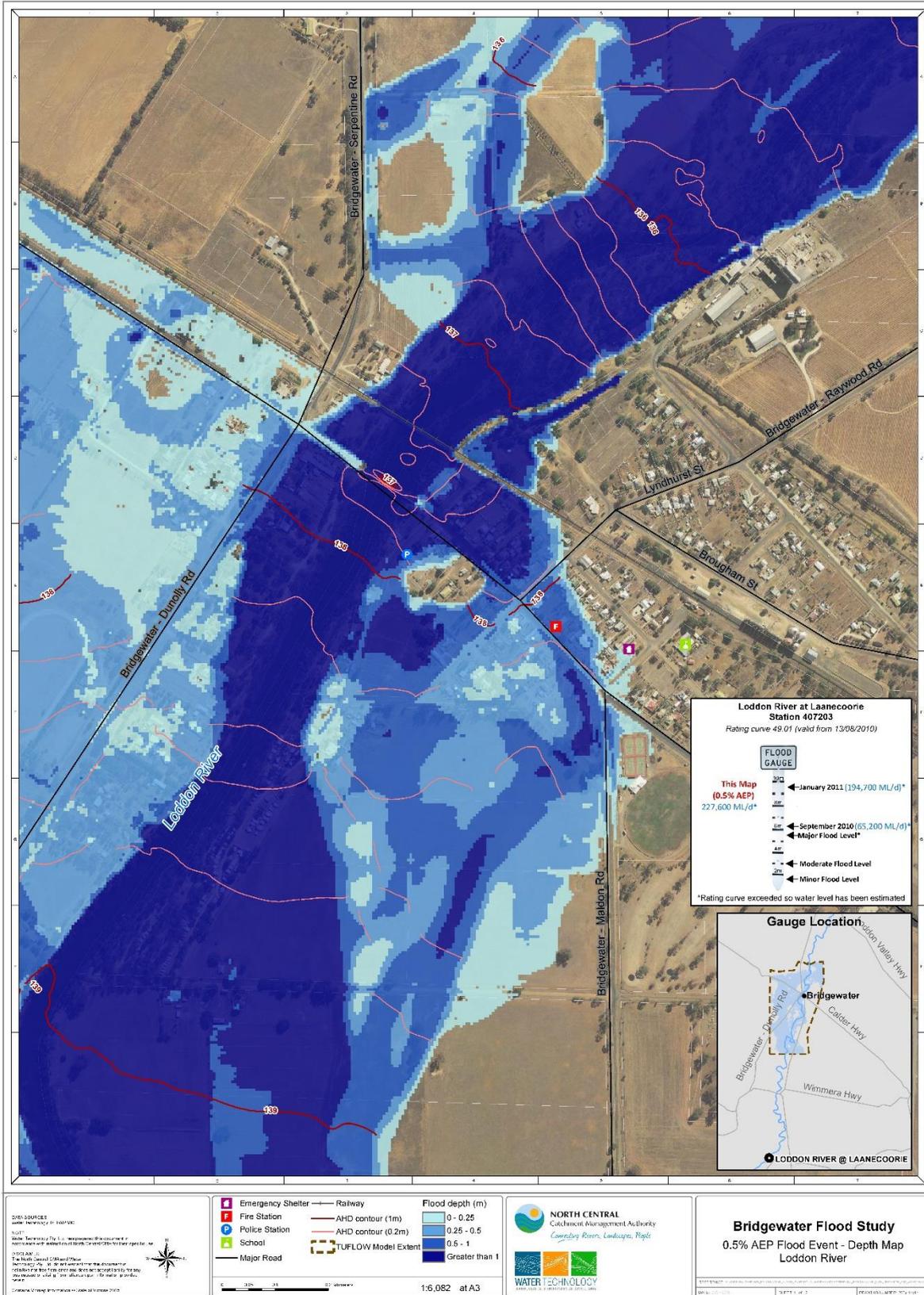
WATER TECHNOLOGY
 WATER & ENVIRONMENTAL SOLUTIONS

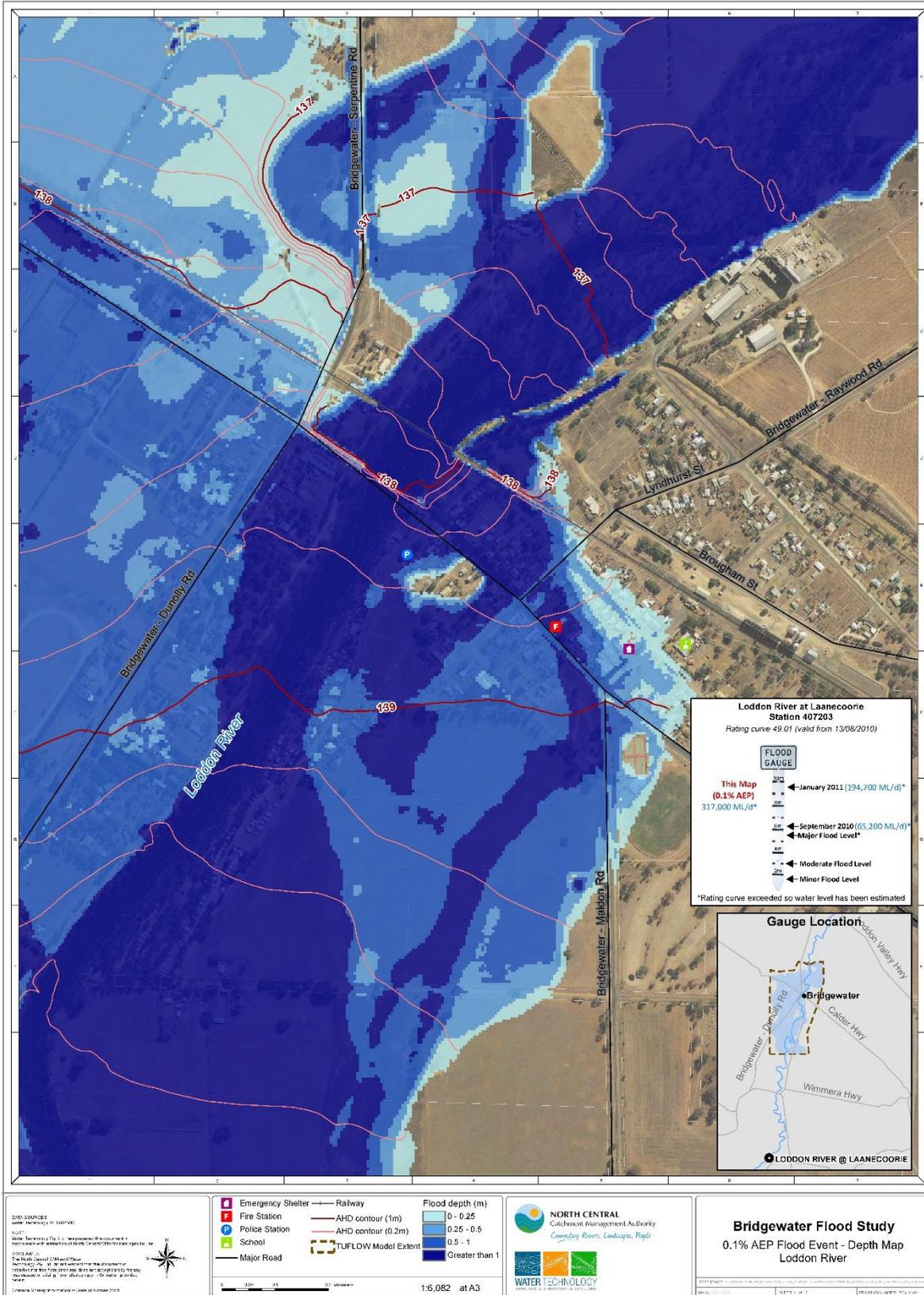
Bridgewater Flood Study
 5% AEP Flood Event - Depth Map
 Loddon River

DATE: 13/08/2010
 DRAWN BY: [Name]
 CHECKED BY: [Name]







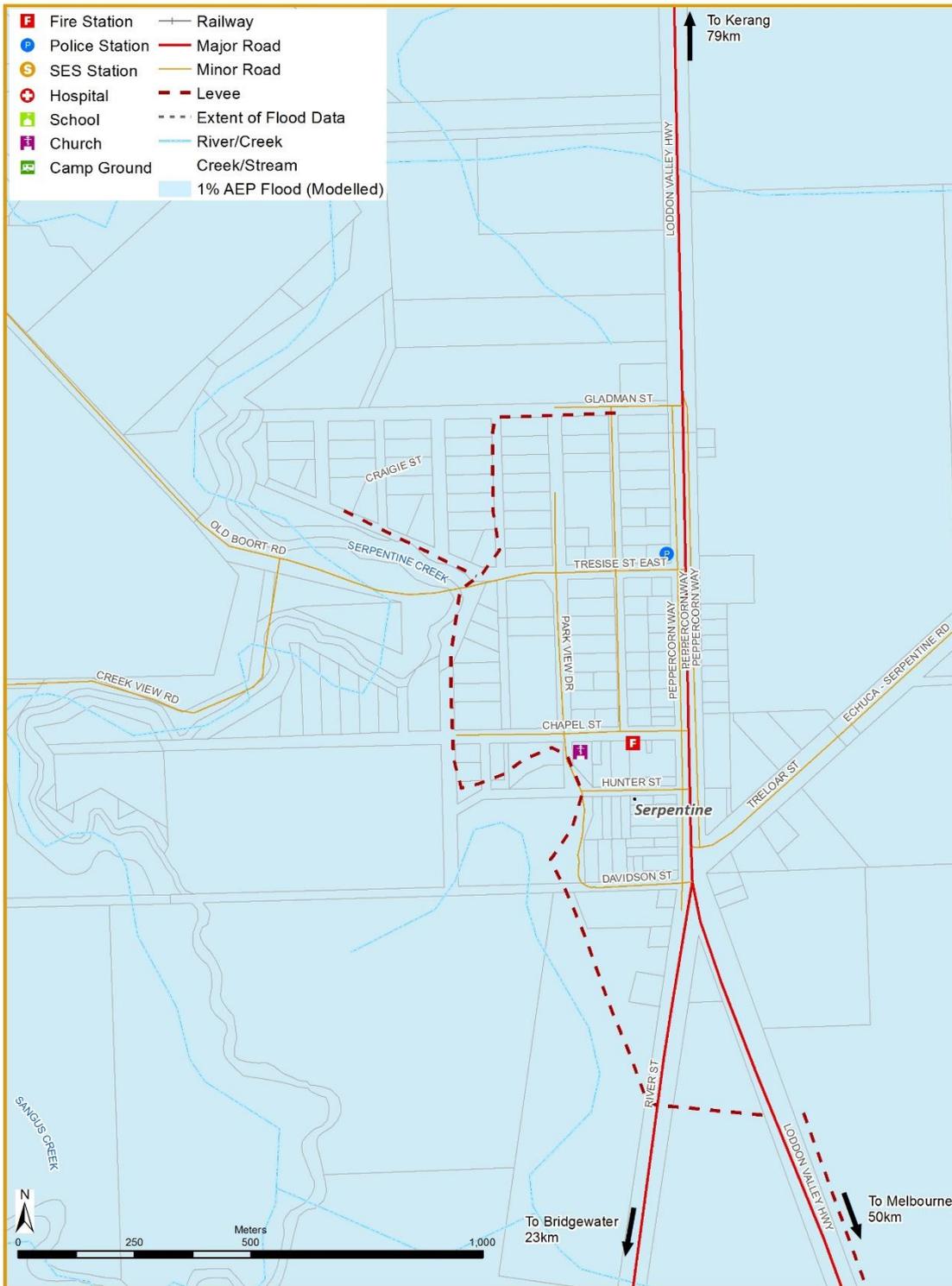


PYRAMID HILL



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SERPENTINE



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BOORT



Appendix F: Local knowledge arrangements

As control agency for flood in Victoria, VICSES is committed to ensuring the incorporation of local knowledge in decision making before, during and after incidents.

Information from community sources including but not limited to observations, historical information and information about current and possible consequences of an incident may be utilised to help inform the process of incorporating local knowledge into decision making during an incident.

A formal flood observer network has not been established as yet.

Important Notes:

These arrangements do not permit community observers and existing agency networks any responsibility for operational decisions and do not permit community observers and existing agency networks to direct operational activity, including the management of flood levees.

Information provided from sources of local knowledge must be processed and validated before it can become intelligence to inform decision making.

Appendix G: Local flood information

Local Flood Guides (LFG's) have been developed for the following townships:

- Bridgewater
- Newbridge
- Serpentine

These Local Flood Guides can be found on the VICSES website, as follows:

<https://www.ses.vic.gov.au/get-ready/your-local-flood-information/loddon-shire-council>

Appendix H: Sandbags and sandbag collection points

This applies to the procurement, storage, distribution, use and disposal of sandbags during flood emergencies, primarily Riverine flood events. Flash Flood events, due to their quick nature, will be directed by the local VICSES Unit.

Use of sandbags

Sandbags can be used to block doorways, drains and other openings into properties as well as to weigh-down manhole covers, garden furniture and to block sinks, toilets and bath drains to prevent water backing up. They have proven to be successful in keeping water out for short periods of time.

Sandbagging is not always the most effective option and should be considered in the context of this Flood Emergency Plan which includes alternatives for managing flood risk. Other alternatives include moving possessions to higher places, securing objects so they do not float away and placing valuables in water tight containers. During a flood event the Incident Controller and operational staff in the flood affected community will assess the overall risk to communities and allocate sandbag resources based on risk.

Responsibilities

VICSES responsibilities include:

- The management of the state-wide procurement and storage of sandbags for flood emergencies
- Providing sandbags to local areas for distribution based on requirements identified in the MFEP
- Identifying distribution arrangements in the MFEP
- Community education and awareness on sandbag management and safe use
- Identifying Critical Infrastructure and Community Critical Facilities in the MFEP
- Providing a support role in flood recovery.

Council responsibilities include:

- Supporting VICSES in developing the MFEP
- Providing a support role during flood response
- Identifying Community Critical Facilities at a municipal level
- Procuring sandbags to protect council owned facilities including Community Critical Facilities managed by council
- Providing locations, plant and equipment, where available and capable, to support sandbagging operations as agreed in the MFEP
- Coordinating the clean-up and community recovery arrangements

Community Critical Facility owners' responsibilities include:

- Working with VICSES to develop an effective flood mitigation plan for their property as part of the MFEP with a priority for permanent structures.

Other 'Response' agencies responsibilities include:

- Supporting VICSES in their response role.

Residential and commercial property owners' responsibilities include:

- Understanding their own flood risk
- Preparing an emergency plan for their home or business
- Procurement and storage of sandbags to protect their own property
- Filling and movement of sandbags to protect their property
- Seek advice from their local council regarding the removal of sandbags from their property, as part of the community recovery

Community and business education

VICSES has an established community education program to support community and business in responding to flood emergencies (see www.ses.vic.gov.au/prepare/floodsafe).

VICSES will use the existing community education tools and programs (such as the Local Flood Guides and the FloodSafe program) to promote:

Practical information on:

- The purpose, use and disposal of sandbags (see <https://www.ses.vic.gov.au/get-ready/floodsafe>)
- Obtaining sandbags
- Safety considerations e.g. WHS, manual handling, safe use and disposal
- Alternative flood mitigation strategies to sandbagging
- Where to get information – Phone 1300 842 737 for the VICSES Information Line
- The responsibilities of critical infrastructure owners, businesses and private individuals to understand their flood risk and develop a flood plan

Key messages:

- Emergency response agencies will not always have the capacity to provide sandbags due to other competing priorities
- Businesses and individuals need to understand the flood risk to their property and, where appropriate, develop a Flood Emergency Plan
- Sandbagging is only one way of protecting properties against floodwater and not always the most effective option. Sandbagging should be considered in the context of a Flood Emergency Plan which considers alternatives for managing flood risk.

Procurement of sandbags

VICSES

VICSES will maintain a supply of sandbags to support the effective readiness and response to flood emergencies as identified in this MFEP.

The number of sandbags required at a State and regional level will be determined from information provided through the MFEP planning process. There may be occasions where the supply of sandbags is limited and priorities for distribution will need to be determined through local emergency management arrangements.

VICSES will maintain the current cross-border and mutual aid arrangements for flood emergencies. VICSES will also work with local councils to access the resource sharing arrangements established between councils during emergencies.

Council

Council will procure sandbags to protect council owned facilities including Community Critical Facilities managed by council

Residential and commercial property owners'

Sandbags and sand may be obtained (purchased) from local hardware and garden/soil suppliers

Storage of sandbags

VICSES

Sandbags will be stored by VICSES in appropriate locations across the municipality. VICSES will monitor the condition of all its sandbags for deterioration.

VICSES sandbags storage locations and initial quantities are as follows:

- Wedderburn VICSES Local Headquarters (LHQ) 4000 bags (minimum)
- CFA Brigade HQ as follows: 1000 bags (minimum) each
Newbridge, Bridgewater, Serpentine, Logan, Pyramid Hill, Durham Ox, Boort
- Other locations to be determined as required

Additional sandbag supplies are held at the Loddon Mallee VICSES Regional Offices, located in Bendigo & Swan Hill. These can be accessed for replenishment or additional requirements. Additional sandbags will be supplied to these locations in the lead up to a flood event.

Council

Sandbags will be stored at appropriate Council locations across the municipality. Council will monitor the condition of all its sandbags for deterioration.

Distribution of sandbags

Priorities

The Incident Controller may make sandbags and sand available for flood mitigation activities during declared flood emergencies.

Sandbags will be issued consistent with the Strategic Control Priorities within the State Flood Emergency Plan, in the following order of priority to protect:

1. Critical Infrastructure and Community Critical facilities identified:
 - (a) in the MFEP or
 - (b) by the Incident Management Team
2. Residential properties identified in the potential flood area
3. Commercial properties identified in the potential flood area
4. Environmental and conservation areas identified in the potential flood area.

Properties identified as being outside the potential flood area, will be referred to an alternative source of sandbags (e.g. local hardware store or sandbag supplier) by VICSES.

Distribution Points

In preparation for a significant flood emergency, VICSES will work with local councils and other agencies to identify appropriate locations for sandbag collection points. Location considerations will include access, safety, human resources and machinery requirements.

Suggested sandbag collection points:

*additional/alternate points can be nominated by the Incident Controller

Wedderburn

Donaldson Park, Chapel St.

Newbridge

Recreation Reserve, off Wimmera Hwy
Vacant land, Market St.

Bridgewater

Recreation Reserve, Bridgewater-Maldon Rd
Vacant Block, Walnut Ave

Pyramid Hill

Racecourse & Rec Reserve, Leitchville-Pyramid Rd

Serpentine

Recreation Reserve, View Dr.

Durham Ox

Vacant Land, Cnr Loddon Valley Hwy & Boort Pyramid Rd

Boort

Showgrounds, Malone St.

The Floodsafe Sandbag Quick Reference Guide (see: <https://www.ses.vic.gov.au/get-ready/floodsafe>) provides details to community members about the indicative number of sandbags required for residential property protection and guidance on the safe use, for the filling and laying of sandbags.

As part of the response arrangements, the Incident Controller will track the distribution of sandbags through the Incident Management Team (IMT). This information will be provided to the recovery team as part of the transition from response to recovery.

Provision of sand**VICSES**

VICSES will have plans in place to acquire sand through its own supply arrangements and where necessary through the emergency management arrangements. These arrangements will be identified in the MFEP. Sand suppliers may be identified in the MFEP.

Council

Council will have plans in place to acquire sand through its own supply arrangements

During a localised non declared flood event, sand will be procured by the local responding VICSES Unit. During a declared flood event, sand will be procured via the Incident Control Centre

Disposal and relocation of used sandbags

Sandbags may be contaminated after use and local councils should ensure that clean up and disposal is considered as part of recovery. Removal and disposal of sandbags used for flood mitigation shall be dealt with under the clean up and community recovery arrangements as outlined in the Emergency Management Manual Victoria. The disposal of sandbags is a shared responsibility between different agencies.

Incident Controllers will provide information on sandbag locations to councils, to assist with clean-up. VICSES will continue to work with relevant agencies to develop protocols for the safe and environmentally responsible disposal of sandbags.