

# City of Ballarat

## FLOOD EMERGENCY PLAN

A Sub-Plan of the Municipal Emergency Management Plan

For City of Ballarat Council  
and  
VICSES Ballarat Unit

Version 1, November 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, 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 [MidWest@ses.vic.gov.au](mailto:MidWest@ses.vic.gov.au).

The VICSES MFEP template 5.3 was used to develop this Plan.

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
0.1	June 2019	Tony Grimme	Draft Version
0.2	August 2019	Clare Mintern	Update with amendments.
1	September 2019	Clare Mintern	Incorporate feedback from MEMPC

This Plan will be maintained on the VICSES website at [www.ses.vic.gov.au/get-ready/your-local-flood-information](http://www.ses.vic.gov.au/get-ready/your-local-flood-information) and City of Ballarat website <https://www.ballarat.vic.gov.au/page/HomePage.aspx>

# List of Abbreviations & Acronyms

The following abbreviations and acronyms are used in the Plan

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

# Part 1. Introduction

## 1.1 Approval and Endorsement

This Municipal Flood Emergency Plan (MFEP) has been prepared by VICSES, Glenelg Hopkins CMA, Corangamite CMA and City of Ballarat staff and with the authority of the City of Ballarat Municipal Emergency Management Planning Committee (City of Ballarat MEMPC) pursuant to Section 20 of the Emergency Management Act 1986 (as amended).

VICSES staff has undertaken consultation with the City of Ballarat staff, Glenelg Hopkins CMA staff, Corangamite CMA staff and Ballarat VICSES Unit members regarding the arrangements contained within this plan.

This MFEP is a sub plan to the City of Ballarat 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 Mid West 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 City of Ballarat MEMPC as a sub-plan to the MEMP.

### Approval



Peter Kambouris

Date 7 November 2019

Grampians Mid West Region VICSES Regional Manager

### Endorsement



Stephen Bigarelli

Date 7 November 2019

Chair – Municipal Emergency Management Planning Committee

## 1.2 Purpose and Scope of this Flood Emergency Plan

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

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 City of Ballarat Flood Planning Committee (MFPC) comprises of the following representatives from the following agencies and organisations:

- VICSES (i.e. Unit Controller & Regional Officer – Emergency Management) (Chair),
- Council (i.e. Municipal Emergency Manager, Drainage Engineer, Statutory Planning Officer)
- Victoria Police (i.e. Municipal Emergency Response Co-ordinator) (MERC),
- Catchment Management Authority (CMA), - Corangamite and Glenelg Hopkins
- Department of Health and Human Services (DHHS) as required,
- Department of Environment, Land, Water and Planning (DELWP) as required,
- Central Highlands Water
- Bureau of Meteorology as required,
- Local community representatives and
- CFA D15 – Eureka Group Catchment

## 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 City of Ballarat and Corangamite and Glenelg-Hopkins CMA's will coordinate targeted community flood engagement programs within the council area.

Refer to appendix H (LFG and FloodSafe Information. Attach any broader FloodSafe details).

### 2.2 Structural Flood Mitigation Measures

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

Gregory Street Reserve – Retarding Basin

- A retarding basin constructed along the Gnarr Creek that reduces flows during large rainfall events and ultimately reduces flood level of inundation downstream.

Crompton Street Reserve – Retarding Basin

- A retarding basin constructed downstream of the Railway Workshops War Memorial to reduce flows that later converge with the Gnarr Creek.

Yarrowee River / Western Freeway – Detention Basin

- Constructed to reduce flows in the Yarrowee River during extreme storm events and alleviate flooding through Ballarat and its CBD.

Doug Dean Reserve – Retention Basin

- Constructed to address flooding from the Bonshaw Creek by reducing flood levels in the immediate area by means of retaining excess water. This structure also reduces flows in the creek which benefits properties/infrastructure downstream.

Smythes Road / Banyule Drive – Drainage Upgrade

### 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](http://www.ses.vic.gov.au/em-sector/vicses-emergency-plans)) and on the Bureau of Meteorology (BoM) website [www.bom.gov.au](http://www.bom.gov.au).

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



### 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 H**.

# 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 – Mid West 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 City of Ballarat. These agencies will be engaged through the IEMT (Incident Emergency Management Team) when enacted or via the RAC when the IEMT is not enacted.

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

If established, liaison with the emergency coordination centre 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 an emergency coordination 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 City of Ballarat 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 available in the MEMP.

### 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:

Incident Level	ICC / ICP	Division	Division Control Point	Sector	Sector Control Point
Level 2-3	Ballarat ICC	East	Ballarat LHQ	Gnarr	TBD as needed
				Canadian	TBD as needed
				Yarrowee	TBD as needed
		Central	Wendouree CFA	CBD	Ballarat LHQ
		West	Wendouree CFA	Redan / Winter / Bonshaw	TBD as needed
				Burrumbeet	Miners Rest CFA
Level 1	Ballarat LHQ				

### 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 (IMs).

### 3.2.6 Incident 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 City of Ballarat, 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](http://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/](http://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 City of Ballarat 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.

Refer to **Appendix C** for response arrangements for flash flood events.

### 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 within City of Ballarat to assist with rescue operations:

- Flood Rescue boats are located at Ballarat, Hepburn and Bacchus Marsh Units.
- Ballarat Unit and Ballarat CFA have a land based Swift Rescue Team.
- HEMS 4 Rescue helicopter is located at Essendon Airport.

### 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:

- Ballarat Aerodrome, off Learmonth Road, Mitchell Park.

### 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 City of Ballarat Council maintains a small stock of sandbags that will be made available at community collection points at Alfredton and Miners Rest. These details will be advertised by both VICSES and City of Ballarat at appropriate times prior to and during an event. 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 location of sandbag collection points.

### 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 City of Ballarat.

### 3.12 Road Closures

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

Regional Roads and the City of Ballarat 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 City of Ballarat 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**

VICSES 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**

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

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

## Part 4. AFTER: Emergency relief and recovery arrangements

### 4.1 General

Arrangements for recovery from a flood incident within the City of Ballarat is detailed in the City of Ballarat MEMP.

### 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 **Appendix D** and 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.

### 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 or location of the transition arrangements are available in the MEMP

# Appendix A: Flood threats for the City of Ballarat

This Appendix is to provide a broad overview of flood risk within the Municipality. Detailed Flood Risk Information for Individual Communities should be detailed in **Appendix C**.

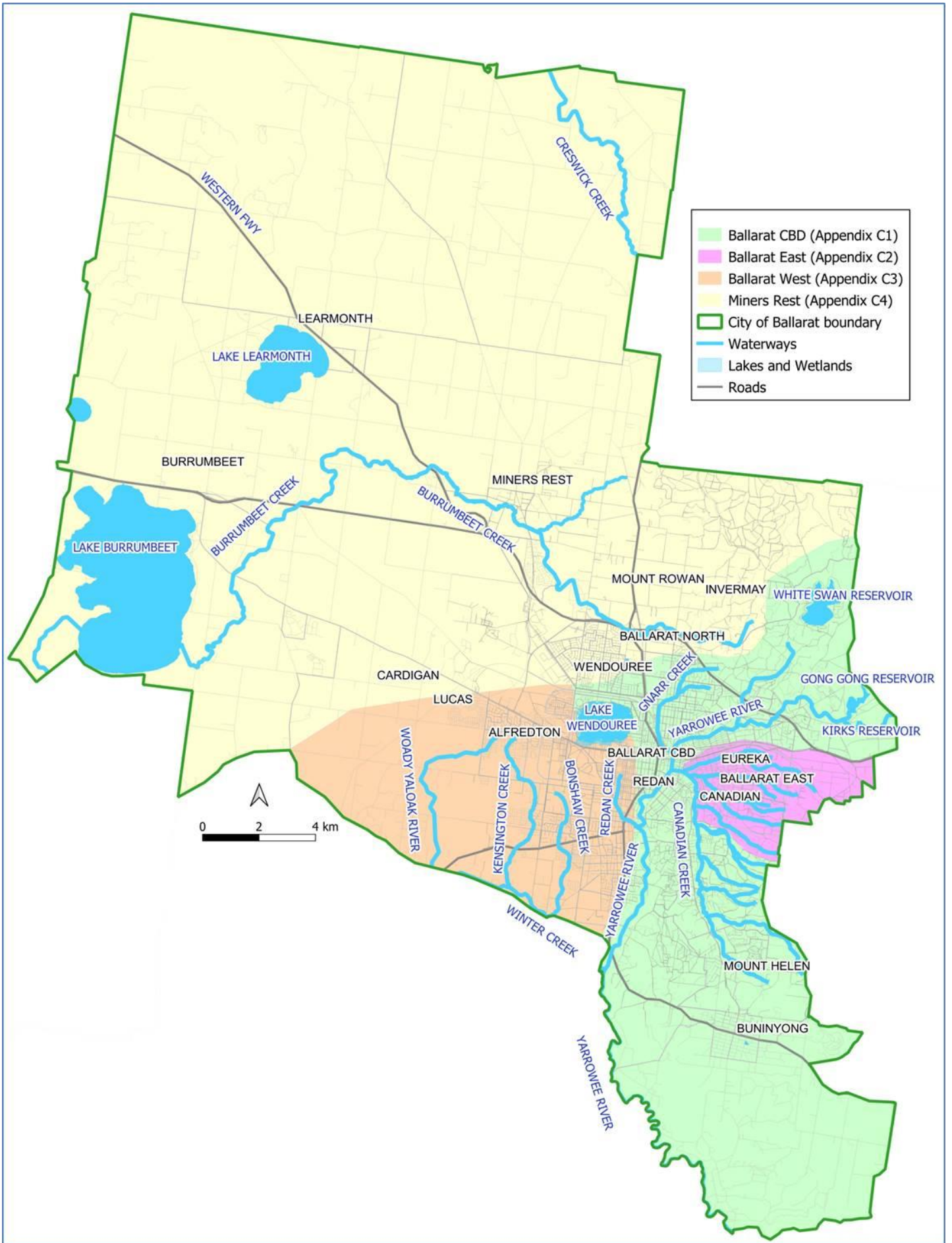
## 5.1 Stormwater and Riverine Flooding

City of Ballarat Council is subject to flash flooding, with large storm events resulting in many of the urban stormwater drainage systems and watercourses within the municipality exceeding their capacity and breaking out of bank. Flooding affects a large number of urban properties, many local and larger roads and, outside the main urban area of the City, rural areas along the watercourses.

The City of Ballarat has a long history of riverine flood events. Towns impacted by riverine flooding include; Miners Rest and Ballarat. Regions within Ballarat that are flood prone include Ballarat Central (CBD), Ballarat North, Mount Pleasant, Sebastopol, Eureka, Ballarat East, Canadian, Redan, Lucas and Miners Rest. Refer to the map below.

Flood events within the City of Ballarat have been infrequent over the last decade. The most recent flood event was recorded in 2017, refer to a list of significant flood events below.

Year	Description
Novemebr 2017	Severe flooding in the Ballarat CBD. Several buildings and cars were flooded in Albert Street between Dana and Grant Street. Also Mair Street and Davies Street were also impacted by flooding .
2012	Flooding in Alfredton, Delacombe, Wendouree and across the Ballarat CBD.
October 2011	Hailstorm and flooding in the CBD. The Bridge Mall and the Wendouree area was significantly impacted, largely businesses were impacted by above floor flooding.
September 2011	Flooding in the CBD near the Town Hall.
February 2011	Flooding in Miners Rest, Delacombe, Alfredton, Burrumbeet, Learmonth and the Ballarat CBD.
January 2011	Significant flooding in Miners Rest, Delacombe, Alfredton, Burrumbeet, Learmonth and across the urban sector of the Municipality.
September 2010	Flooding in the Burrumbeet Creek catchment, specifically in the Miners Rest area as well as the Winter Creek catchment, specifically in the vicinity of Bonshaw Creek, Delacombe.
December 1991	Flooding in Melbourne and Ballarat affecting 20,000 people, injuring 5 and rendering 200 homeless. Flooding in Ballarat was most severe in Gnarr Creek with the Lydiard Street area recorded the highest number of buildings impacted.
Febuary 1990	Flooding affected the CBD, Canadian Creek and its tributaries, among other areas of Ballarat.
April 1989	Hailstorm hit Ballarat causing \$24 million in damages.
December 1988	Flooding along Gnarr Creek, Canadian Creek, Redan Creek, Winter Creek and the Yarrowee River with significant inundation of the CBD. 358 buildings were flooded above floor level.
1971	Hailstorm event impacted Ballarat.
1933	Yarrowee River flooding caused extensive building damage in Ballarat East.
1869	Severe flooding in the Yarrowee River put most of the lower section of the city including Bridge and Grenville Streets underwater.



## 5.2 Major Waterways

The major waterways within the City of Ballarat are listed in the table below.

Waterway	Description
<p><b>Yarrowee River</b></p>	<p>The Yarrowee River catchment upstream of the Western Freeway is a mix of cleared and forested land. Several reservoirs including White Swan and Gong Gong are located in the catchment.</p> <p>Downstream of the Western Freeway, the Yarrowee River enters residential areas of Ballarat, and changes into a modified concrete/bluestone lined channel. From the Railway embankment, low flows in the Yarrowee River are conveyed via an underground conduit. The River is then open from south of Eastwood Street.</p> <p>During significant flood events, the capacity of the underground conduit is exceeded, and overland flows occur. The overland flows occur in the Ballarat CBD. South of the CBD the Canadian Creek inflows into the Yarrowee River.</p>
<p><b>Gnarr Creek</b></p>	<p>The headwaters of the Gnarr Creek are located north of the Western Freeway and are fed by the Devils Gully waterway which begins just north east of the Western Freeway.</p> <p>From Landsborough Street the branches of the Gnarr Creek have merged into one lined concrete/blue stone channel that conveys flows that pass under the railway embankment. Adjacent to Doveton Street, Gnarr Creek enters an underground pipe/culvert and joins the Yarrowee River adjacent to Mair Street. During significant flood events, the capacity of the underground pipe/culvert is exceeded, and overland flow occurs.</p>
<p><b>Canadian Creek</b></p>	<p>Canadian Creek rises adjacent to Mount Helen and flows in a northerly direction. The catchment has cleared and forested portions. From University Drive to York Street, Canadian Creek flows along a modified earthen channel with several on-line retarding basins. A lined channel (concrete/blue stone) has been constructed from York Street to the confluence with the Yarrowee River, adjacent to Anderson Street.</p> <p>Canadian Creek has several important tributaries which flow from east to west through the developed areas of Ballarat East, Eureka and Canadian. The tributaries are Specimen Vale Creek, Warrenheip Gully, Pennyweight Creek and Lal Lal Drain. Specimen Vale Creek is piped or lined</p> <p>(concrete/blue stone) downstream of Charlesworth Street while Warrenheip Gully is lined downstream of Joseph Street.</p>
<p><b>Burrumbeet Creek</b></p>	<p>Burrumbeet Creek rises in the hills to the northeast of Ballarat with many minor tributaries including some to the north and flows through Miners Rest and Windermere to terminate at Lake Burrumbeet. The Burrumbeet Creek catchment above Lake Burrumbeet is approximately 206 km<sup>2</sup> in size.</p> <p>Townships within the catchment include Invermay and Miners Rest as well as the smaller settlements of Mount Rowan, Burrumbeet and Learmonth. The northern suburbs of Ballarat are also within the catchment.</p> <p>The upper parts of the catchment, upstream of Invermay are relatively steep and flooding is relatively well confined to watercourse corridors. Downstream from Invermay the hydraulic grade reduces and flooding is more extensive as water overflows onto surrounding land and into the many shallow depressions and swampy areas within the catchment. Response to rain is generally slow until the catchment wets up. Response times are then short.</p> <p>Flooding in the Burrumbeet Creek catchment becomes reasonably widespread during severe events although high hazard areas are in the main limited to main flow channels and road crossings. Many roads are affected as floodwater rises. As flooding becomes more severe, many of these roads become impassable with some flooded to depth.</p>

## 5.3 Building Damages

Refer to the table below for property and building damages for flood events within the City of Ballarat Council. The table also provides an indication of when a Level 2 and 3 Incident Control Centre (ICC) will be required, based on the number of above floor damages.

Observed rainfall trigger (mm)	Average Recurrence Interval (ARI)	Total number of properties flooded (buildings flooded above floor)					Total damages for the City of Ballarat.
		Ballarat CBD (Appendix C1)	Ballarat East, Eureka, Canadian (Appendix C2)	West Ballarat, Sebastopol, Redan, Lucas, Delacombe (Appendix C3)	Miners Rest (Appendix C4)	Burrumbeet Creek Catchment (Appendix C4)	
-49 mm in 6 hours to -62 mm in 12 hours	5	3,750	196 (11)	677	(0)	83 (1)	4,706 (12)
-56 mm in 6 hours to -71 mm in 12 hours	10		252 (20)		(0)	100 (2)	(22)
-67 mm in 6 hours to -84 mm in 12 hours	20	5,338	329 (33)	1092	(0)	112 (3)	6,871 (36)
-82 mm in 6 hours to -103 mm in 12 hours	50		392 (52)		(14)	160 (18)	(70)
-94 mm in 6 hours to -118 mm in 12 hours	100	6,447 (262)	462 (54)	1664	(31)	178 (36)	8,751 (352)
-102 mm in 6 hours to -125 mm in 12 hours	200		518 (97)		(36)	187 (0)	

- Level 2 ICC
- Level 3 ICC

## 5.4 Dams and Lakes

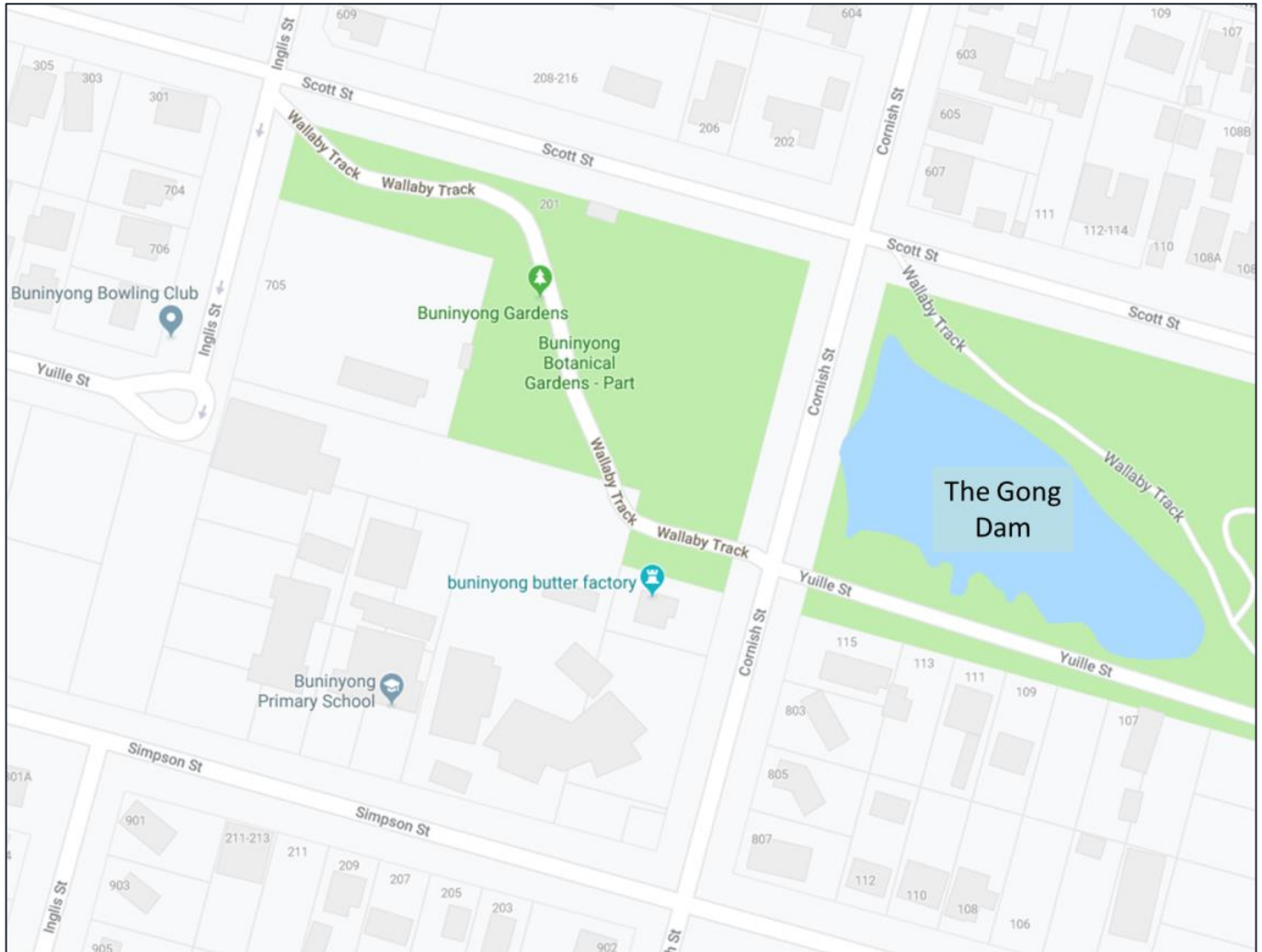
Significant dams or lakes within the City of Ballarat Council area are listed below.

Location	Owner	Full Supply level/volume	Comments
The Gong Dam, Buninyong	City of Ballarat Council	17.5 ML	Refer to the detailed description of flood impacts provided below.
White Swan Reservoir	Central Highlands Water	14,107 ML  Significant freeboard to absorb extreme flood events. This storage does not spill.	<b>Dam Safety</b> The dam embankments containing White Swan Reservoir have an extremely low probability of failure. However, in the unlikely event of failure the consequences may be Extreme. Further information regarding the risk and impacts from dam failure can be obtained from DELWP – Flood Zoom. <b>Impact on Natural Flooding</b> During natural flood events on the Yarrowee River (i.e. no dam failure), White Swan Reservoir will have very little influence on flooding downstream.
Kirks Reservoir	Central Highlands Water	398 ML Spillway designed to cater for extreme flood events.	<b>Dam Safety</b> Kirks Dam has an extremely low probability of failure. However, in the unlikely event of failure the consequences may be High. Further information regarding the risk and impacts from dam failure can be obtained from DELWP – Flood Zoom. <b>Impact on Natural Flooding</b> During natural flood events on the Yarrowee River (i.e. no dam failure) Kirks Reservoir will have very little influence on flooding downstream.
Gong Gong Reservoir	Central Highlands Water	1,909 ML Spillway designed to cater for extreme flood events.	<b>Dam Safety</b> Gong Gong Dam has an extremely low probability of failure. However, in the unlikely event of failure the consequences may be High. Further information regarding the risk and impacts from dam failure can be obtained from DELWP – Flood Zoom. <b>Impact on Natural Flooding</b> During natural flood events on the Yarrowee River (i.e. no dam failure) Gong Gong Reservoir will have very little influence on flooding downstream.
Lake Burrumbeet	DELWP	38,000 ML	The Lake has no influence on flooding other than a local backwater effect when the lake is full. When full this Lake may cause nascent flooding to adjacent properties.
Lake Learmonth	DELWP	7,500 ML	When full this Lake may cause nascent flooding to adjacent properties. When the Lake is full, overflows are released into lower Burrumbeet Creek.



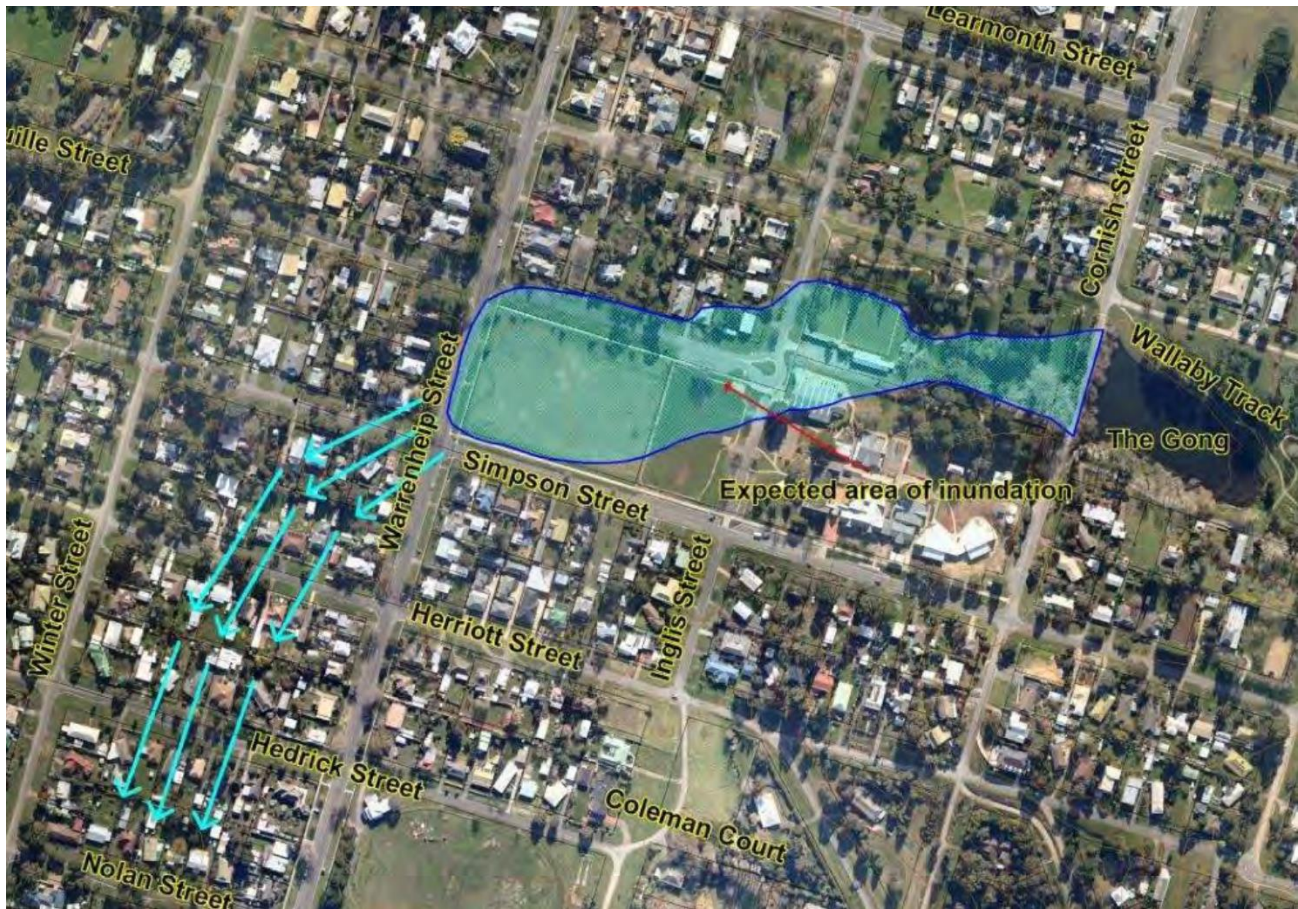
## The Gong Dam, Buninyong

The Gong Dam full supply level is estimated to be 17.5ML (City of Ballarat 2016), constructed in the 1860's to supply water to the Buninyong Brewery. The Buninyong community strongly support the preservation of The Gong Dam for its historic and aesthetic values. It contains a steep upstream catchment that consists of natural springs, a waterway and local drainage infrastructure. An earthen embankment was constructed across the waterway currently forms The Gong Dam, as well as Cornish Street roadway. There is a small 450mm diameter pipe that acts as the main spillway for the dam and is considered to be undersized for the 100 year ARI flood event.



Location of The Gong Dam.

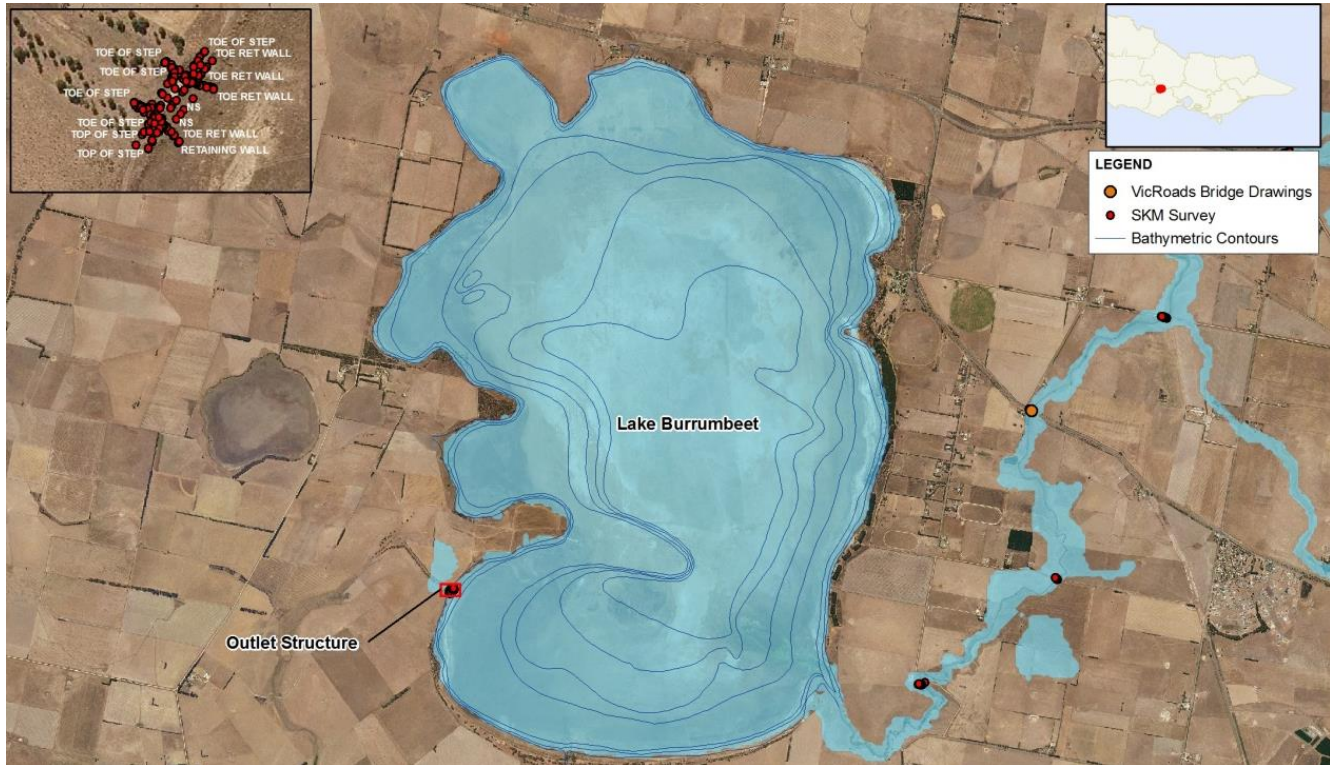
The Gong Dam has the potential to breach the dam wall, this will result in inundation of the Buninyong Botanical Gardens, Buninyong Bowling Club and fast moving floodwater through the drop off area and entrance of the Buninyong Primary School in Yuille Street. Properties in Yuille Street and Inglis Street are likely to experience inundation. Refer to the map below of The Gong Dam approximate flood impact area.



The Gong Dam approximate flood impact area (City of Ballarat 2016).

## Lake Burrumbeet

When Lake Burrumbeet is full water can be diverted into Baillie Creek via an outlet structure, refer to the map below for the location of the structure. For further details refer to the Burrumbeet Creek Flood Investigation (Water Technology 2013).



## Lake Learmonth

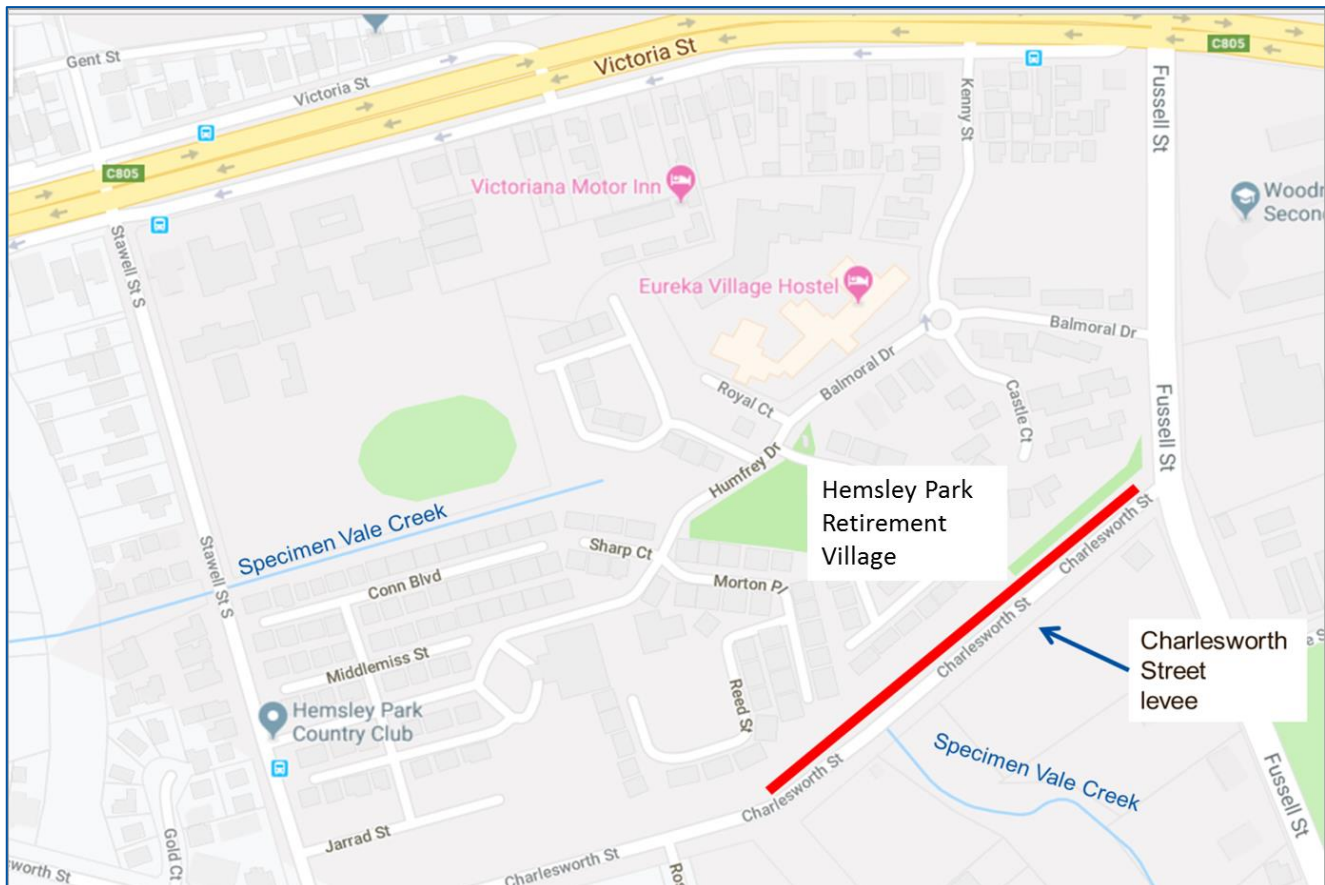
When Lake Learmonth is full water can be diverted into lower Burrumbeet Creek via an outlet structure in accordance with the Lakes operational guidelines (Lawson and Treloar 2003). Refer to the map below for the location of the structure. For further details refer to the Burrumbeet Creek Flood Investigation (Water Technology 2013).



## 5.9 Retarding Basin

A large earthen embankment has been constructed along Charlesworth Street, Eureka. The Charlesworth Street embankment has been deemed a retarding basin due to the embankment slowing the flow of water along Specimen Vale Creek while still allowing low flows through the outlet. The embankment provides protection to the Hemsley Park Retirement Village up to a 100 year ARI flood event (Water Technology 2014), refer to the location map and levee photo below.

The Specimen Vale Creek transitions from an open waterway to an underground piped system at Charlesworth Street. It then flows under the Hemsley Park Retirement Village and forms an open channel again in Stawell Street.



Charlesworth Street embankment.

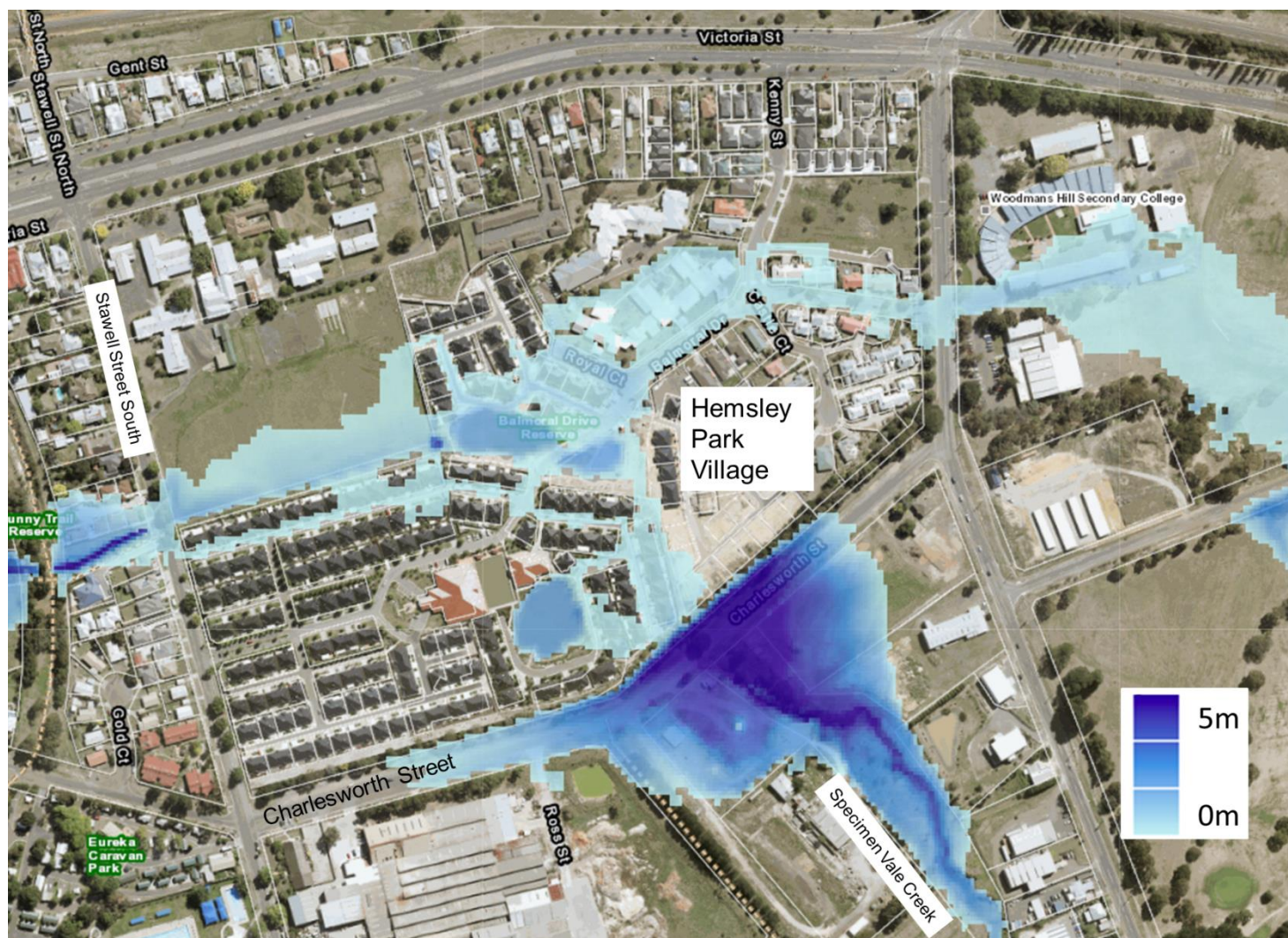


Flooding west of Stawell Street (Specimen Vale Street), downstream of the Hemsley Park Retirement Village, during the 1991 flood event (City of Ballarat 2016).



Flooding east of Stawell Street (Specimen Vale Street), downstream of the Hemsley Park Retirement Village, during the 1991 flood event (City of Ballarat 2016).

Flood modelling (Water Technology 2014) completed along Specimen Vale Creek established that this earthen embankment plays a critical role in flood retention for Specimen Vale Creek. During the 100 year flood event 55ML of floodwater will be retained by this embankment, refer to map below.

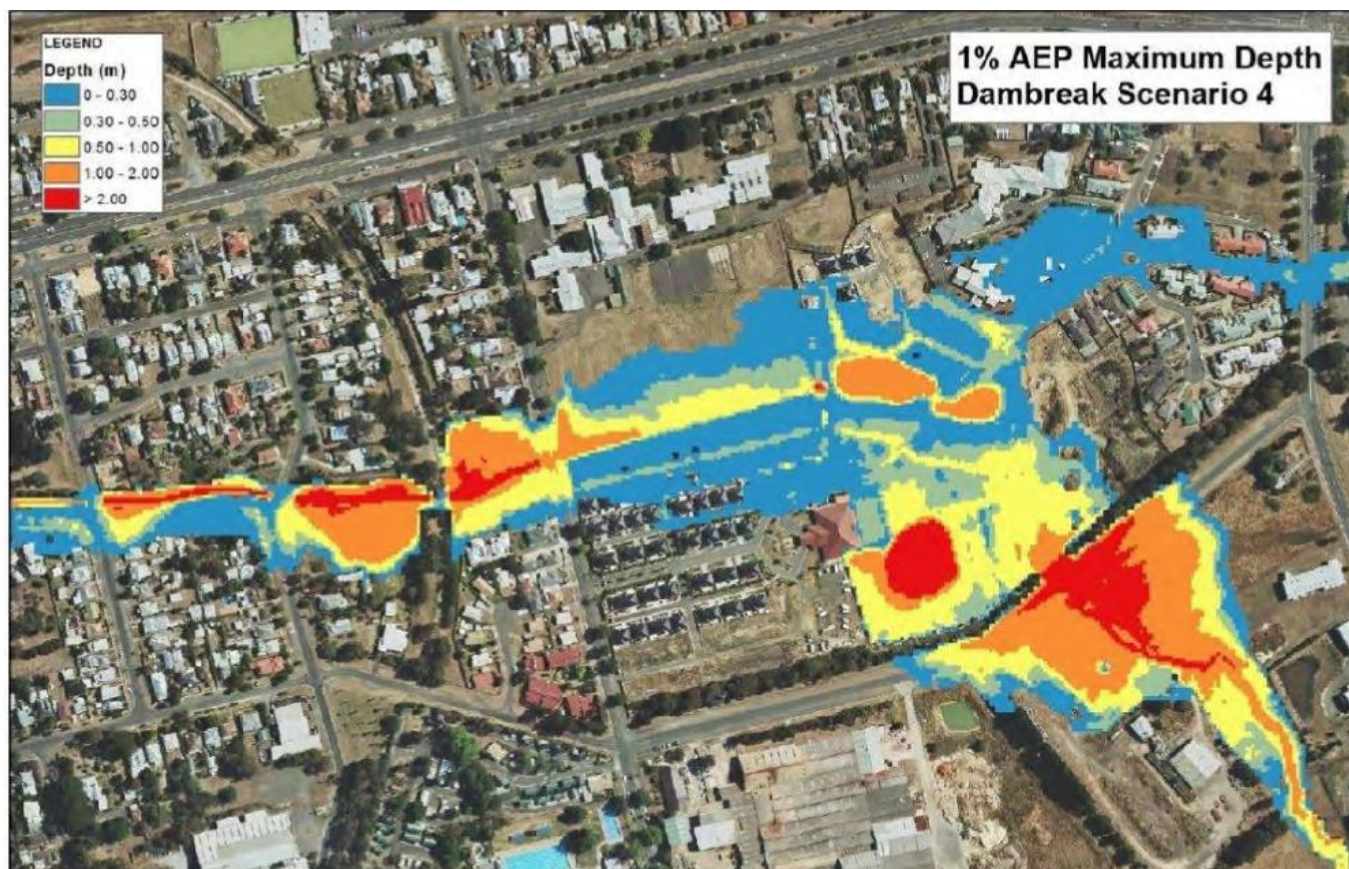


Hemsley Park Village, Charlesworth Street, Eureka 100 year ARI flood extent (Water Technology 2014).

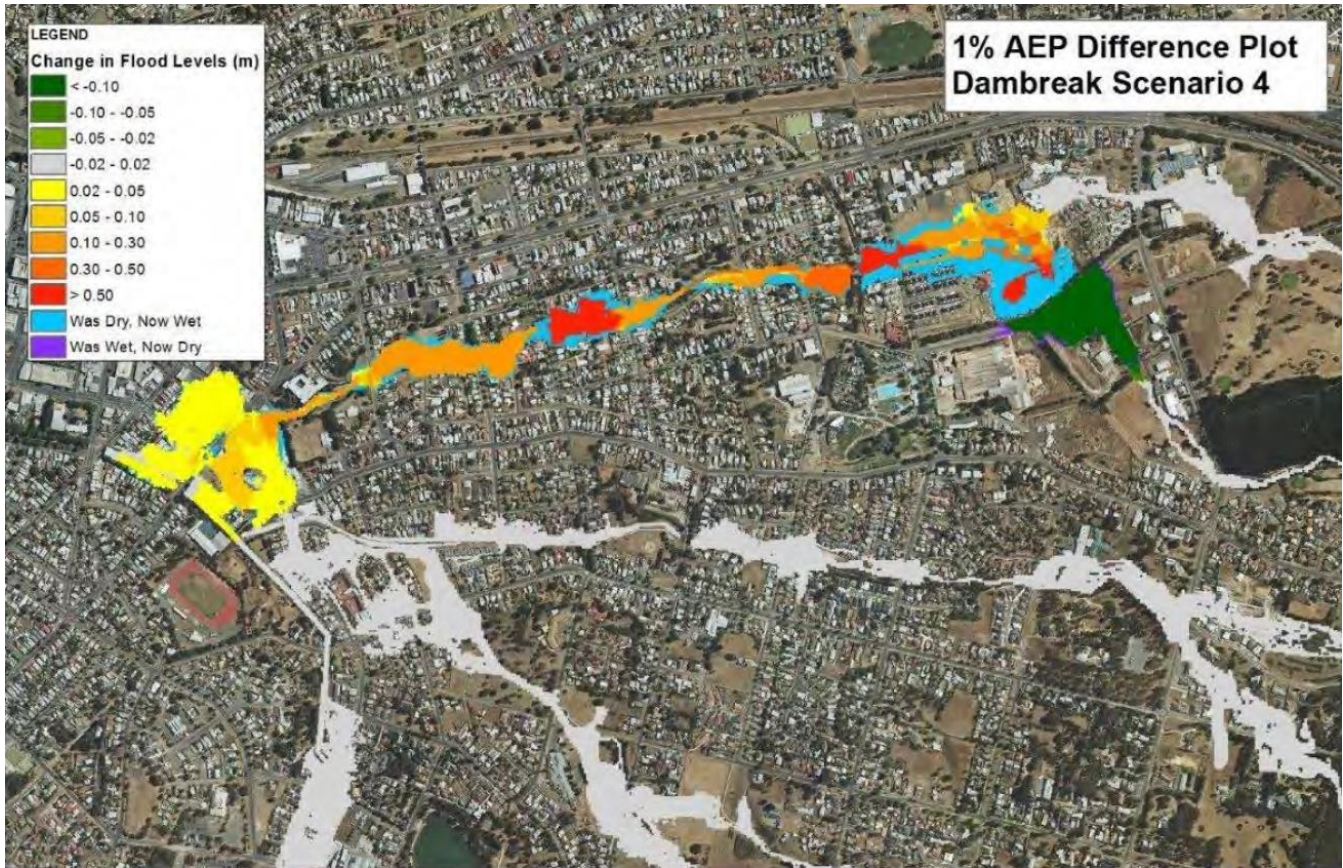
Specimen Vale Creek flows through a 2100mm diameter concrete culverts, situated below the Charlesworth Street and then proceeds to flow along the underground drainage network towards Stawell Street. The underground section of the drainage network is undersized for a 100 year ARI flood event, and overflow is restricted because of the existing Charlesworth Street embankment.

During the September 2016 flood event and previous events, the Charlesworth Street inlet became heavily blocked, significantly reducing the amount of floodwater that passed through the drainage system, increasing the upstream flood water level retained by the Charlesworth Street embankment. The Charlesworth Street culvert is also prone to blockage during high flows in Specimen Vale Creek.

Extreme floods, greater than a 100 year ARI flood event are estimated to overtop the Charlesworth Street levee and flow into Hemsley Park Retirement Village. Flood consequences for the Hemsley Park Village and downstream impacts were modelled for the scenario of the Charlesworth Street embankment failure during a 100 year ARI flood event, refer to the flood maps below. The number properties flooded along Specimen Vale Creek increased from 96 to 174, while the number of buildings flooded above floor increased from 28 to 108.



Consequence of failure of the Charlesworth Street embankment during a 100 year ARI flood event (City of Ballarat 2016).



Downstream consequence of the Charlesworth Street embankment failure during a 100 year ARI flood event (City of Ballarat 2016).



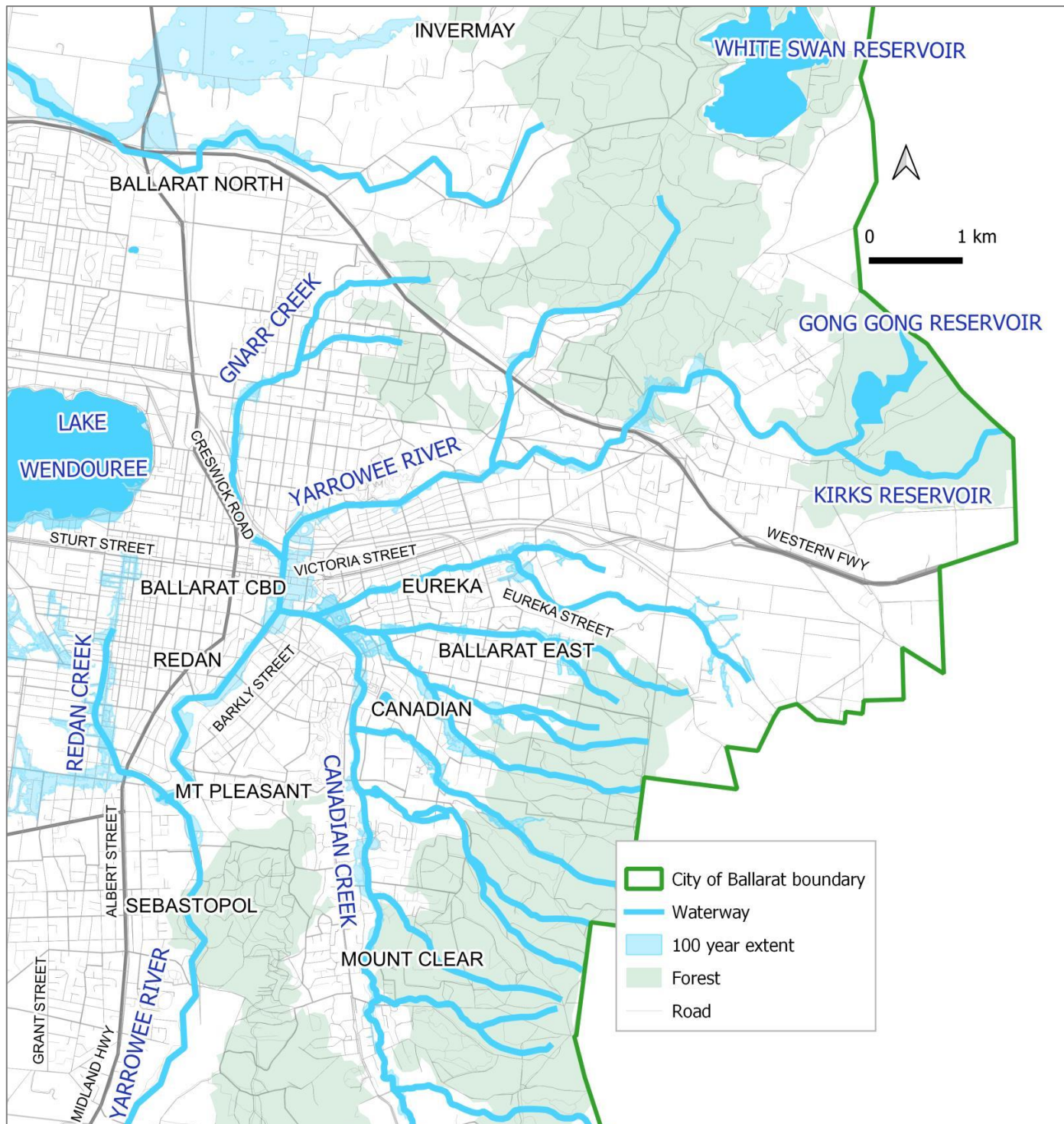
## Appendix B: Typical flood peak travel times

Source (Mid West Catchment Flood Intelligence Summary)

Location From	Location To	Typical Travel Time	Comments	Duration
<b>Miners Rest (Burrumbeet Creek)</b>				
Start of rainfall (upper catchment)	Miners Rest	1.5 - 6 hours	Begin to rise from normal levels	24 - 26 hours
Start of rainfall (upper catchment)	Miners Rest	2.5 - 10 hours	To peak	
<b>Ballarat West (Kensington Creek, Winter Creek, Redan Creek)</b>				
Start of rainfall (upper catchment)	Ballarat West	1.5 - 6 hours	Begin to rise from normal levels	9 - 12 hours
Start of rainfall (upper catchment)	Ballarat West	2.5 - 10 hours	to peak	
<b>Ballarat East (Canadian Creek tributaries)</b>				
Start of rainfall (upper catchment)	Ballarat East	3 - 6 hours	Begin to rise from normal levels	0.5 - 1 day
Start of rainfall (upper catchment)	Ballarat East	4 - 6 hours	To peak	
<b>Central Ballarat (Yarrowee River, Gnarr Creek, Canadian Creek)</b>				
Start of rainfall (upper catchment)	Central Ballarat	4 - 6 hours	Begin to rise from normal levels	9 - 12 hours
Start of rainfall (upper catchment)	Central Ballarat	8 - 12 hours	to peak	

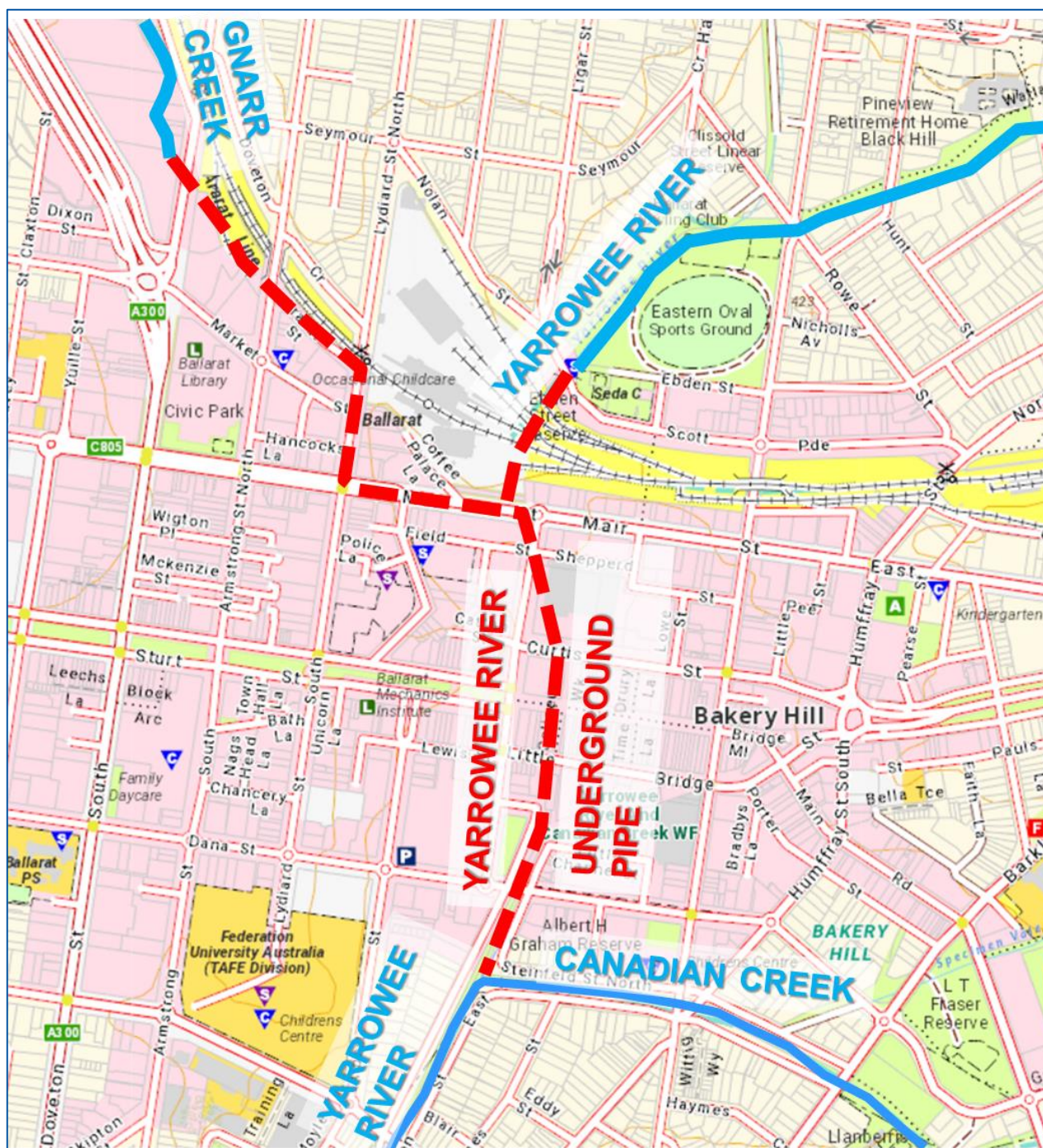
# Appendix C1: Central Ballarat, Ballarat North, Mount Pleasant, Sebastopol (Yarrowee River, Gnarr Creek, Canadian Creek) Flood Emergency Plan

This area encompasses the Ballarat Central Business District (CBD), which is heavily urbanised. Three main waterways that contribute to flooding in the Ballarat CBD include Gnarr Creek, Yarrowee River and Canadian Creek.

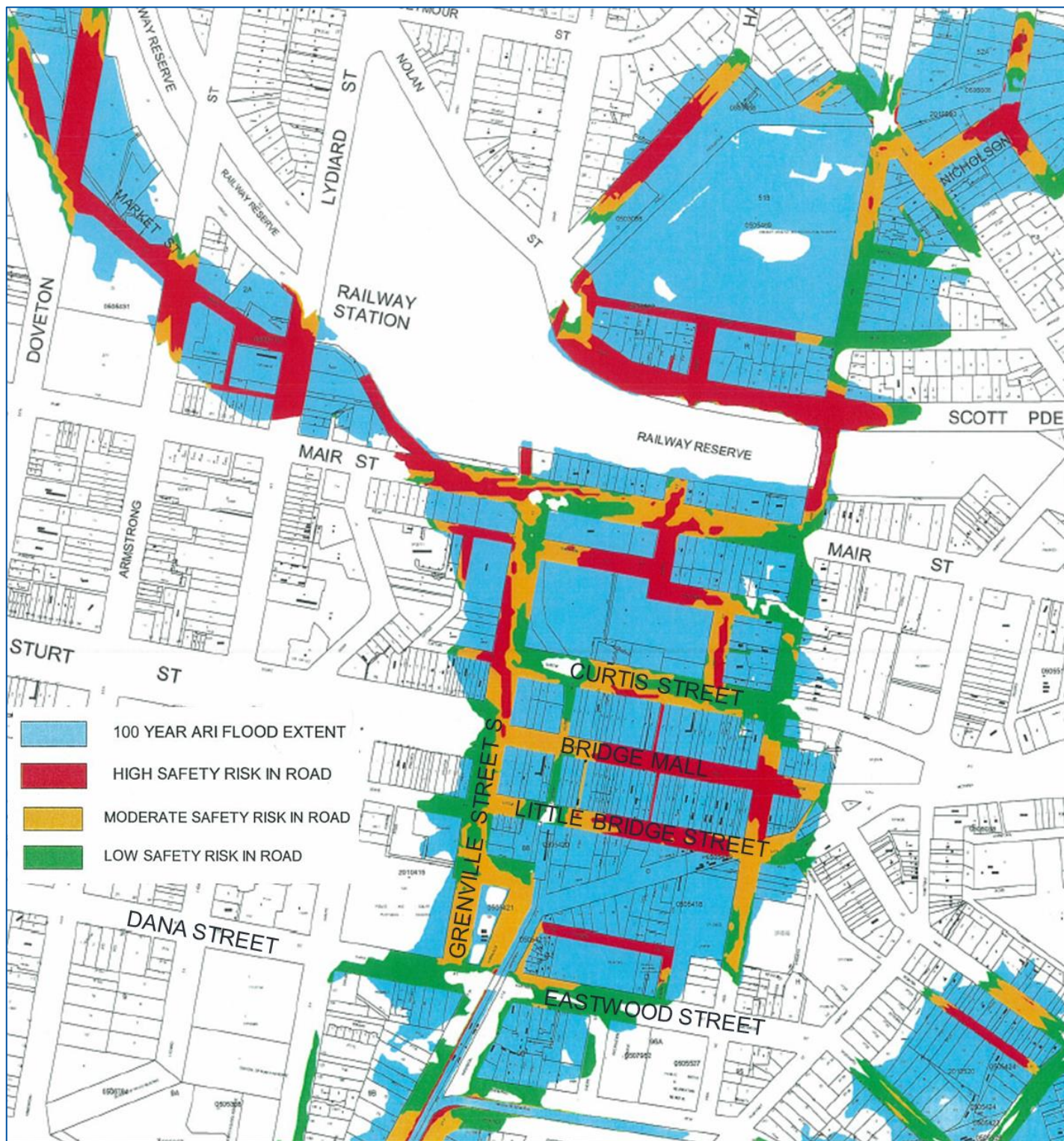


The riverine network is known to frequently cause flooding in the Ballarat CBD. During significant flood events, the capacity of pipes that convey the Yarrowee River and Gnarr Creek flows is exceeded, causing overland flow in the Ballarat CBD. The Yarrowee River headwaters begin to the north of the Western Freeway draining the Ditchfield Bushland Reserve. From the railway to Eastwood Street the Yarrowee River is conveyed via an underground pipe. Gnarr Creek also enters an underground pipe near Doveton Street, where it joins the Yarrowee River underground pipe beneath the Ballarat CBD. Refer to the map below showing the approximate location of underground waterway pipes shown in red.

During a 100 year flood over 262 buildings are flooded above floor, of these 70 are in the Bridge Mall. Within the Central Ballarat area, buildings in the Bridge Mall are the first to be flooded above floor.



During significant flood events, not only do these waterways cause widespread damage to infrastructure and businesses, high floodwater velocities present significant risk to life of pedestrians and motorists. Significant flood hazards exist at pedestrian accessways in Davies Street, Mair Street, Lydiard Street, Doveton Street and the Bridge Mall. Refer to the map below showing roads with high risk to safety as a result of high velocity flood flows during a 100 year flood event.



## Historic Flood Events

The Ballarat CBD is heavily flood prone which has experienced frequent flood events, causing extensive flood damage. The Gnarr Creek caused extensive damage to the Ballarat CBD when 76mm of rainfall occurred in less than two hours in December 1991 (City of Ballarat 2016). This caused considerable damage to critical infrastructure and a significant number of businesses. It has been reported that floodwaters in the Bridge Mall were approximately one metre in depth. Refer to photos below that demonstrate hazardous flash flooding that occur along major roads and accessways within the Ballarat CBD.

The Insurance Council of Australia has estimated that the damage from the 1991 flood along Gnarr Creek cost \$24 million, and the 2011 Ballarat CBD flood cost is estimated to be \$90 million (City of Ballarat 2016).



Flooding along Coffee Palace Lane from Gnarr Creek during the 1991 flood event (City of Ballarat 2016).



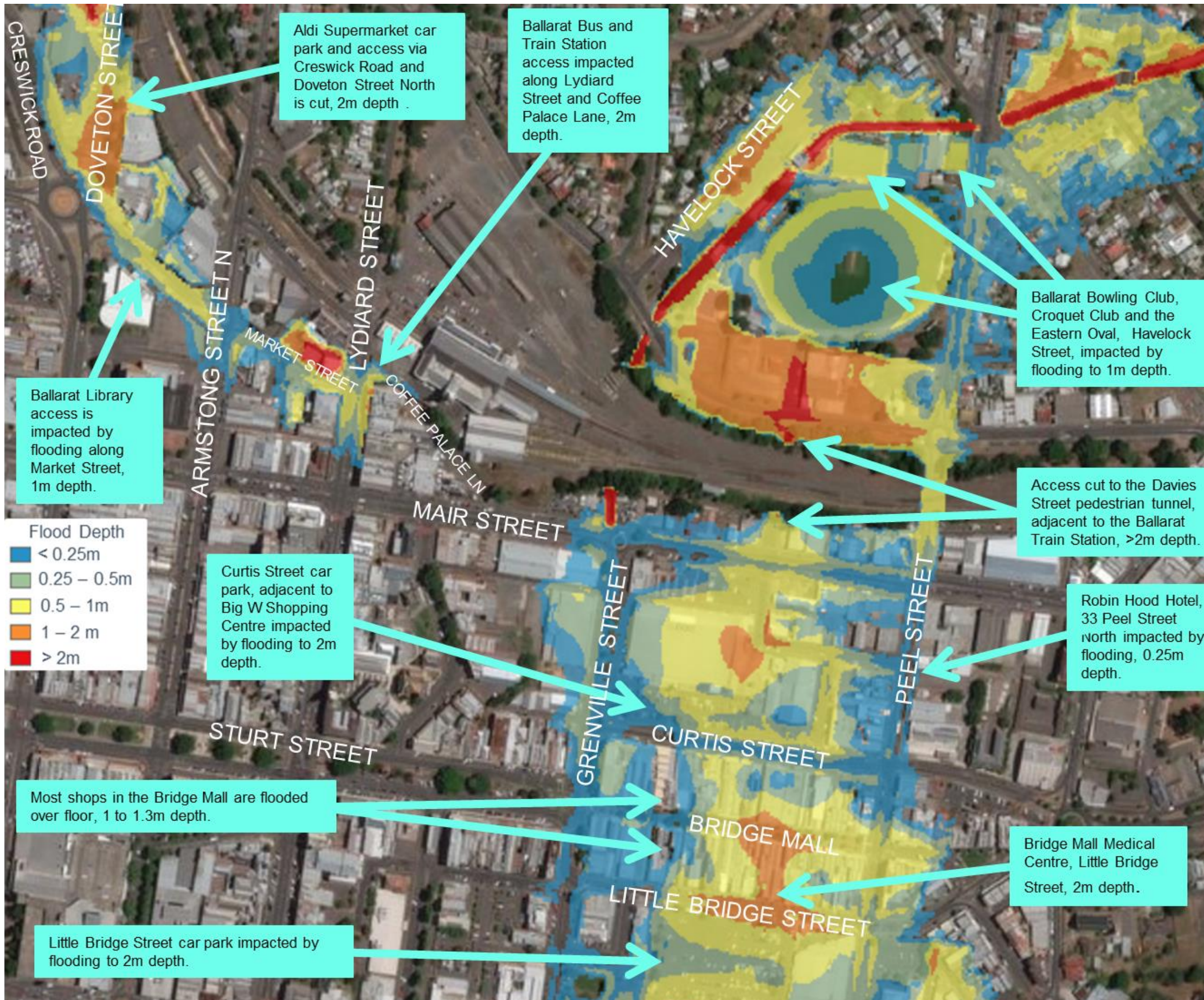
Flooding along Davies Street pedestrian culverts from Yarrowee River during the 1991 flood event (City of Ballarat 2016).

## Flood Impacts and Actions Required

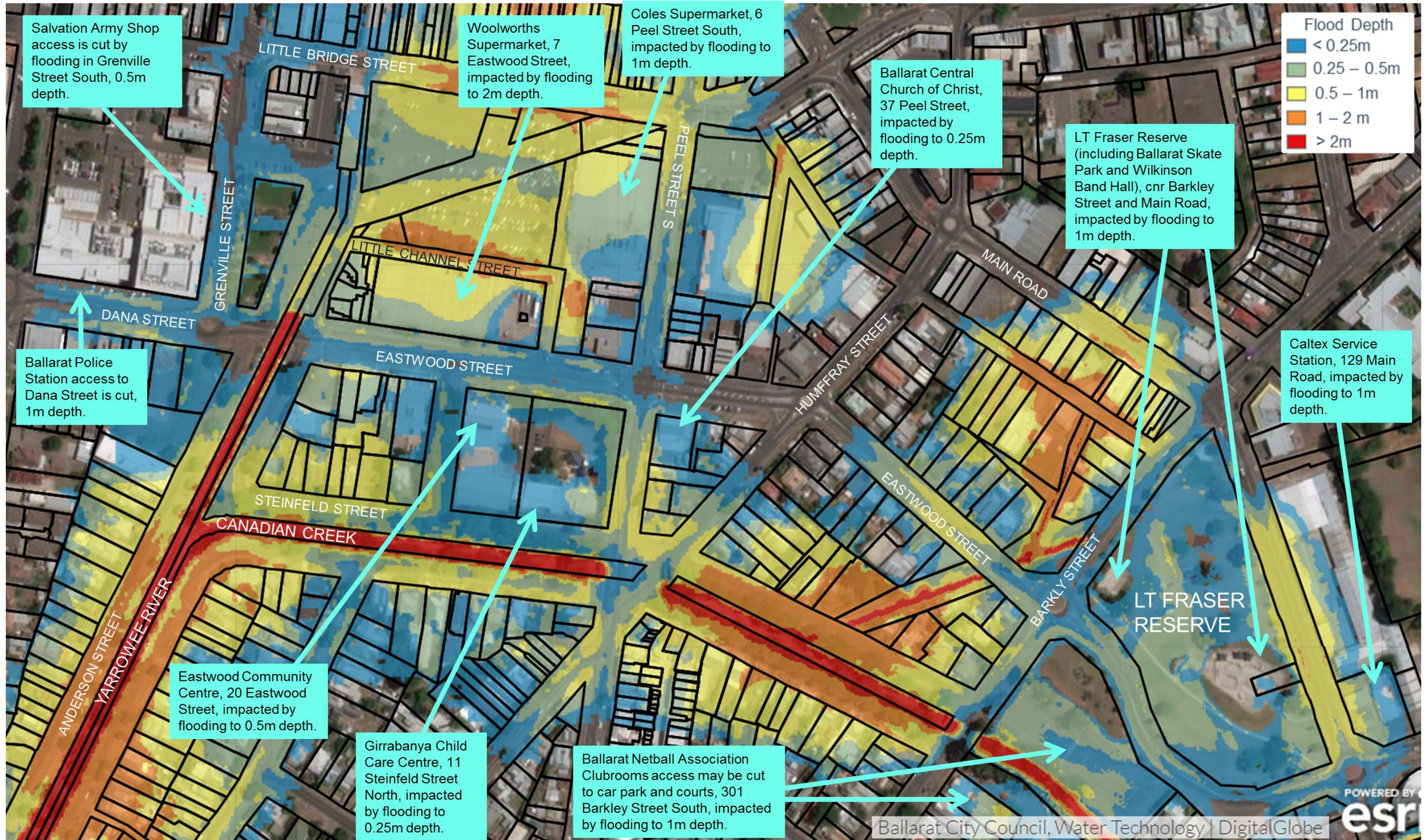
Key assets at risk of flooding in Central Ballarat are listed in the table below.

Asset register				
Asset Name and location	Average Recurrence Interval (ARI)	Consequence / Impact	Mitigation/ Action	Lead Agency
70 buildings in the Bridge Mall are flooded above floor, refer to Intelligence card and damages map for locations.	100 year flood	Buildings are flooded above floor. Access/egress may be cut by flooding (flood depth may be 0.2m or greater)	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
Eastwood Community Centre, 20 Eastwood Street, Ballarat Central.	100 year flood	Eastwood Community Centre may be flooded above floor by 0.5m or greater.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Coles Supermarket, 6 Peel Street South, Ballarat Central.	100 year flood	Coles Supermarket may be flooded above floor by 1m or greater.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Woolworths Supermarket, 7 Eastwood Street, Ballarat Central.	100 year flood	Woolworths Supermarket may be flooded above floor by 2m or greater.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Girrabanya Child Care Centre, 11 Steinfeld Street North, Ballarat Central.	100 year flood	Girrabanya Child Care Centre may be flooded above floor by 0.25m or greater.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Caltex Service Station, 129 Main Road, Ballarat Central.	100 year flood	Caltex Service Station may be flooded above floor by 1m or greater.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Robin Hood Hotel, 33 Peel Street North, Ballarat Central.	100 year flood	Robin Hood Hotel may be flooded above floor by 0.25m or greater.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Bridge Mall Medical Centre, Little Bridge Street, Ballarat Central.	100 year flood	Bridge Mall Medical Centre may be flooded above floor by 2m depth or greater.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Access to the Ballarat Bus and Train Station may be impacted by flooding along Lydiard Street and Coffee Palace Lane.	100 year flood	Access to the Ballarat Bus and Train Station may be impacted by flooding along Lydiard Street and Coffee Palace Lane 2m depth.	Deploy road closure signs as needed. Undertake evacuations as needed.	City of Ballarat Council Victoria Police
Davies Street pedestrian tunnel, adjacent to the Ballarat Train Station, >2m depth.	100 year flood	Davies Street pedestrian tunnel may be impacted by flooding 2m depth.	Deploy road closure signs as needed.	City of Ballarat Council
Aldi Supermarket car park and access to Creswick Road and Doveton Street North.	100 year flood	Aldi Supermarket car park and access to Creswick Road and Doveton Street North may be flooded by 2m or greater.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police

For more detailed information regarding buildings and roads impacted refer to the Ballarat Central Flood Intelligence Card and flood impact maps below. Also refer to the Ballarat Central flood depth maps in **Appendix F**, a list of flood observers in **Appendix H** and community sandbag collection points in **Appendix I**.



Ballarat CBD flood impacts during a 100 year ARI flood event.



Ballarat Central (south of Little Bridge Street) flood impacts during a 100 year ARI flood event.



## Central Ballarat Flood Intelligence Card

Flood travel time							Time from start of rain to steep rise in floodwater 4 - 6 hours
							Time from start rainfall to flood peak 8 - 12 hours
							Riverine flooding duration: 9 - 12 hours
Observed rainfall (mm)	Average Recurrence Interval (ARI) (Water Tech 2017)	Yarrowee and Gnarr Creek Catchment damages total number buildings flooded (above floor)	Consequence / Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action Actions may include (but not limited to) Evacuation, closure of road, sandbagging, issue warning and who is responsible	
~49 mm in 6 hours to ~62 mm in 12 hours	5	3,750	Most flows in Gnarr Creek, Canadian Creek and the Yarrowee River are in channel, with minor break outs at Havelock Street and Anderson Street.		Doveton Street North depth 0m Lydiard Street depth 0m Mair Street depth 0m Bridge Mall depth 0m Havelock Street depth 0.25m Anderson Street depth 0.25m	VICSES activate CFA ground observers to take photos and record flood levels at key crossings. Council and Regional Roads Victoria to deploy road closure signs and undertake traffic management as needed. VICSES sandbag buildings as needed. Victoria Police evacuate buildings as needed. Council clear debris from waterway crossings, drains and culvers as needed.	
~56 mm in 6 hours to ~71 mm in 12 hours	10	-	More extensive flooding in Havelock Street and Anderson Street impacting the Ballarat Bowling Club and the Ballarat Croquet Club adjacent to the Eastern Oval. Minor flooding in Steinfeld Street North.		Doveton Street North depth 0m Lydiard Street depth 0m Mair Street depth 0m Bridge Mall depth 0m Havelock Street depth 0.30m Anderson Street depth 0.28m	Refer to actions listed above.	
~67 mm in 6 hours to ~84 mm in 12 hours	20	5,338	Extensive flooding in the Bridge Mall and surrounding streets. Further inundation impacting the Peel Street North underpass. Further properties impacted on Peel, Bridge, Anderson and Steinfeld Streets. Possible closure of Dana Street.	Shallow flooding depth 0.25m in Dana Street, adjacent to the Ballarat Police Station.	Doveton Street North depth 0.45m Lydiard Street depth 0.4m Mair Street depth 0.35m Bridge Mall depth 0.45m Havelock Street depth 0.85m Anderson Street depth 0.95m	Refer to actions listed above.	
~82 mm in 6 hours to ~103 mm in 12 hours	50	-	More extensive flooding in Lydiard Street. Additional inundation through the CBD impacting properties in Mair Street. Possible road closure of Havelock Street.		Doveton Street North depth 1.25m Lydiard Street depth 0.82m Mair Street depth 0.75m Bridge Mall depth 1.35m Havelock Street depth 1.25m Anderson Street depth 1.28m	Refer to actions listed above.	
~94 mm in 6 hours to ~118 mm in 12 hours	100	6,447 (262)	Significant flooding between the Western Freeway and CBD with a number of breakouts near the Eastern Oval impacting properties on Scott St, Ebden St, Havelock St North, Peel St North, Rowe St and Nicholson St (U/S of CBD), Anderson St East and West, Albert St and James St, Humffray and Gladstone Streets (D/S of CBD). Possible closure of Creswick Road.	Ballarat Police Station access to Dana Street is cut, 1m depth. Most shops in the Bridge Mall are flooded over floor, 1 to 1.3m depth. Ballarat Bus and Train Station access impacted along Lydiard Street and Coffee Palace Lane, 2m depth. Davies Street pedestrian tunnel, adjacent to the Ballarat Train Station, >2m depth. Ballarat Library access is impacted in Market Street, depth 1m Aldi Supermarket car park and access to Creswick Road and Doveton Street North impacted, 2m depth. Ballarat Bowling Club (Havelock Street) 1m depth. Ballarat Croquet Club (Havelock Street) 1m depth. Eastern Oval (Havelock Street) 1m depth. Salvation Army Shop access is cut in Grenville Street South, 0.5m depth. Little Bridge Street car park flood depth 2m Curtis Street car park, adjacent to Big W Shopping Centre flood 2m depth. Robin Hood Hotel, 33 Peel Street North, 0.25m depth. Ballarat Central Church of Christ, 37 Peel Street, 250m depth. Eastwood Community Centre, 20 Eastwood Street, 0.5m depth. Public Toilets, Little Bridge Street, 2m depth. Coles Supermarket, 6 Peel Street South, 1m depth. Woolworths Supermarket, 7 Eastwood Street, 2m depth. Caltex Service Station, 129 Main Road, 1m depth. Ballarat Netball Association Clubrooms access may be cut to car park and courts, 301 Barkley Street South, 1m depth. LT Fraser Reserve (including Ballarat Skate Park and Wilkinson Band Hall), cnr Barkley Street and Main Road, 1m depth. Bridge Mall Medical Centre, Little Bridge Street, 2m depth. Girrabanya Child Care Centre, 11 Steinfeld Street North, 0.25m depth.	Doveton Street North depth 2m Lydiard Street depth 1m Mair Street depth 1m Bridge Mall depth 2m Havelock Street depth 2m Anderson Street depth >2m Main Road depth 1m	Refer to actions listed above.	

				<b>Number of buildings flooded above floor:</b> X70 BRIDGE MALL, X42 MAIN ROAD, X33 HUMFFRAY STREET SOUTH, x18 ANDERSON STREET WEST, X16 EASTWOOD STREET, x12 ROWE STREET, X7 STEINFELD STREET NORTH, X7 NICHOLSON STREET, X6 SCOTT PARADE, X5 PORTER STREET, X5 EUREKA STREET, X4 DANA STREET, X3 CLYDE STREET, X3 BARKLY STREET, X2 DOVETON STREET NORTH, X2 DAVIES STREET, X2 DAVIES STREET, X2 HUNT STREET, 1A NORWICH PLAZA, X1 WAINWRIGHT STREET		
37mm	18 November 2017	-	Sheppard Street store was also among the businesses hit hard by the flash flooding which submerged much of Mair and Davies streets. Cars parked in Albert Street Ballarat, between Dana and Grant streets, had water lapping half way up their doors and shops around Curtis and Eastwood Streets reported flooding. Ballarat SES were also contacted about flooded garages and fallen tree branches when winds hit with the storm. VICSES had 15 requests for assistance.			
31 mm	October 2011	-	Businesses in Mair Street and the Bridge Mall affected by flash flooding			
76mm in 2 hours on a wet catchment	December 1991	-	The largest flood event on record in Gnarr Creek, with Lydiard Street and Bridge Mall areas most severely affected.			
100mm over 3 days	February 1990	-	Flooding impacted the CBD.			

## Central Ballarat Property Inundation Table (Water Technology 2015)

Buildings subject to above floor flooding during a 100 year ARI flood event for the Ballarat CBD are provided below.

ID	Address	Depth of known building over-floor flooding for each ARI event (m)					Building type and comments
		10	20	50	100	200	
1	8 BRIDGE MALL				1.34		
2	10 BRIDGE MALL				1.26		
3	12-14 BRIDGE MALL				1.23		
4	17 BRIDGE MALL				1.18		
5	1A NORWICH PLAZA				1.18		
6	17 BRIDGE MALL				1.16		
7	17 BRIDGE MALL				1.16		
8	17 BRIDGE MALL				1.15		
9	25 BRIDGE MALL				1.14		
10	25 BRIDGE MALL				1.05		
11	27 BRIDGE MALL				1.03		
12	31 BRIDGE MALL				1.02		
13	29 BRIDGE MALL				1.02		
14	BRIDGE MALL				1.01		
15	42 BRIDGE MALL				1		
16	16 BRIDGE MALL				1		
17	22 BRIDGE MALL				0.98		
18	28 BRIDGE MALL				0.96		
19	26 BRIDGE MALL				0.96		
20	43 BRIDGE MALL				0.94		
21	35 BRIDGE MALL				0.94		
22	34 BRIDGE MALL				0.94		
23	32 BRIDGE MALL				0.94		
24	30 BRIDGE MALL				0.94		
25	45 BRIDGE MALL				0.92		
26	38-40 BRIDGE MALL				0.91		
27	38-40 BRIDGE MALL				0.91		
28	46 BRIDGE MALL				0.9		
29	42 BRIDGE MALL				0.9		
30	58 BRIDGE MALL				0.89		
31	54 BRIDGE MALL				0.89		
32	46 BRIDGE MALL				0.89		
33	60 BRIDGE MALL				0.86		
34	68-70 BRIDGE MALL				0.84		
35	66 BRIDGE MALL				0.84		
36	64 BRIDGE MALL				0.84		
37	62 BRIDGE MALL				0.84		
38	74 BRIDGE MALL				0.83		
39	47 BRIDGE MALL				0.82		

ID	Address	Depth of known building over-floor flooding for each ARI event (m)					Building type and comments
		10	20	50	100	200	
40	53 BRIDGE MALL				0.8		
41	53 BRIDGE MALL				0.79		
42	63 BRIDGE MALL				0.78		
43	59 BRIDGE MALL				0.78		
44	57 BRIDGE MALL				0.78		
45	78 BRIDGE MALL				0.77		
46	76 BRIDGE MALL				0.77		
47	63 BRIDGE MALL				0.77		
48	82 BRIDGE MALL				0.76		
49	80 BRIDGE MALL				0.76		
50	84 BRIDGE MALL				0.75		
51	86 BRIDGE MALL				0.72		
52	88 BRIDGE MALL				0.71		
53	71 BRIDGE MALL				0.7		
54	73 BRIDGE MALL				0.69		
55	90 BRIDGE MALL				0.68		
56	79-81 BRIDGE MALL				0.68		
57	77 BRIDGE MALL				0.68		
58	75 BRIDGE MALL				0.68		
59	83 BRIDGE MALL				0.67		
60	85 BRIDGE MALL				0.66		
61	98 BRIDGE MALL				0.65		
62	BRIDGE MALL				0.65		
63	104 BRIDGE MALL				0.64		
64	104 BRIDGE MALL				0.64		
65	100 BRIDGE MALL				0.64		
66	85 BRIDGE MALL				0.63		
67	87 BRIDGE MALL				0.62		
68	613 MAIN ROAD				0.6		
69	99 BRIDGE MALL				0.6		
70	93 BRIDGE MALL				0.6		
71	89 BRIDGE MALL				0.6		
72	4/603 MAIN ROAD				0.59		
73	9/603 MAIN ROAD				0.59		
74	613 MAIN ROAD				0.59		
75	613 MAIN ROAD				0.59		
76	523 MAIN ROAD				0.58		
77	1/808 HUMFFRAY STREET SOUTH				0.57		
78	812 HUMFFRAY STREET SOUTH				0.57		
79	728 HUMFFRAY STREET SOUTH				0.56		
80	730 HUMFFRAY STREET SOUTH				0.56		
81	732 HUMFFRAY STREET SOUTH				0.56		
82	802-804 HUMFFRAY STREET S				0.56		

ID	Address	Depth of known building over-floor flooding for each ARI event (m)					Building type and comments
		10	20	50	100	200	
83	806 HUMFFRAY STREET SOUTH				0.56		
84	722 HUMFFRAY STREET SOUTH				0.55		
85	724 HUMFFRAY STREET SOUTH				0.55		
86	640 HUMFFRAY STREET SOUTH				0.54		
87	640 HUMFFRAY STREET SOUTH				0.54		
88	718 HUMFFRAY STREET SOUTH				0.54		
89	716 HUMFFRAY STREET SOUTH				0.54		
90	720 HUMFFRAY STREET SOUTH				0.54		
91	640 HUMFFRAY STREET SOUTH				0.53		
92	701 HUMFFRAY STREET SOUTH				0.52		
93	640 HUMFFRAY STREET SOUTH				0.52		
94	704 HUMFFRAY STREET SOUTH				0.51		
95	702 HUMFFRAY STREET SOUTH				0.51		
96	703 HUMFFRAY STREET SOUTH				0.51		
97	708 HUMFFRAY STREET SOUTH				0.5		
98	706 HUMFFRAY STREET SOUTH				0.5		
99	705 HUMFFRAY STREET SOUTH				0.49		
100	710 HUMFFRAY STREET SOUTH				0.48		
101	709 HUMFFRAY STREET SOUTH				0.48		
102	707 HUMFFRAY STREET SOUTH				0.48		
103	714 HUMFFRAY STREET SOUTH				0.46		
104	712 HUMFFRAY STREET SOUTH				0.46		
105	29 SCOTT PARADE				0.45		
106	29 SCOTT PARADE				0.45		
107	3 DAVIES STREET				0.45		
108	4 DAVIES ST				0.45		
109	714 HUMFFRAY STREET SOUTH				0.45		
110	33 SCOTT PARADE				0.44		
111	31 SCOTT PARADE				0.44		
112	305 NICHOLSON STREET				0.43		
113	310 NICHOLSON STREET				0.43		
114	35 SCOTT PARADE				0.43		
115	35 SCOTT PARADE				0.43		
116	301 NICHOLSON STREET				0.42		
117	303 NICHOLSON STREET				0.42		
118	307 NICHOLSON STREET				0.42		
119	302 NICHOLSON STREET				0.41		
120	304 NICHOLSON STREET				0.41		
121	306 NICHOLSON STREET				0.41		
122	3 HUNT STREET				0.41		
123	1 HUNT STREET				0.41		
124	13 ROWE STREET				0.4		
125	2/36 ROWE STREET				0.4		

ID	Address	Depth of known building over-floor flooding for each ARI event (m)					Building type and comments
		10	20	50	100	200	
126	19 ROWE STREET				0.4		
127	21 ROWE STREET				0.4		
128	40 ROWE STREET				0.4		
129	38 ROWE STREET				0.38		
130	17A ROWE STREET				0.38		
131	17 ROWE STREET				0.38		
132	15 ROWE STREET				0.38		
133	MAIN ROAD				0.37		
134	34 ROWE STREET				0.37		
135	32 ROWE STREET				0.37		
136	36 ROWE STREET				0.37		
137	509 MAIN ROAD				0.36		
138	513 MAIN ROAD				0.36		
139	MAIN ROAD				0.36		
140	415 MAIN ROAD				0.35		
141	423 MAIN ROAD				0.35		
142	501 MAIN ROAD				0.35		
143	507 MAIN ROAD				0.35		
144	418 MAIN ROAD				0.34		
145	416 MAIN ROAD				0.34		
146	417 MAIN ROAD				0.33		
147	421 MAIN ROAD				0.33		
148	2 WAINWRIGHT STREET				0.33		
149	420 MAIN ROAD				0.33		
150	310-312 MAIN ROAD				0.32		
151	310-312 MAIN ROAD				0.32		
152	422 MAIN ROAD				0.32		
153	411 MAIN ROAD				0.32		
154	415 MAIN ROAD				0.32		
155	310-312 MAIN ROAD				0.31		
156	410 MAIN ROAD				0.3		
157	406 MAIN ROAD				0.3		
158	406 MAIN ROAD				0.3		
159	310-312 MAIN ROAD				0.29		
160	401 MAIN ROAD				0.29		
161	401 MAIN ROAD				0.29		
162	406 MAIN ROAD				0.29		
163	409 MAIN ROAD				0.29		
164	1/301 MAIN ROAD				0.28		
165	302 MAIN ROAD				0.28		
166	304 MAIN ROAD				0.28		
167	238 MAIN ROAD				0.27		
168	242 MAIN ROAD				0.27		

ID	Address	Depth of known building over-floor flooding for each ARI event (m)					Building type and comments
		10	20	50	100	200	
169	244 MAIN ROAD				0.27		
170	221 MAIN ROAD				0.27		
171	301 MAIN ROAD				0.27		
172	211 MAIN ROAD				0.26		
173	228 MAIN ROAD				0.26		
174	230 MAIN ROAD				0.26		
175	234 MAIN ROAD				0.26		
176	236 MAIN ROAD				0.26		
177	101 EUREKA STREET				0.25		
178	209 MAIN ROAD				0.25		
179	211 MAIN ROAD				0.25		
180	214 MAIN ROAD				0.25		
181	207 MAIN ROAD				0.24		
182	205 MAIN ROAD				0.24		
183	204 MAIN ROAD				0.24		
184	218 MAIN ROAD				0.23		
185	220 MAIN ROAD				0.23		
186	224 MAIN ROAD				0.23		
187	226 MAIN ROAD				0.23		
188	4 EUREKA STREET				0.22		
189	6-8 EUREKA STREET				0.22		
190	208 MAIN ROAD				0.22		
191	208 MAIN ROAD				0.22		
192	210 MAIN ROAD				0.22		
193	212 MAIN ROAD				0.22		
194	216 MAIN ROAD				0.22		
195	2/810 HUMFFRAY STREET SOUTH				0.21		Secondary building
196	12 EUREKA STREET				0.21		
197	202 MAIN ROAD				0.21		
198	101 EUREKA STREET				0.21		
199	7 PORTER STREET				0.2		
200	2/810 HUMFFRAY STREET SOUTH				0.2		
201	2/810 HUMFFRAY STREET SOUTH				0.2		Secondary building
202	2/810 HUMFFRAY STREET SOUTH				0.2		Secondary building
203	86 MAIN ROAD				0.19		
204	109 MAIN ROAD				0.19		
205	9 PORTER STREET				0.19		
206	76 MAIN ROAD				0.18		
207	1/1-3 EASTWOOD STREET				0.18		
208	2/1-3 EASTWOOD STREET				0.18		
209	1/808 HUMFFRAY STREET SOUTH				0.17		Secondary building
210	100 MAIN ROAD				0.16		
211	1/808 HUMFFRAY STREET SOUTH				0.16		

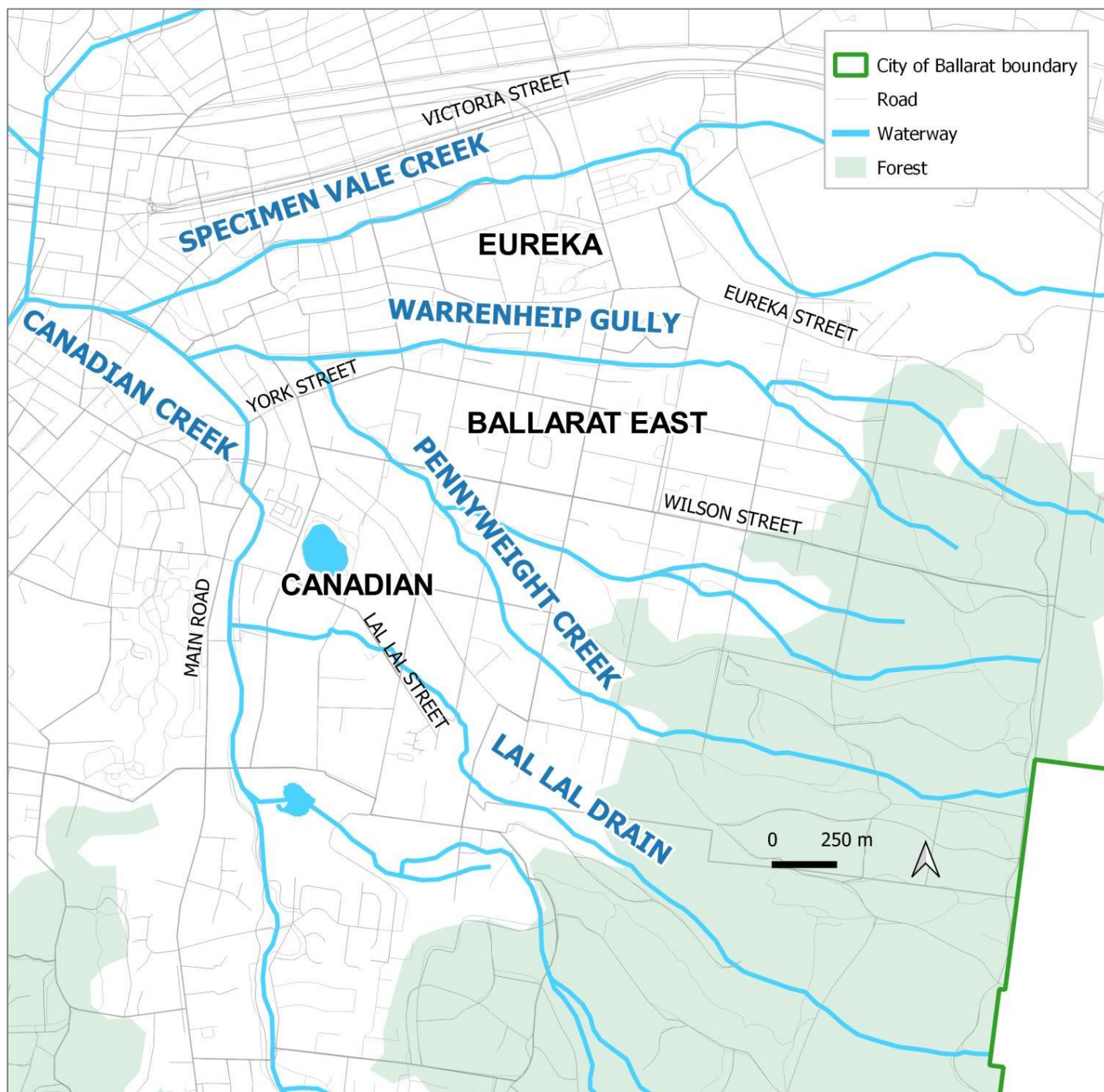
ID	Address	Depth of known building over-floor flooding for each ARI event (m)					Building type and comments
		10	20	50	100	200	
212	1/808 HUMFFRAY STREET SOUTH				0.16		Secondary building
213	16 ANDERSON STREET WEST				0.15		
214	46 EASTWOOD STREET				0.15		
215	14A ANDERSON STREET WEST				0.15		
216	3/1-3 EASTWOOD STREET				0.15		
217	31 ANDERSON STREET EAST				0.15		
218	9 STEINFELD STREET NORTH				0.15		
219	100 MAIN ROAD				0.15		
220	5/1-3 EASTWOOD STREET				0.14		
221	102 BARKLY STREET				0.14		
222	8/1-3 EASTWOOD STREET				0.14		
223	11 PORTER STREET				0.14		
224	102 MAIN ROAD				0.14		
225	14 ANDERSON STREET WEST				0.13		
226	9/1-3 EASTWOOD STREET				0.13		
227	6-7/1-3 EASTWOOD STREET				0.13		
228	6-7/1-3 EASTWOOD STREET				0.13		
229	37 ANDERSON STREET EAST				0.12		
230	32 ANDERSON STREET WEST				0.12		
231	36 ANDERSON STREET WEST				0.12		
232	11 ANDERSON STREET EAST				0.11		
233	34 ANDERSON STREET WEST				0.11		
234	10/1-3 EASTWOOD STREET				0.1		
235	106 MAIN ROAD				0.1		
236	1-3 EASTWOOD STREET				0.1		
237	3 STEINFELD STREET NORTH				0.09		
238	10 EASTWOOD STREET				0.09		
239	222 MAIN ROAD				0.08		
240	29 ANDERSON STREET EAST				0.08		
241	33 ANDERSON STREET EAST				0.08		
242	2/121 CLYDE STREET				0.07		
243	109 MAIN ROAD				0.07		
244	21 STEINFELD STREET NORTH				0.07		
245	39-41 MAIN ROAD				0.07		
246	104 BARKLY STREET				0.06		
247	35 ANDERSON STREET EAST				0.06		
248	11 DANA STREET				0.05		
249	10 EASTWOOD STREET				0.05		
250	9 DANA STREET				0.05		
251	5 STEINFELD STREET NORTH				0.05		
252	6 STEINFELD STREET SOUTH				0.04		
253	1 STEINFELD STREET NORTH				0.03		
254	204 BARKLY STREET				0.03		



ID	Address	Depth of known building over-floor flooding for each ARI event (m)					Building type and comments
		10	20	50	100	200	
255	21 DANA STREET				0.03		Secondary building
256	15 ANDERSON STREET EAST				0.02		
257	101 MAIN ROAD				0.02		
258	15 PORTER STREET				0.02		
259	109 CLYDE STREET				0.02		
260	18 ANDERSON STREET WEST				0.02		
261	30 ANDERSON STREET WEST				0.02		
262	813 DOVETON STREET NORTH				0.01		

## Appendix C2: Ballarat East, Eureka, Canadian (Canadian Creek Tributaries) Flood Emergency Plan

Canadian Creek has four main tributaries which arise in the Canadian Forest; Specimen Vale Creek, Warrenheip Gully, Pennyweight Gully and the Lal Lal Drain. In places these waterways flow through lined channels, such as Warrenheip Gully from the Otway Street South to where it joins with the Canadian Creek, refer to map below.



## Historic Flood Events

Flood photos of significant flood events in Ballarat East during January 2011 and December 1991 are shown below. During the January 2011 flood event up to 200mm of rainfall was recorded over a five days, including 80 to 100mm in a 26 hour period over January 13<sup>th</sup> and 14<sup>th</sup>.



Flooding of the Canadian Lead Primary School along Pennyweight Creek, January 2011 flood event (Water Technology 2014).



Joseph Street overtopped by flooding during the January 2011 flood event (Water Technology 2014).



Flooding along Richards Street (Pennyweight Creek), January 2011 flood event (Water Technology 2014).



Flooding along Callow Street (Warrenheip Gully), 1991 flood event (Water Technology 2014).

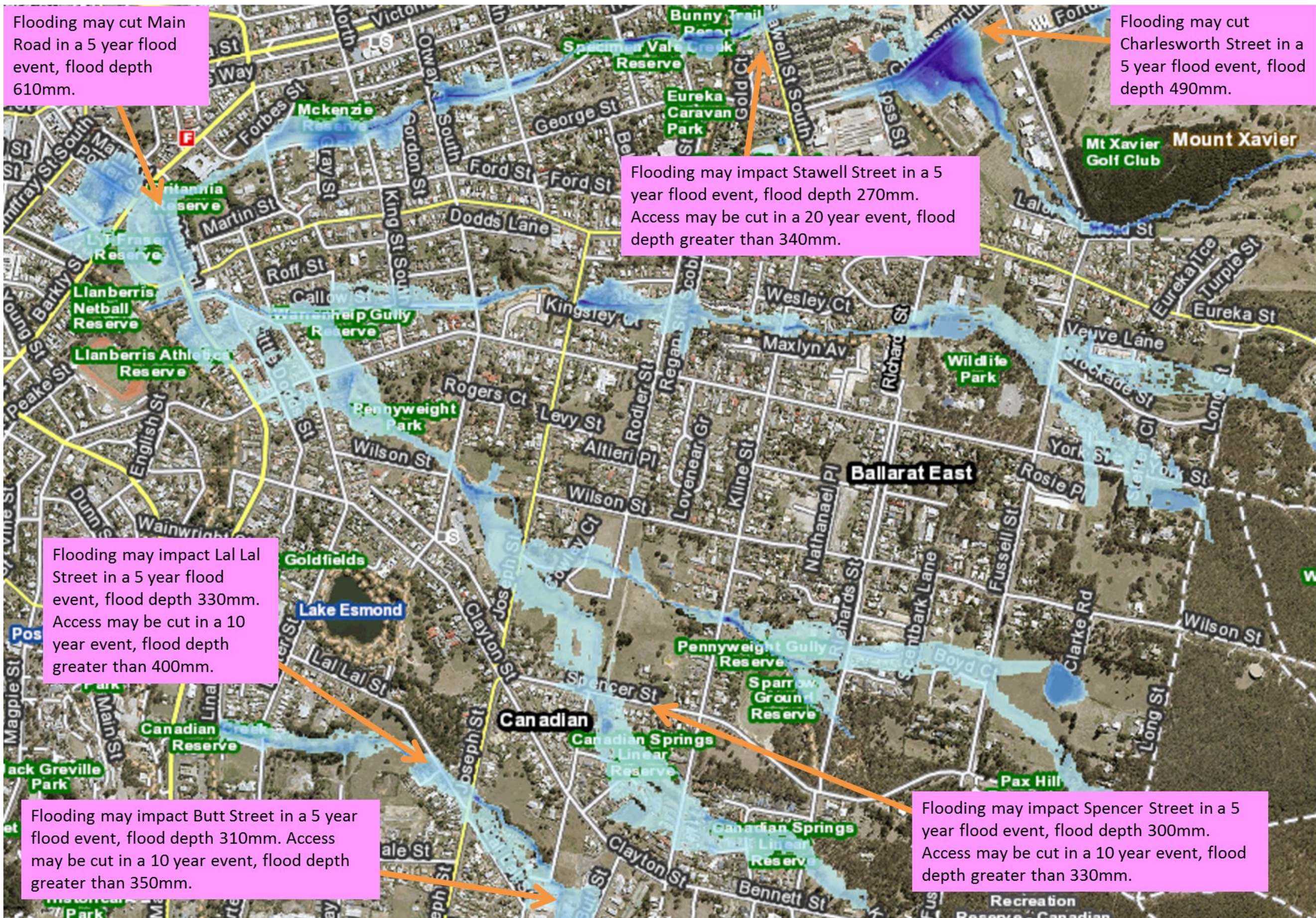
## Ballarat East Flood Impacts and Required Actions

Key assets at risk of flooding in Ballarat East are listed in the table below.

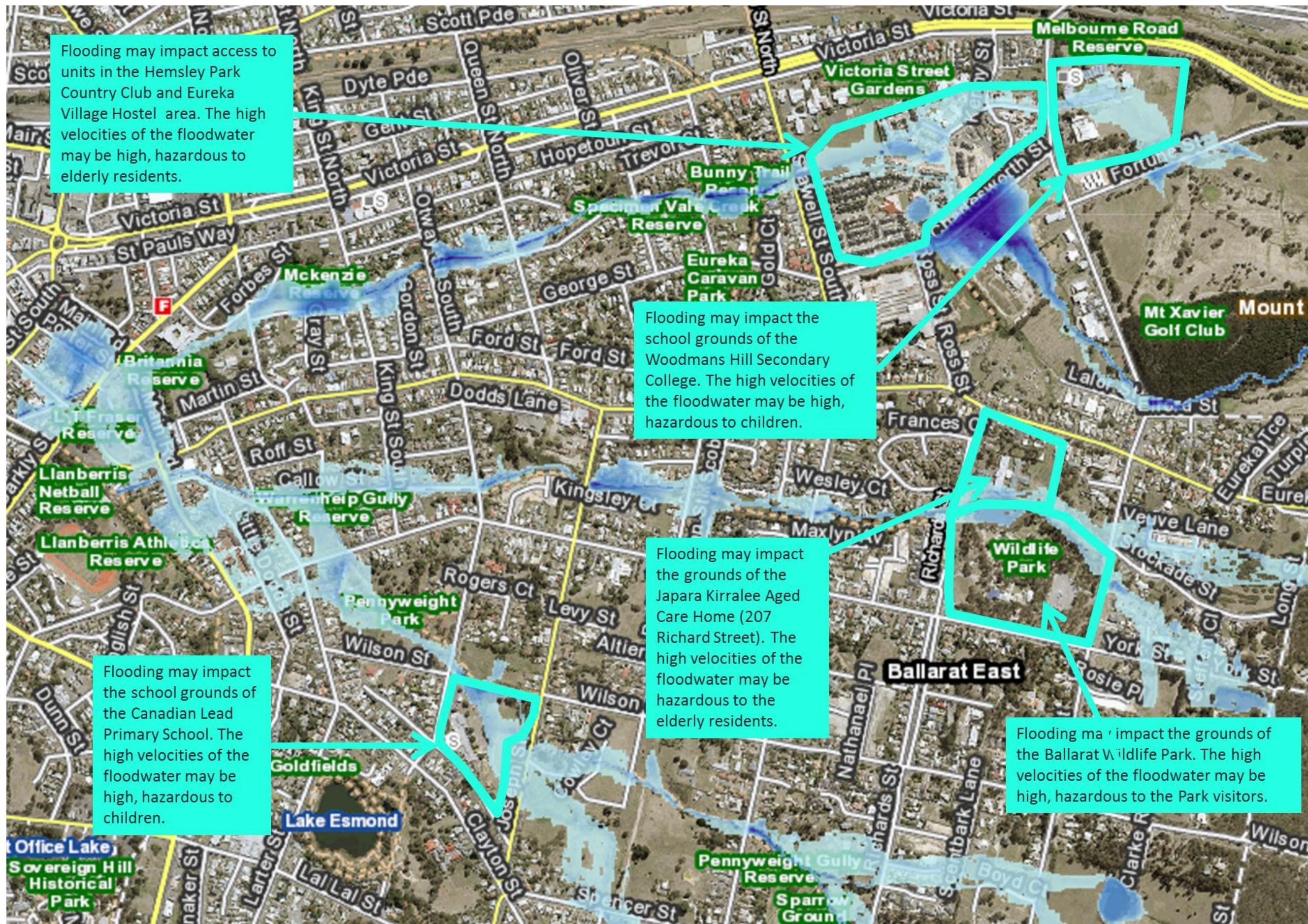
<b>Asset register</b>				
<b>Asset Name and location</b>	<b>Average Recurrence Interval (ARI)</b>	<b>Consequence / Impact</b>	<b>Mitigation/ Action</b>	<b>Lead Agency</b>
Canadian Lead Primary School, 301 Otway Street South	5 year flood	School grounds and playground may be impacted by flooding. The high velocities of floodwater may be high, hazardous to children.	Notify school of flooding impacting their school grounds.	VICSES
Residents of units living in the Windsor Gardens, Begonia Village Estates, Hemsley Park Country Club, Hemsley Park Rest Home and Eureka Village Hostel area, Charlesworth Street, Eureka	5 year flood	Flooding may impact access to units in the Hemsley Park Country Club, Hemsley Park Rest Home and Eureka Village Hostel area	Notify residents of units living in the Hemsley Park Country Club, Hemsley Park Rest Home and Eureka Village Hostel of flooding impacting the area.	VICSES
Woodmans Hill Secondary College, 1 Fussell Street, Eureka	5 year flood	School grounds may be impacted by flooding.	Notify school of flooding impacting their school grounds.	VICSES
11 buildings are flooded above floor, refer to Intelligence card and damages map for locations.	5 year flood	Buildings are flooded above floor.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
Japara Kirralee Aged Care Home, 207 Richard Street, Eureka	5 year flood	Flooding may impact access and the grounds of the Aged Care Home.	Notify the Japara Kirralee Aged Care Home of flooding impacting the area.	VICSES
Ballarat Wildlife Park, 250 Fussell Street, Eureka	5 year flood	The grounds of the Park may be impacted by flooding.	Notify the Ballarat Wildlife Park the flooding may impact the grounds of the park.	VICSES
Main Road, Canadian	5 year flood	Access/egress may be cut by flooding (flood depth may be 0.61m or greater)	Deploy road closure signs and undertake traffic management	City of Ballarat Council
Charlesworth Street, Eureka	5 year flood	Access/egress may be cut by flooding (flood depth may be 0.49m or greater)	Deploy road closure signs and undertake traffic management	City of Ballarat Council
9 additional buildings are flooded above floor, refer to Intelligence card and damages map for locations.	10 year flood	Buildings are flooded above floor.	Sandbag buildings and undertake evacuations as needed..	VICSES Victoria Police
Butt Street, Canadian	10 year flood	Access/egress may be cut by flooding (flood depth may be 0.35m or greater)	Deploy road closure signs and undertake traffic management	City of Ballarat Council
Lal Lal Street, Canadian	10 year flood	Access/egress may be cut by flooding (flood depth may be 0.40m or greater)	Deploy road closure signs and undertake traffic management	City of Ballarat Council
Spencer Street, Ballarat East	10 year flood	Access/egress may be cut by flooding (flood depth may be 0.33m or greater)	Deploy road closure signs and undertake traffic management	City of Ballarat Council
13 additional buildings are flooded above floor, refer to Intelligence card and damages map for locations.	20 year flood	Buildings are flooded above floor.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
19 additional buildings are flooded above floor, refer to Intelligence card and damages map for locations.	50 year flood	Buildings are flooded above floor.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
2 additional buildings are flooded above floor, refer to Intelligence card and damages map for locations.	100 year flood	Buildings are flooded above floor.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police

43 additional buildings are flooded above floor, refer to Intelligence card and damages map for locations.	200 year flood	Buildings are flooded above floor.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
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For more detailed information regarding buildings and roads impacted refer to the Ballarat East Flood Intelligence Card and flood damages/impact maps below. Also refer to the Ballarat East flood depth maps in **Appendix F**, a list of flood observers in **Appendix H** and community sandbag collection points in **Appendix I**.



Ballarat East roads impacted by flooding with the 100 year ARI flood extent.



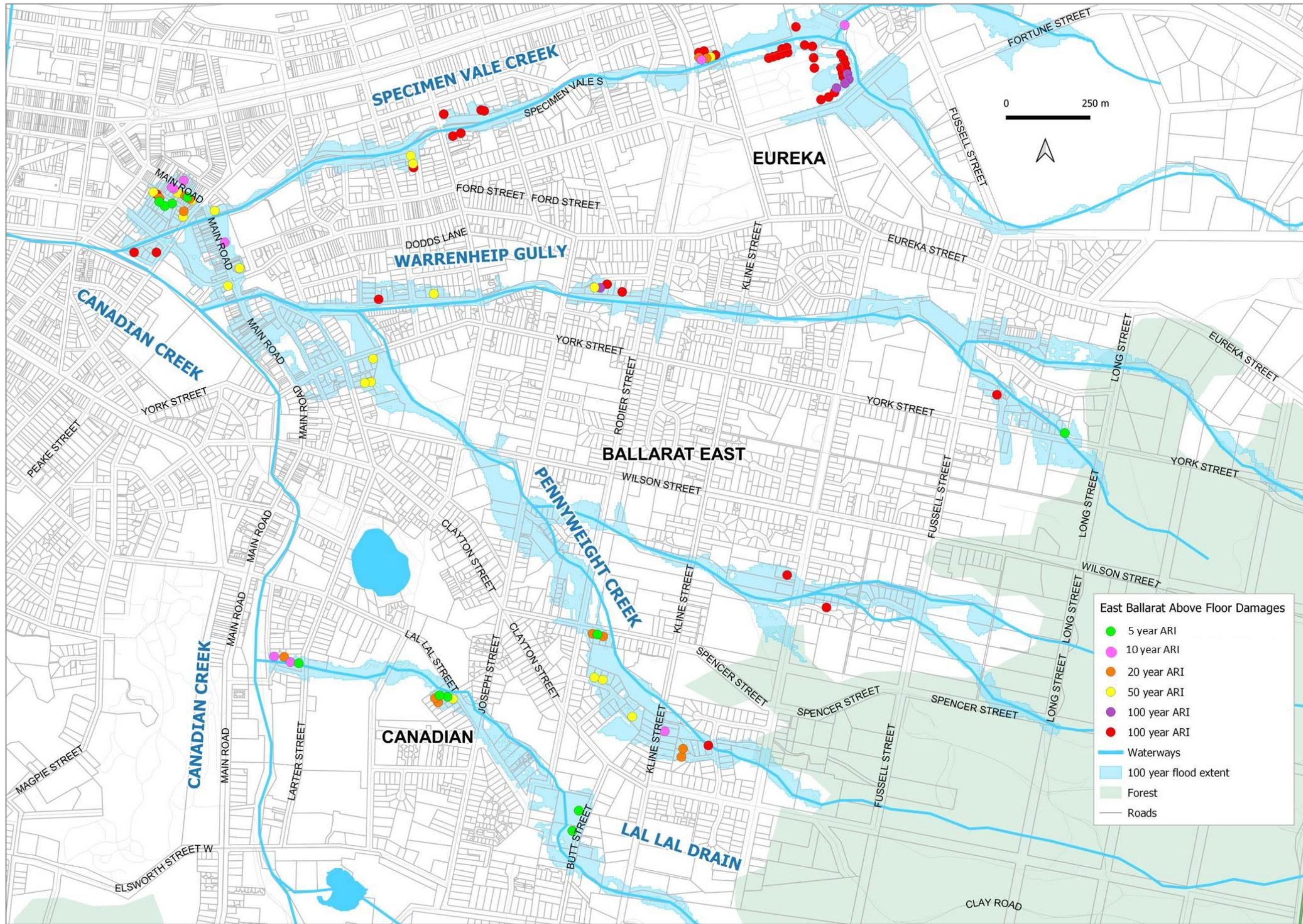
Ballarat East schools and elderly villages impacted by flooding with the 100 year ARI flood extent.



## Ballarat East Flood Intelligence Card (Water Technology 2014)

Flood travel time							Time from start of rain to steep rise in floodwater 3 - 4 hours
							Time from start rainfall to flood peak 4 - 6 hours
							Riverine flooding duration: 15 - 20 hours
Observed rainfall (mm) (Water Tech 2014)	Average Recurrence Interval (ARI) (Water Tech 2013)	Canadian Creek Catchment Tributaries damages total number buildings flooded (above floor)	Consequence / Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action Actions may include (but not limited to) Evacuation, closure of road, sandbagging, issue warning and who is responsible	
~47 mm in 6 hours to ~60 mm in 12 hours	5	196 (11)		11 buildings are flooded above floor; 240 LAL LAL STREET (units 10 and 11), 5 PORTER STREET (5, 7, 9), X2 BUTT STREET (8-14, 16-22), 813B YORK STREET, 100 MAIN ROAD, 1/322 LARTER STREET, 108 SPENCER STREET	Main Road depth 0.61m Charlesworth Street depth 0.49m Stawell Street depth 0.27m Butt Street depth 0.31m Lal Lal Street depth 0.33m Spencer Street depth 0.3m	VICSES activate CFA ground observers to take photos and record flood levels at key crossings. Council and Regional Roads Victoria to deploy road closure signs and undertake traffic management as needed. VICSES sandbag buildings as needed. Victoria Police evacuate buildings as needed. Council clear debris from waterway crossings, drains and culvers as needed.	
~55 mm in 6 hours to ~70 mm in 12 hours	10	252 (20)	Flooding along Fraser Reserve, Ballarat East impacting properties on Main Road between Bradshaw Street and Eureka Street, Golden Point.	Additional 9 buildings flooded above floor: X4 MAIN ROAD (39-41, 76, 86, 109-127), 523 KLINE STREET, 23 BALMORAL DRIVE, 4/21 LINAKER STREET, 6/14 STAWELL STREET S, 2/322 LARTER STREET	Main Road depth 0.69m Charlesworth Street depth 1.03m Stawell Street depth 0.30m Butt Street depth 0.35m Lal Lal Street depth 0.40m Spencer Street depth 0.33m	Refer to actions listed above.	
~66 mm in 6 hours to ~84 mm in 12 hours	20	329 (33)	Flooding near Fraser Reserve impacting properties near Barkly St between Main Road and Steinfeld St North. Minor inundation over Olympic Avenue.	Additional 13 buildings flooded above floor: X2 MAIN ROAD (96-98, 102), 14 STAWELL STREET S, (UNITS 5 AND 7), 11 PORTER STREET, 3/21 LINAKER STREET, 102 BARKLY STREET, X2 LAL LAL STREET (8/240, 9/240), X2 DEEP LEAD CLOSE (6, 7), X2 SPENCER STREET (106, 110)	Main Road depth 0.80m Charlesworth Street depth 1.82m Stawell Street depth 0.34m Butt Street depth 0.38m Lal Lal Street depth 0.46m Spencer Street depth 0.37m	Refer to actions listed above.	
~81 mm in 6 hours to ~103 mm in 12 hours	50	392 (52)	Inundation near Fraser Reserve impacting properties on Barkly St, Main Road, Eastwood St and Steinfeld St North.	Additional 19 buildings flooded above floor: X2 CLAYTON PARK DRIVE (20, 22), 11 CARBONI COURT, 210 YORK STREET, 107A LARTER STREET (UNITS 1 AND 2), X2 GORDON STREET (1, 1A), X5 MAIN ROAD (90, 106, 107, 129, 202), 1/240 LAL LAL STREET, 104 BARKLY STREET, 205 CALLOW STREET, 8/14 STAWELL STREET S, 3-5 WHIM PLACE, 15 PORTER STREET	Main Road depth 0.86m Charlesworth Street depth 2.62m Stawell Street depth 0.39m Butt Street depth 0.42m Lal Lal Street depth 0.54m Spencer Street depth 0.40m	Refer to actions listed above.	
~93 mm in 6 hours to ~118 mm in 12 hours	100	462 (54)	Some minor inundation over Canadian Lakes Boulevard, Recreation Road and Bradby Avenue. Additional properties inundated on Eastwood and Steinfeld St North.	Additional 2 buildings flooded above floor: 12 CARBONI COURT, 302 CHARLESWORTH STREET	Main Road depth 0.89m Charlesworth Street depth 3.16m Stawell Street depth 0.43m Butt Street depth 0.45m Lal Lal Street depth 0.59m Spencer Street depth 0.42m	Refer to actions listed above.	
	200	518 (97)		Additional 43 buildings flooded above floor: 4 HENFIELD CLOSE, X12 29 STAWELL STREET S, X3 14 STAWELL STREET S (UNITS 3, 4, 9), X4 29 STAWELL STREET S (UNITS 21, 54, 68), X2 OTWAY STREET S (13, 17), X2 CARBONI COURT (13, 2/16), X5 302 CHARLESWORTH STREET, 204 BARKLY STREET, 30 GLAZEBROOK STREET (UNITS 5 AND 6), 4/208 SPECIMEN VALE S, 3 JENOLA COURT, 3 GORDON STREET, 21 STEINFELD STREET N, 11 CANADIAN SPRINGS DRIVE, 13 PORTER STREET, 408 RICHARDS STREET	Main Road depth 0.96m Charlesworth Street depth 3.33m Stawell Street depth 0.49m Butt Street depth 0.48m Lal Lal Street depth 0.64m Spencer Street depth 0.44m	Refer to actions listed above.	
80-100 mm in 26 hours, 200mm over 5 days	January 2011	-	Significant flash flooding throughout the Canadian Creek Tributaries.				
80-90mm in 48 hours, with 90 minute bursts of >40mm	December 1991	-	Significant and widespread flash flooding throughout the Canadian Creek Tributaries.				

80-100mm over 4 days	February 1990	-	Moderate pockets of flash flooding throughout the Canadian Creek Tributaries.			
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East Ballarat above floor damages and the Canadian Creek Tributaries 100 year ARI flood extent.

## East Ballarat Property Inundation Table (Water Technology 2014)

Colours used in the property table below are the same used in the East Ballarat above floor damages map above. Green, buildings flooded above floor in a 5 year ARI flood event. Pink, buildings flooded above floor in a 10 year ARI flood event, etc.

ID	Address	Depth of property flooding for each ARI event (m)						Depth of building over-floor flooding for each ARI event (m)						Building type and comments
		5	10	20	50	100	200	5	10	20	50	100	200	
1	5 PORTER STREET	0.88	0.88	1.04	1.19	1.24	1.33	0.68	0.68	0.84	0.99	1.04	1.13	
2	16-22 BUTT STREET	0.42	0.42	0.45	0.49	0.52	0.55	0.41	0.41	0.44	0.48	0.51	0.54	
3	7 PORTER STREET	0.63	0.63	0.79	0.94	0.99	1.08	0.33	0.33	0.49	0.64	0.7	0.78	
4	8-14 BUTT STREET	0.31	0.31	0.36	0.42	0.46	0.49	0.3	0.3	0.35	0.4	0.44	0.48	
5	813B YORK STREET	20.28	20.28	20.29	20.29	20.3	20.31	0.28	0.28	0.29	0.29	0.3	0.31	
6	11/240 LAL LAL STREET	0.55	0.55	0.62	0.69	0.74	0.79	0.26	0.26	0.32	0.39	0.44	0.49	
7	9 PORTER STREET	0.43	0.43	0.59	0.74	0.79	0.88	0.23	0.23	0.39	0.55	0.6	0.69	
8	10/240 LAL LAL STREET	0.28	0.28	0.35	0.43	0.48	0.53	0.19	0.19	0.26	0.34	0.39	0.44	
9	100 MAIN ROAD	0.17	0.17	0.33	0.49	0.54	0.63	0.17	0.17	0.33	0.48	0.53	0.62	
10	1/322 LARTER STREET	0.3	0.3	0.38	0.45	0.52	0.58	0.17	0.17	0.24	0.32	0.38	0.45	
11	108 SPENCER STREET	0.29	0.29	0.34	0.38	0.41	0.44	0.17	0.17	0.22	0.27	0.3	0.33	
12	86 MAIN ROAD	0.39	0.39	0.55	0.7	0.76	0.85	0.16	0.16	0.31	0.47	0.52	0.61	
13	523 KLINE STREET		0.14	0.15	0.18	0.2	0.23		0.13	0.14	0.17	0.19	0.22	
14	109-127 MAIN ROAD		0.33	0.44	0.5	0.53	0.6		0.12	0.23	0.29	0.32	0.39	Shops
15	76 MAIN ROAD		0.29	0.45	0.6	0.66	0.75		0.1	0.25	0.41	0.46	0.55	
16	23 BALMORAL DRIVE		0.16	0.25	0.32	0.35	0.38		0.1	0.19	0.26	0.29	0.32	Units
17	4/21 LINAKER STREET		0.29	0.39	0.49	0.58	0.66		0.09	0.19	0.29	0.38	0.46	
18	39-41 MAIN ROAD		20.07	20.23	20.39	20.44	20.53		0.07	0.23	0.39	0.44	0.53	
19	6/14 STAWELL STREET S		0.11	0.4	0.67	0.84	1.13		0.05	0.35	0.61	0.79	1.08	
20	2/322 LARTER STREET		0.14	0.22	0.3	0.37	0.44		0.02	0.1	0.18	0.26	0.33	
21	102 MAIN ROA		0.08	0.24	0.4	0.45	0.54			0.13	0.29	0.34	0.43	
22	5/14 STAWELL STREET S		0.02	0.31	0.58	0.75	1.04			0.11	0.38	0.56	0.84	

ID	Address	Depth of property flooding for each ARI event (m)						Depth of building over-floor flooding for each ARI event (m)						Building type and comments
		5	10	20	50	100	200	5	10	20	50	100	200	
23	11 PORTER STREET		0.53	0.69	0.84	0.89	0.98			0.11	0.26	0.31	0.4	
24	3/21 LINAKER STREET		0.12	0.23	0.34	0.44	0.52			0.11	0.22	0.32	0.4	
25	102 BARKLY STREET		0.43	0.59	0.75	0.8	0.89			0.1	0.26	0.31	0.4	
26	96-98 MAIN ROAD		0.36	0.52	0.67	0.73	0.82			0.1	0.25	0.3	0.39	
27	7/14 STAWELL STREET S			0.2	0.47	0.64	0.92			0.08	0.34	0.52	0.8	
28	8/240 LAL LAL STREET		0.1	0.17	0.25	0.3	0.35			0.07	0.15	0.2	0.25	
29	9/240 LAL LAL STREET		0.13	0.19	0.26	0.31	0.36			0.04	0.11	0.16	0.21	
30	6 DEEP LEAD CLOSE		0.08	0.12	0.18	0.21	0.24			0.03	0.09	0.12	0.16	
31	106 SPENCER STREET		0.25	0.28	0.32	0.35	0.38			0.03	0.07	0.1	0.13	
32	110 SPENCER STREET		0.03	0.09	0.13	0.15	0.18			0.02	0.05	0.08	0.11	
33	7 DEEP LEAD CLOSE		0.08	0.12	0.19	0.24	0.28			0.01	0.07	0.12	0.16	
34	20 CLAYTON PARK DRIVE		0.06	0.06	0.06	0.06	0.07				0.01	0.01	0.01	
35	22 CLAYTON PARK DRIVE		0.11	0.16	0.19	0.24	0.26				0.04	0.09	0.11	
36	11 CARBONI COURT			0.09	0.63	0.97	1.31				0.33	0.68	1.02	
37	210 YORK STREET			0.23	0.47	0.52	0.57				0.23	0.28	0.33	
38	1/107A LARTER STREET			0.13	0.37	0.44	0.49				0.18	0.25	0.3	Units
39	2/107A LARTER STREET			0.15	0.4	0.46	0.52				0.15	0.22	0.27	Units
40	106 MAIN ROAD		0.13	0.28	0.44	0.49	0.58				0.14	0.19	0.28	
41	1 GORDON STREET		0.14	0.22	0.34	0.4	0.45				0.11	0.17	0.22	
42	90 MAIN ROAD		0.33	0.48	0.64	0.69	0.78				0.11	0.16	0.25	
43	107 MAIN ROAD			0.1	0.22	0.3	0.35				0.07	0.15	0.2	
44	1/240 LAL LAL STREET		0.03	0.07	0.13	0.16	0.21				0.06	0.09	0.14	
45	104 BARKLY STREET		0.1	0.26	0.41	0.47	0.56				0.05	0.1	0.19	
46	129 MAIN ROAD			0.07	0.13	0.17	0.23				0.05	0.09	0.15	Shops
47	1A GORDON STREET		0.1	0.19	0.31	0.36	0.41				0.04	0.09	0.14	
48	205 CALLOW STREET		0.1	0.2	0.25	0.27	0.29				0.04	0.06	0.08	
49	8/14 STAWELL STREET S				0.19	0.37	0.64				0.03	0.21	0.49	

ID	Address	Depth of property flooding for each ARI event (m)						Depth of building over-floor flooding for each ARI event (m)						Building type and comments
		5	10	20	50	100	200	5	10	20	50	100	200	
50	3-5 WHIM PLACE		0.02	0.03	0.06	0.08	0.1				0.02	0.04	0.06	
51	15 PORTER STREET		0.11	0.26	0.42	0.47	0.56				0.01	0.06	0.15	
52	202 MAIN ROAD		0.12	0.22	0.28	0.32	0.38				0.01	0.05	0.11	
53	12 CARBONI COURT				0.13	0.48	0.82					0.21	0.56	
54	302 CHARLESWORTH STREET					0.08	0.29					0.01	0.22	Units
55	4 HENFIELD CLOSE		0.07	0.1	0.11	0.13	0.14						0.02	
56	29 STAWELL STREET S						0.58						0.55	Units
57	29 STAWELL STREET S						0.59						0.4	Units
58	29 STAWELL STREET S						20.4						0.4	Units
59	13 OTWAY STREET S					0.01	0.51						0.37	
60	29 STAWELL STREET S						20.34						0.34	Units
61	13 CARBONI COURT					0.24	0.58						0.25	
62	2/16 CARBONI COURT					0.11	0.44						0.25	Units
63	9/14 STAWELL STREET S					0.14	0.41						0.24	
64	4/14 STAWELL STREET S					0.27	0.55						0.22	
65	29 STAWELL STREET S						0.32						0.2	
66	29 STAWELL STREET S						20.2						0.2	Units
67	17 OTWAY STREET S					0.21	0.71						0.2	
68	302 CHARLESWORTH STREET					0.14	0.36						0.18	Units
69	204 BARKLY STREET			0.04	0.16	0.23	0.42						0.18	
70	5/30 GLAZEBROOK STREET				0.09	0.38	0.88						0.16	Units
71	6/30 GLAZEBROOK STREET					0.23	0.73						0.16	Units
72	29 STAWELL STREET S					0.01	0.21						0.14	Units
73	4/208 SPECIMEN VALE S						0.31						0.13	
74	302 CHARLESWORTH STREET						0.25						0.11	Units

ID	Address	Depth of property flooding for each ARI event (m)						Depth of building over-floor flooding for each ARI event (m)						Building type and comments
		5	10	20	50	100	200	5	10	20	50	100	200	
75	68/29 STAWELL STREET S						20.11						0.11	Units
76	3 JENOLA COURT						20.07						0.07	
77	29 STAWELL STREET S						0.12						0.06	Units
78	3/14 STAWELL STREET S						0.2						0.05	
79	54/29 STAWELL STREET S					0.03	0.11						0.05	Units
80	29 STAWELL STREET S						0.12						0.05	Units
81	21/29 STAWELL STREET S					0.04	0.1						0.04	Units
83	3 GORDON STREET					0	0.05						0.04	
84	21 STEINFELD STREET N		0.12	0.16	0.23	0.26	0.37						0.04	
85	54/29 STAWELL STREET S					0	0.07						0.03	Units
88	54/29 STAWELL STREET S					0.01	0.09						0.02	Units
89	11 CANADIAN SPRINGS DRIVE		0.03	0.06	0.09	0.11	0.13						0.02	
90	13 PORTER STREET		0.13	0.29	0.45	0.5	0.59						0.02	
91	408 RICHARDS STREET					0.02	0.04						0.02	
92	29 STAWELL STREET S						0.06						0.01	Units
93	21/29 STAWELL STREET S					0	0.1						0.01	Units
94	29 STAWELL STREET S						0.1						0.01	Units
95	29 STAWELL STREET S						0.12						0.01	Units
96	29 STAWELL STREET S						0.05						0.01	Units
97	115 CALLOW STREET		0.05	0.11	0.15	0.17	0.19						0.01	

## Appendix C3: West Ballarat: Sebastopol, Redan, Lucas, Delacombe Flood Emergency Plan

This area encompasses the western section of Ballarat, which is heavily urbanised and has relatively flat topography. The main waterways include Woody Yaloak River, Kensington Creek, Bonshaw Creek and Redan Creek. During heavy rainfall events, the limited capacity of these waterways and the substantial urban stormwater runoff often quickly floods a large number of adjacent properties and roads, refer to photos and maps below. Flooding can occur within a few hours from the start of rainfall.

During September 2010 and January 2011 substantial flooding occurred along Bonshaw Creek in Delacombe. The worst flooding occurred along Banyule Drive, Loris Court, Earls Square and Lynne Court, refer to flood maps below. Delacombe has an impervious catchment with minimal floodplain storage, this increases stormwater runoff into Bonshaw Creek. During the January 2011 flood event the capacity of the main Bonshaw Creek conduit was quickly overcome by flooding in Bonshaw Creek, as seen in the photo below, significantly contributing to overland flow along the Doug Dean Reserve.



Flooding at Doug Dean Reserve (Bonshaw Creek), 2011 flood event (City of Ballarat 2016).

During the January 2011 flood event, floodwater from Bonshaw Creek overtopped Greenhalghs Road, flowing through Banyule Drive, refer to flood photos below. At the end of Banyule Drive, floodwater cannot overtop the crest level of the Glenelg Highway, resulting in a damming effect along Banyule Drive. This causing over floor flooding of a number of buildings in Banyule Drive, Loris Court, Earls Square and Lynne Court.

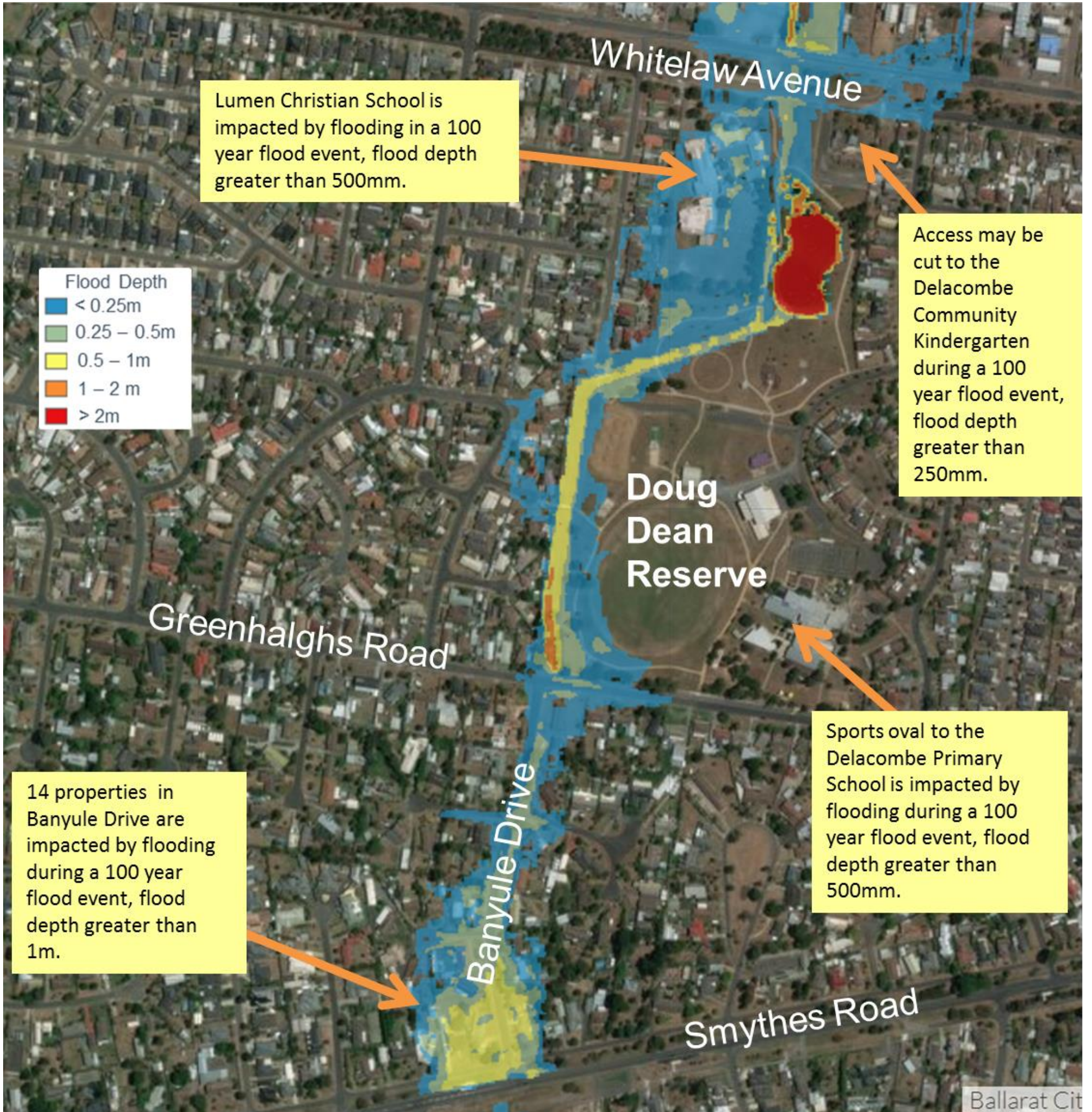




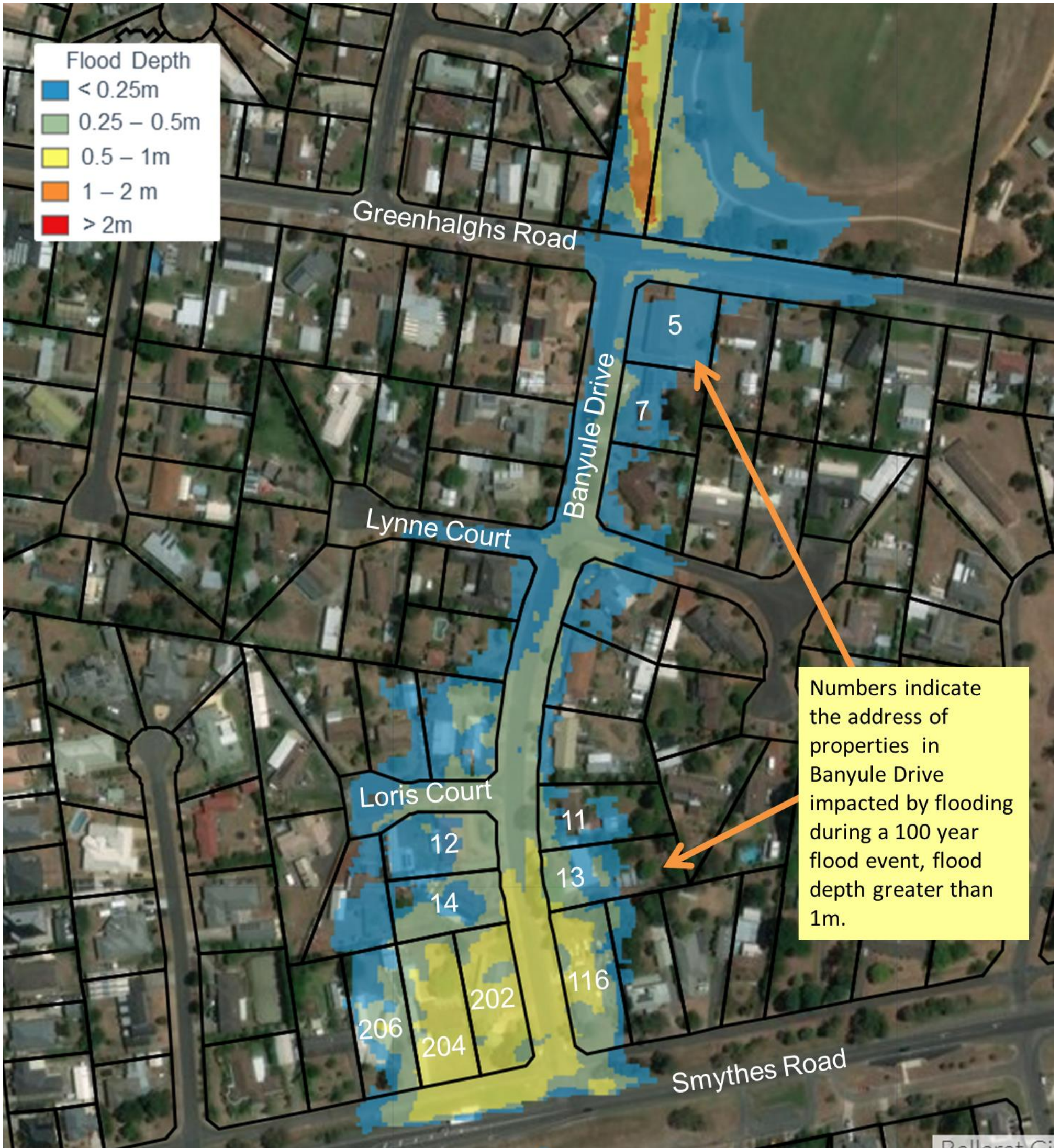
Greenhalghs Road, Dough Dean Reserve (Bonshaw Creek) during the January 2011 flood event (City of Ballarat 2016).



Banyule Drive, Delacombe, January 2011 flood event (City of Ballarat 2016).

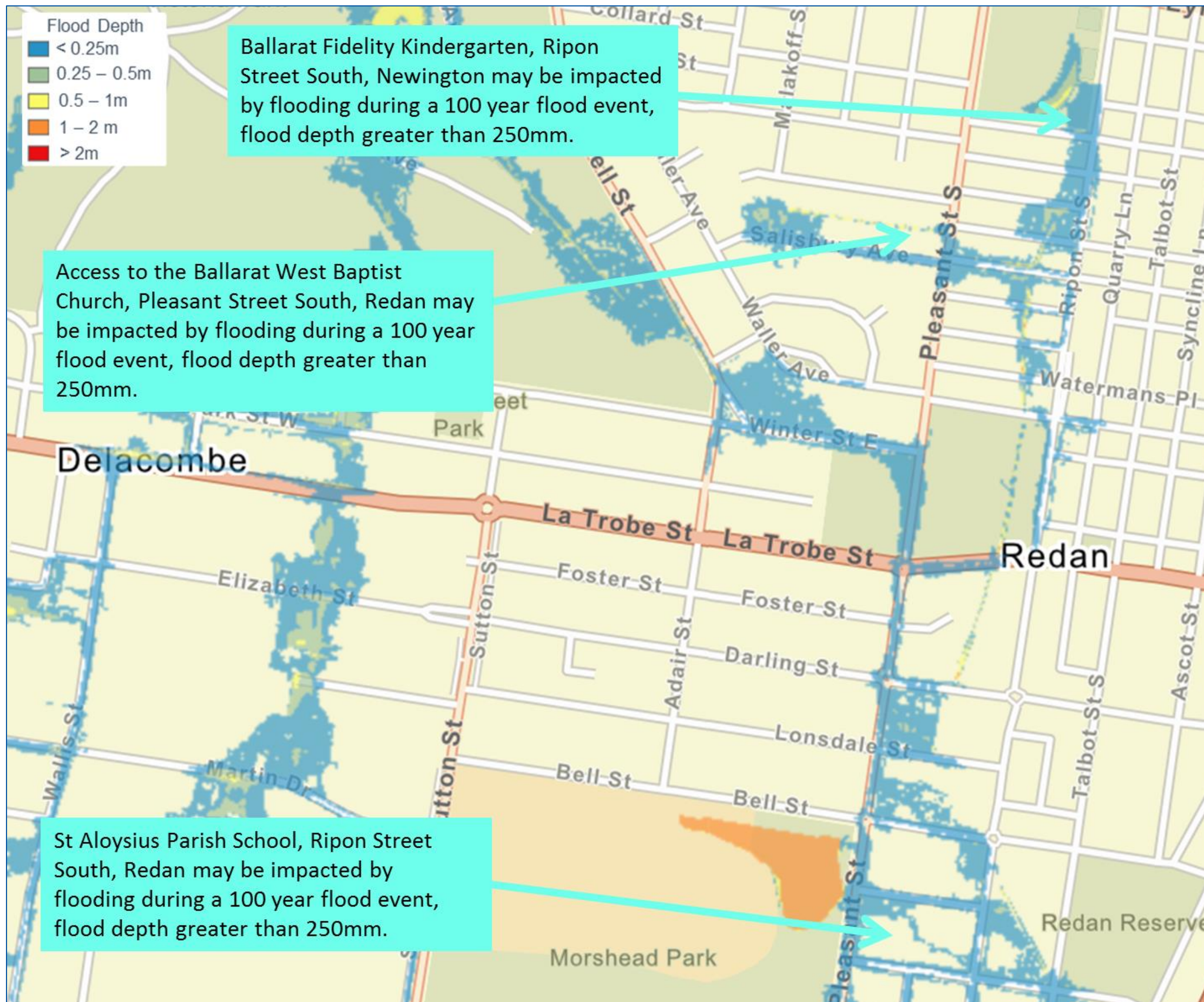


100 year flood extent map for Doug Dean Reserve (Bonshaw Creek), Delacombe (Water Technology 2019).



100 year flood extent map for Banyule Dive, Delacombe (Water Technology 2019)





100 year flood extent map and key West Ballarat assets impacted by flooding (Water Technology 2019).

## Flood Impacts and Required Actions

Key assets in West Ballarat at risk of flooding are listed in the table below.

Asset register				
Asset Name and location	Average Recurrence Interval (ARI)	Consequence / Impact	Mitigation/ Action	Lead Agency
Access is cut to the Glenelg Highway at three locations, where Woody Yaloak River, Kensington Creek and Bonshaw Creek intersect the Glenelg Highway	100 year flood	Access/egress is cut to the Glenelg Highway	Deploy road closure signs and undertake traffic management	Regional Roads Victoria
Ballarat Fidelity Kindergarten, Ripon Street South, Newington	100 year flood	The grounds of the Ballarat Fidelity Kindergarten is impacted by flooding, access/egress may be cut along Ripon Street South	Evacuate the buildings of the Kindergarten before access is cut. Floodwater is a hazard to students attending the Kindergarten	Victoria Police
Delacombe Community Kindergarten, Whitelaw Avenue.	100 year flood	Access/egress may be cut to the Delacombe Community Kindergarten, Whitelaw Avenue	Evacuate the buildings of the Kindergarten before access is cut. Floodwater is a hazard to students attending the Kindergarten	Victoria Police
The sports oval of the Delacombe Primary School, Greenhalghs Road	100 year flood	The sports oval of the Delacombe Primary School, Greenhalghs Road is impacted by flooding	Notify the school of the flood risk to their students	VICSES
Lumen Christian School, Whitelaw Avenue, Delacombe	100 year flood	The grounds of the Lumen Christian School is impacted by flooding, access/egress may be cut along Whitelaw Avenue	Evacuate the buildings of the School before access is cut. Floodwater is a hazard to students attending the School	Victoria Police
Ballarat West Baptist Church, Pleasant Street South, Newington	100 year flood	Access/egress may be cut to the Delacombe Community Kindergarten, Whitelaw Avenue	Evacuate the building of the Church before access is cut. Floodwater is a hazard to patrons attending the Church	Victoria Police
St Aloysius School, Ripon Street South, Redan	100 year flood	The grounds of the St Aloysius School is impacted by flooding, access/egress may be cut along Ripon Street South	Evacuate the buildings of the School before access is cut. Floodwater is a hazard to students attending the School	Victoria Police
Buildings in Delacombe and Alfredton are flooded above floor, refer to Intelligence card and damages map for locations	100 year flood	Buildings are flooded above floor	Sandbag buildings and undertake evacuations as needed	VICSES Victoria Police

For more detailed information regarding buildings and roads impacted refer to the West Ballarat Flood Intelligence Card and flood asset impact maps above. Also refer to the West Ballarat flood depth maps in **Appendix F**, a list of flood observers in **Appendix H** and community sandbag collection points in **Appendix I**.

## West Ballarat Flood Intelligence Card

Flood travel time				Time from start of rain to steep rise in floodwater 1.5 - 6 hours		
				Time from start rainfall to flood peak 2.5 - 10 hours		
				Riverine flooding duration: 9 - 12 hours		
Observed rainfall (mm) assumes rainfall across whole catchment	Average Recurrence Interval (ARI)	West Ballarat damages total number buildings flooded (above floor) (Water Tech 2017)	Consequence / Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action Actions may include (but not limited to) Evacuation, closure of road, sandbagging, issue warning and who is responsible
~40 mm in 5 hours to ~70 mm in 48 hours	5	677	Impacts/damages/consequences are unknown due to limited flood intelligence information available.			Council clear debris from waterway crossings, drains and culvers to reduce blockages. Council deploy road closure signs and undertake traffic management as needed. VICSES activate CFA ground observers to take photos and record flood levels at key crossings.
~45 mm in 5 hours to ~85 mm in 48 hours	10					In addition to actions listed above: VICSES sandbag houses impacted by flooding as needed.
~60 mm in 5 hours to ~100 mm in 48 hours	20	1,092				Refer to actions listed above.
~75 mm in 5 hours to ~120 mm in 48 hours	50					In addition to actions listed above: Regional Roads Victoria and Council deploy road closure signs and undertake traffic management as needed. Victoria Police evacuate buildings as needed.
~85 mm in 5 hours to ~140 mm in 48 hours	100	1,664 (50*)	<p>Widespread flooding impacting 1,664 properties, the deepest flooding occurring along Bonshaw Creek. The majority of buildings flooded over floor are in Delacombe and Alfredton. Access is cut to the Glenelg Highway (Smythes Road) where Woody Yaloak River, Kensington Creek and Bonshaw Creek intersect the Glenelg Highway. Depth of water may be greater than 2m.</p> <p>Access may also be cut to Greenhalghs Road, Ballarat – Carngham Road / La Trobe Street, Whitelaw Avenue and Banyule Drive (among others).</p>	<p><b>Grounds and road access may be impacted by flooding:</b> Delacombe Community Kindergarten (Whitelaw Avenue) Delacombe Primary School (Greenhalghs Road) Ballarat Fidelity Kindergarten (Ripon Street South, Newington) Ballarat West Baptist Church (Pleasant Street South, Newington) St Aloysius School (Ripon Street South, Redan) Moreshead Park Soccer Ground (Pleasant Street South, Redan) Ballarat Livestock Centre (La Trobe Street, Delacombe)</p> <p><b>Properties impacted by deep flooding (&gt;250mm):</b> Lumen Christian School (Delacombe) x6 Banyule Drive (5, 7, 11, 12, 13, 14) Delacombe x4 Smythes Road (116, 202, 204, 206) Delacombe x3 Ascot Gardens Drive (42,45,50) Delacombe x2 Edmund Drive (2, 4) Delacombe x6 Royale Street (11, 13, 15, 17, 19, 21) Delacombe x2 Whitelaw Avenue (106, 112) Delacombe x5 Wallis Street (10, 12, 14, 16, 44) Delacombe X3 Greenbank Court (1, 2, 3) Delacombe X8 Stonepark Road (4, 8, 10, 11, 12, 15, 16, 17) Delacombe 1103 La Trobe Street, Delacombe X3 Christine Avenue (19, 21, 23) Alfredton 1-48 Ningana Street, Alfredton 2-22 Victory Avenue, Alfredton 13-34 Kallioota Street, Alfredton 1-25 Coonatta Street, Alfredton 1-18 Balyarta Street, Alfredton 61-69 Cuthberts Road, Alfredton 1-10 Townsend Court, Alfredton 1-5 Omeo Drive, Alfredton 14-32 Hume Crescent, Alfredton</p>	<p>Glenelg Highway (Smythes Road) depth &gt;2m Greenhalghs Road depth 2m Ballarat – Carngham Road / La Trobe Street depth 2m Sturt Street (Alfredton) depth 0.25m Whitelaw Avenue depth 0.5m Banyule Drive depth 1m</p>	Refer to actions listed above.
	September 2010		Widespread flooding along Bonshaw Creek.			
80-100mm in 26 hours, 200mm over 5 days	January 2011		Widespread flooding along Bonshaw Creek. Several buildings were flooded over floor in Banyule Drive, Delacombe.			

\*Estimated number of buildings flooded above floor (a floor level survey was not undertaken for West Ballarat, the number of buildings flooded above floor is unknown).

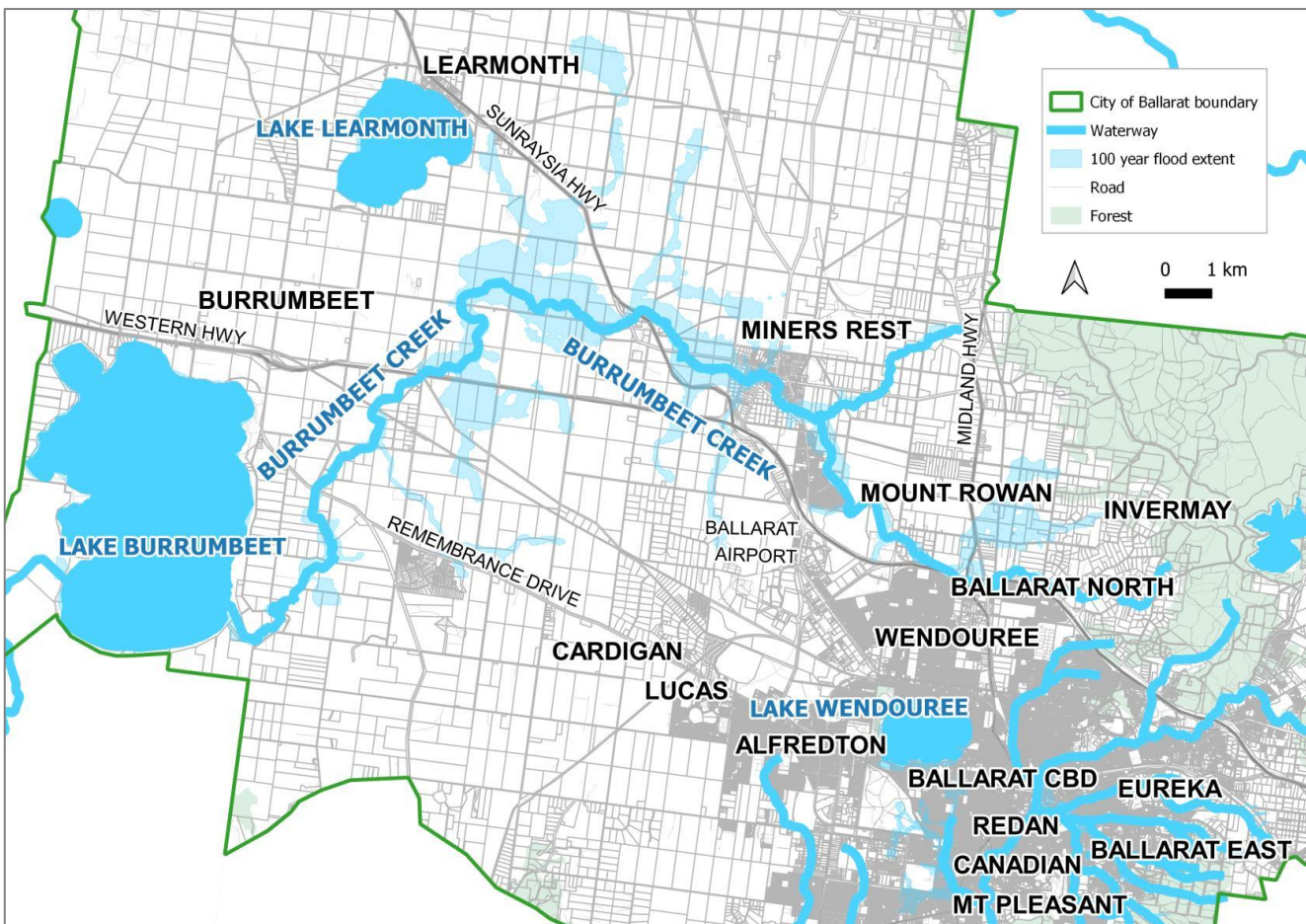
# Appendix C4: Miners Rest and Burrumbeet Creek Catchment Flood Emergency Plan

Burrumbeet Creek rises in the hills to the northeast of Ballarat and flows through Miners Rest to terminate at Lake Burrumbeet. Townships within the catchment include Invermay and Miners Rest as well as the smaller settlements of Mount Rowan, Burrumbeet and Learmonth. The northern suburbs of Ballarat are also within the catchment.

The upper parts of the catchment, upstream of Invermay are relatively steep and flooding is relatively well confined to watercourse corridors. Downstream from Invermay the land is flatter and flooding is more extensive as water overflows onto surrounding land and into the many shallow depressions and swampy areas within the catchment.

Flooding in the Burrumbeet Creek catchment becomes reasonably widespread during severe events although high hazard areas are in the main limited to main flow channels and road crossings. A number of houses are flooded over-floor, refer to building damage maps below. The majority of these are located in Miners Rest with the balance in the vicinity of Invermay. Many roads are affected as floodwater rises. As flooding becomes more severe, many of these roads become impassable, refer to flood impact maps below.

Flooding in Miners Rest is predominantly caused by riverine flooding from the Burrumbeet Creek. During significant rainfall events, the Burrumbeet Creek will break its banks and flood through the township. Flooding in these locations is dependent on the severity of the rainfall event. Refer to the flood intelligence card below for flood triggers.



Miners Rest, Burrumbeet Creek.



## Historic flood events

Major flooding occurred in the Burrumbeet Creek catchment during September 2010, January 2011 and more recently in September 2016. Rainfall statistics from the January 2011 flood event indicate that 203 millimetres of rainfall occurred over a four day period, with 95 millimetres of rain falling on 14th of January alone. Properties suffered significant inundation (see photos below) and considerable damage occurred to critical infrastructure, including roads, bridges and a sewer pump station.



A Dundas Street house flooded above floor in Miners Rest during the January 2011 flood event (source: City of Ballarat).



A Miners Rest house flooded above floor during the January 2011 flood event (source: City of Ballarat).



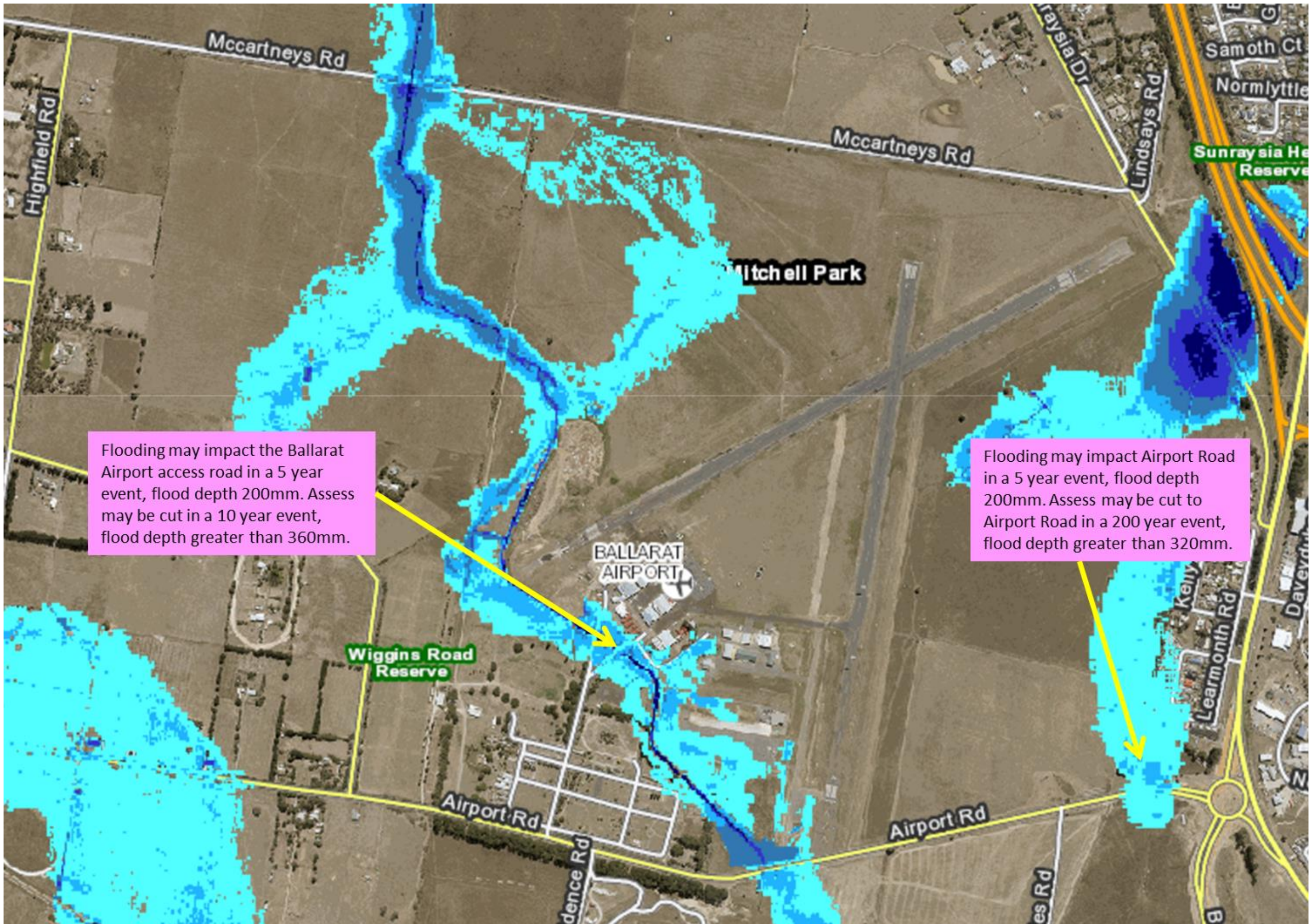
A house in Creek Street, Miners Rest flooded above floor during the January 2011 flood event (source: City of Ballarat).

## Flood Impacts and Required Actions

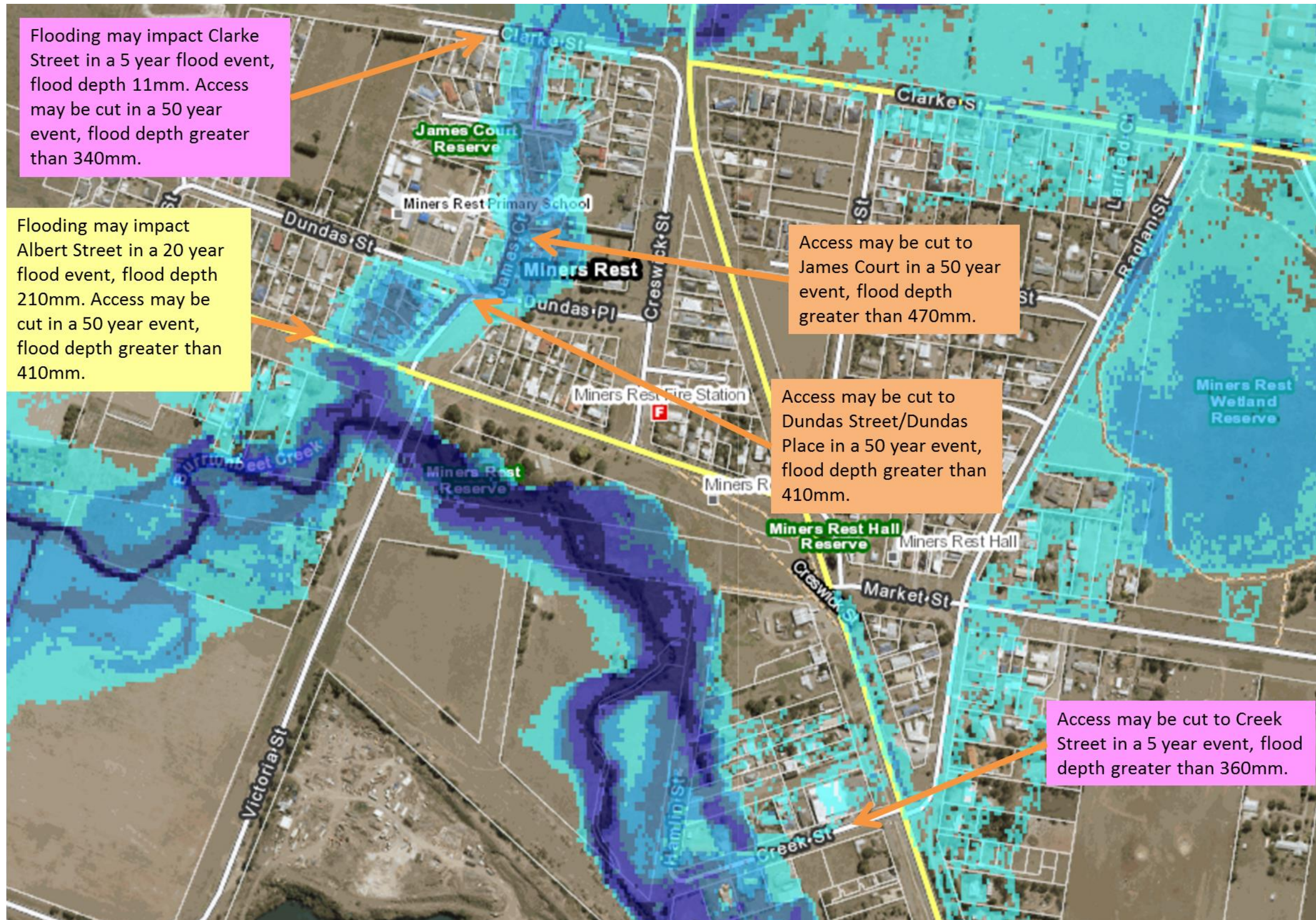
Key assets at risk of flooding are listed in the table below.

Asset register				
Asset Name and location	Average Recurrence Interval (ARI)	Consequence / Impact	Mitigation/ Action	Lead Agency
Ararat to Ballarat Railway Line	5 year flood	Access/egress may be impacted by flooding (flood depth may be 0.58m or greater)	Suspend rail services during the flood event	VLIN
Building at 4 Hakea Drive, Invermay	5 year flood	Building is flooded above floor.	Sandbag as needed.	VICSES
Building at 36 High Street, Learmonth	10 year flood	Building is flooded above floor.	Sandbag as needed.	VICSES
Ballarat Airport	10 year flood	Access/egress may be impacted by flooding (flood depth may be 0.36m or greater)	Notify the business manager that access to the Airport may be cut by flooding.	VICSES
Access to 15 Olliers Road Mount Rowan	10 year flood	Access/egress may be cut by flooding (flood depth may be 0.35m or greater)	Evacuate before access is cut	Victoria Police
Building at 15 Olliers Road, Mount Rowan	20 year flood	Caravan Repair Business building is flooded above floor.	Notify the business owner before the property is impacted to notify them of the flood risk.	VICSES
15 additional buildings flooded	50 year flood	Buildings are flooded above floor.	Sandbag as needed.	VICSES
High Street, Learmonth	50 year flood	Access/egress may be cut by flooding (flood depth may be 0.35m or greater)	Deploy road closure signs and undertake traffic management	Regional Roads Victoria
Clarke Street, Miners Rest	50 year flood	Access/egress may be cut by flooding (flood depth may be 0.35m or greater)	Deploy road closure signs and undertake traffic management	Regional Roads Victoria
Dundas Street/Place, Miners Rest	50 year flood	Access/egress may be cut by flooding (flood depth may be 0.41m or greater)	Deploy road closure signs and undertake traffic management	Regional Roads Victoria
Albert Street, Miners Rest	50 year flood	Access/egress may be cut by flooding (flood depth may be 0.49m or greater)	Deploy road closure signs and undertake traffic management	Council
18 additional buildings flooded	100 year flood	Buildings are flooded above floor.	Sandbag as needed.	VICSES
Howe Street, Miners Rest	100 year flood	Access/egress may be cut by flooding (flood depth may be 0.35m or greater)	Deploy road closure signs and undertake traffic management	Regional Roads Victoria

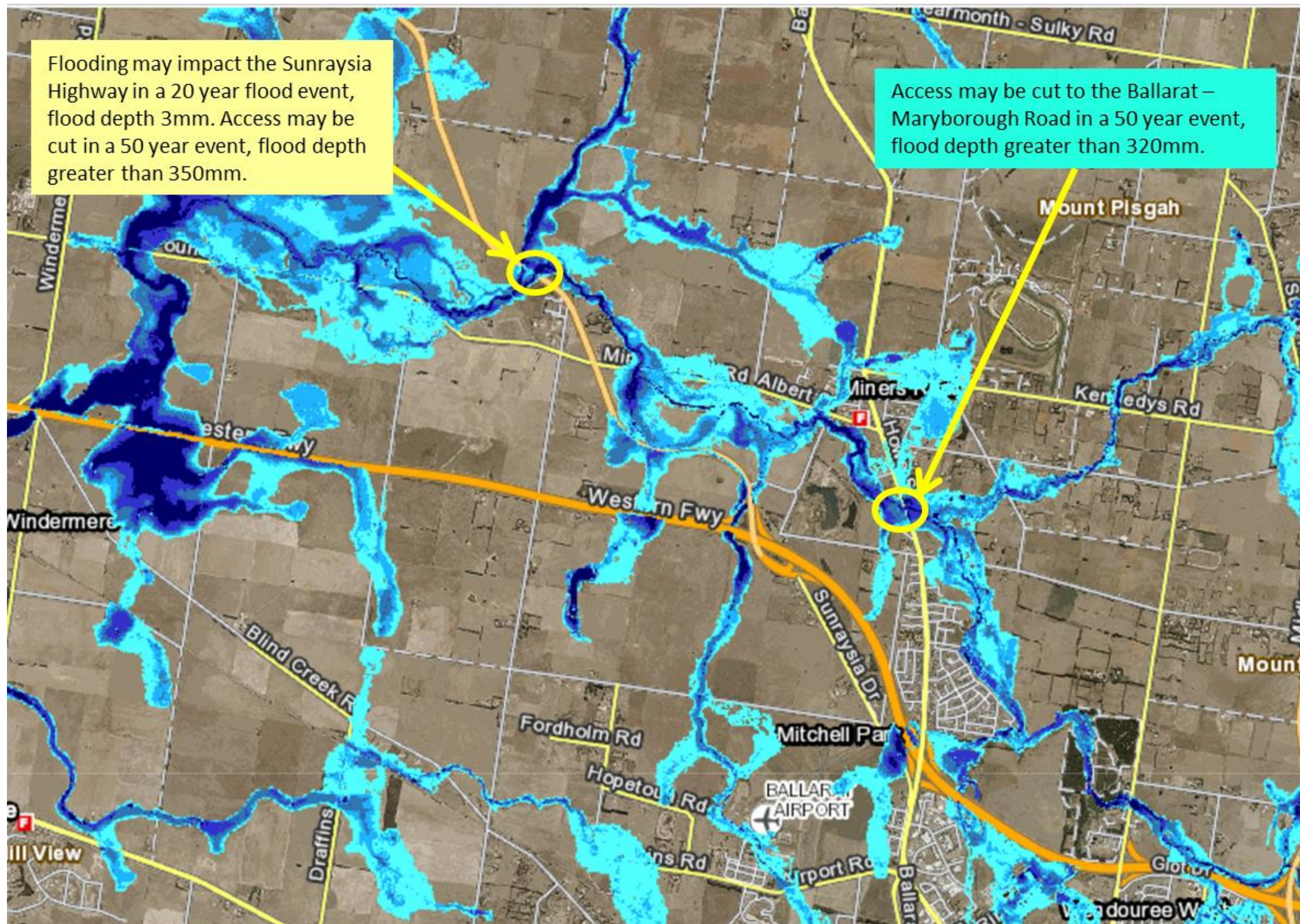
For more detailed information regarding buildings and roads impacted refer to the Miners Rest Flood Intelligence Card and flood damages/impact maps below. Also refer to the Miners Rest flood depth maps in **Appendix F**, a list of flood observers in **Appendix H** and community sandbag collection points in **Appendix I**.



Ballarat Airport access roads impacted by flooding over the Burrumbeet Creek Catchment 100 year ARI flood extent.



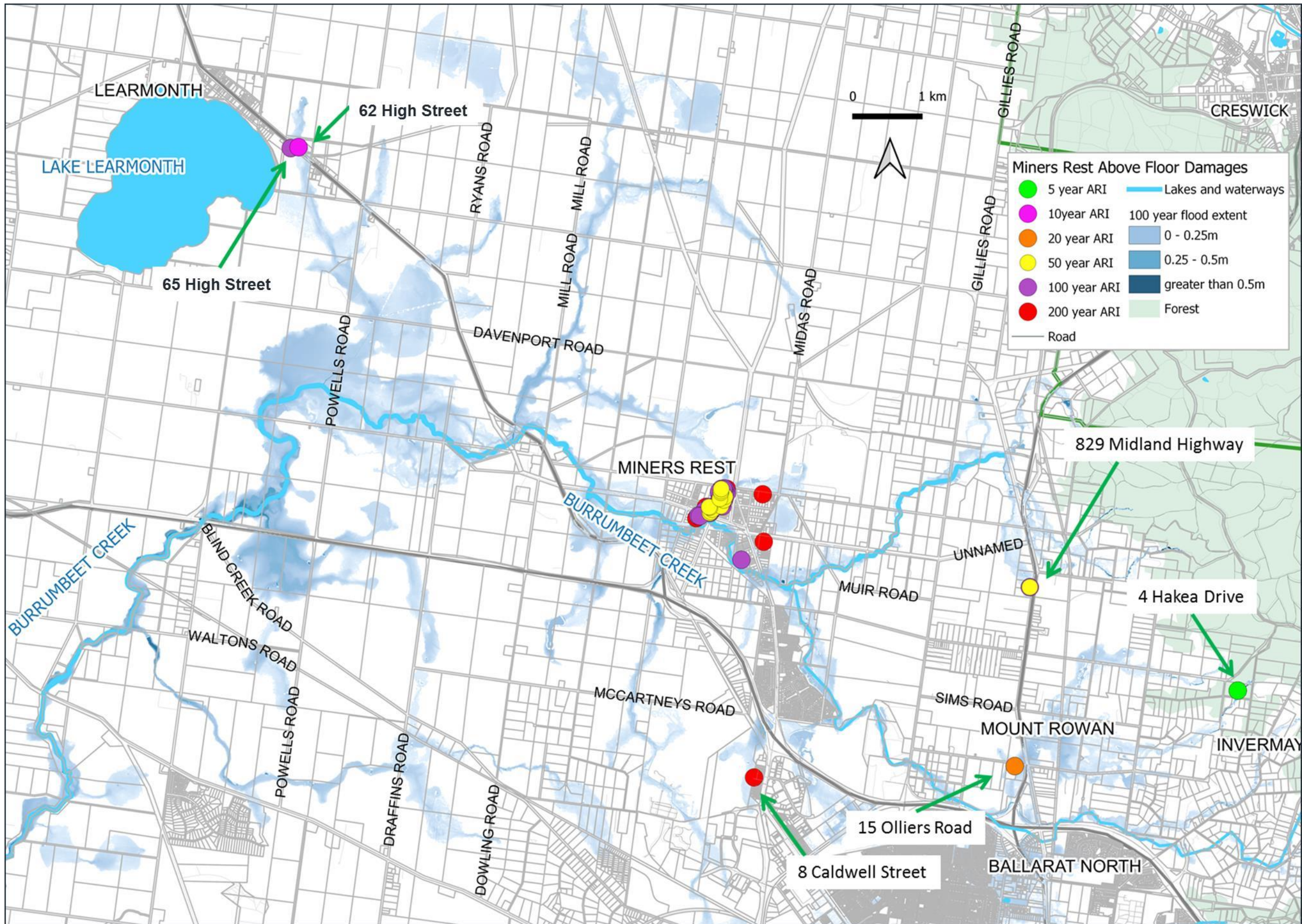
Miners Rest roads impacted by flooding with the 100 year ARI flood extent.



Main roads north of Ballarat impacted by flooding over the Burrumbeet Creek Catchment 100 year ARI flood extent.

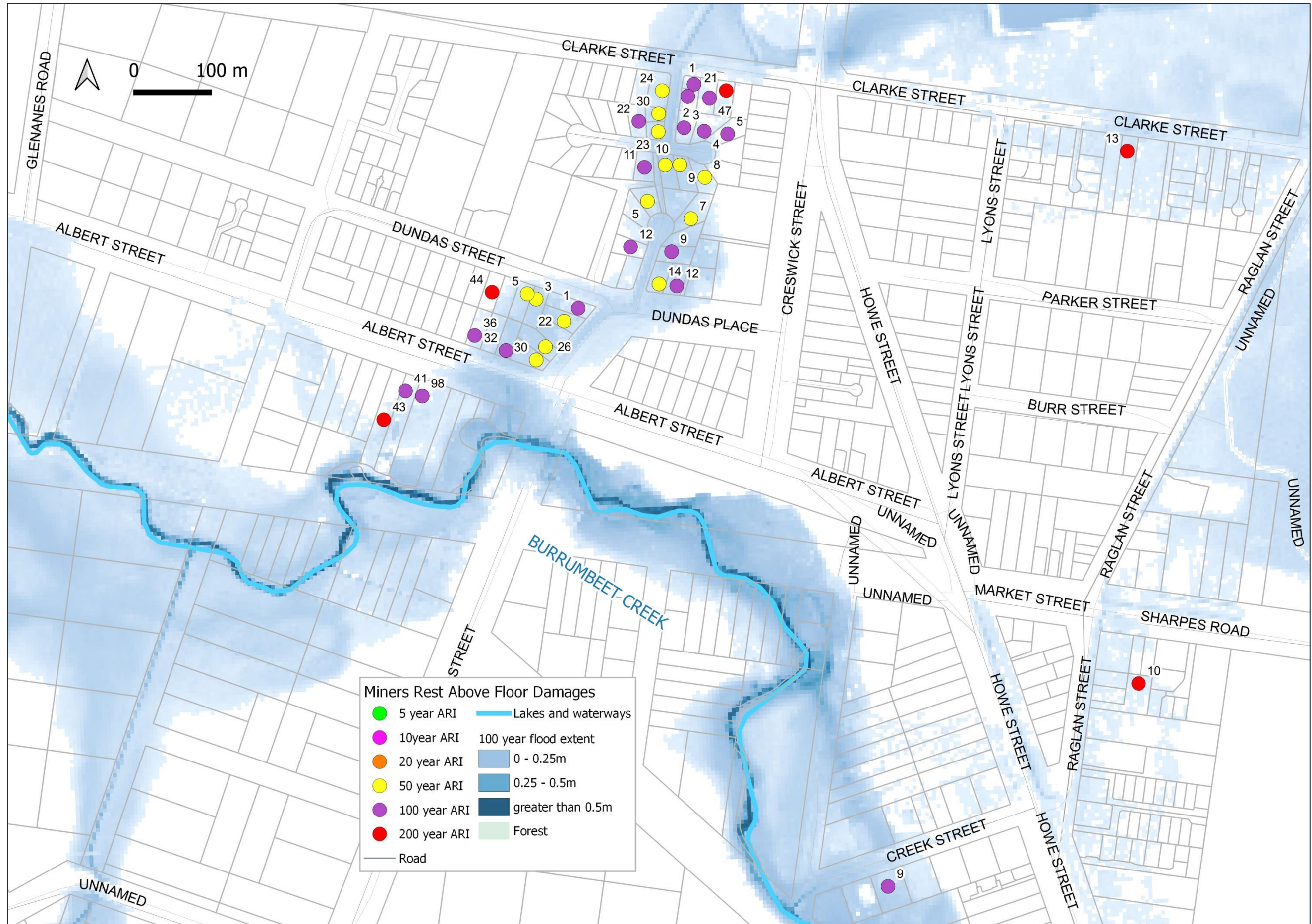
## Miners Rest and Burrumbeet Creek Catchment Flood Intelligence Card

Flood travel time					Time from start of rain to steep rise in floodwater 1.5 - 6 hours			Time from start rainfall to flood peak at Miners Rest 2.5 - 10 hours			Riverine flooding duration: 24 - 36 hours		
Observed rainfall (mm) assumes rainfall across whole catchment	Average Recurrence Interval (ARI) (Water Tech 2013)	Burrumbeet Creek at Lake Burrumbeet Design Flows (ML/d)	Burrumbeet Creek Catchment damages total number buildings flooded (above floor)	Miners Rest damages total number buildings flooded (above floor)	Consequence / Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action Actions may include (but not limited to) Evacuation, closure of road, sandbagging, issue warning and who is responsible					
~40 mm in 5 hours to ~70 mm in 48 hours	5	3,802	83 (1)	(0)	Limited flooding of urban areas along Clarke St (due to local rainfall). Limited flooding of Creek Street and Hamlin St. Ford on Victoria Street is inundated. Inundation of Garlands Road. Limited overtopping of Miners Rest Wetland and shallow inundation of a limited number of Sharpes Road and Raglan St properties	A building 4 Hakea Drive, Invermay is flooded above floor.	<b>Railway Line</b> depth 0.58m <b>Learmonth:</b> High Street depth 0m <b>Mount Rowan:</b> Olliers Road depth 0.28m <b>Miners Rest;</b> Clarke Street depth 0.11m Dundas Street/Place depth 0m James Street depth 0m Creek Street depth 0.36m	VICSES to check on residents in Creek Street, Hamlin Street and Victoria Street. VICSES activate CFA ground observers to take photos and record flood levels at key crossings.					
~45 mm in 5 hours to ~85 mm in 48 hours	10	5,443	100 (2)	(0)	Inundation of Miners Rest Road (to the west of Albert Street)	One additional building at 62 High Street, Learmonth is flooded above floor.	<b>Railway Line</b> depth 0.64m <b>Learmonth:</b> High Street depth 0m <b>Mount Rowan:</b> Olliers Road depth 0.35m <b>Miners Rest;</b> Clarke Street depth 0.17m Dundas Street/Place depth 0m James Street depth 0m Creek Street depth 0.50m	In addition to actions listed above: Council and Regional Roads Victoria to deploy road closure signs and undertake traffic management as needed.					
	September 2010 15 year event	5,961											
~60 mm in 5 hours to ~100 mm in 48 hours	20	7,690	112 (3)	(0)	Extensive ponding of surface water to the immediate south of Macarthur Park due to flows from south of the freeway (Wendouree).	One additional building at 15 Olliers Road, Mount Rowan (Caravan repair business) is flooded above floor.	<b>Railway Line</b> depth 0.70m <b>Learmonth:</b> High Street depth 0.03m <b>Mount Rowan:</b> Olliers Road depth 0.45m <b>Miners Rest;</b> Clarke Street depth 0.22m Dundas Street/Place depth 0m James Street depth 0m Creek Street depth 0.63m	In addition to actions listed above: VICSES sandbag buildings as needed. Victoria Police evacuate buildings as needed. Council clear debris from waterway crossings, drains and culvers as needed.					
~75 mm in 5 hours to ~120 mm in 48 hours	50	10,541	160 (18)	(14)	Limited inundation of Sunraysia Highway to the south and west of Miners Rest.	Additional 15 buildings flooded above floor: X5 Douglas Close (8, 9, 10, 23,23A, 24), x3 Dundas Place (14, 22, 26), X2 Dundas Street (3, 5), X2 James Court (5, 7), 30 Albert Street, 829 Midland Highway.	<b>Railway Line</b> depth 0.75m <b>Learmonth:</b> High Street depth 0.35m <b>Mount Rowan:</b> Olliers Road depth 0.56m <b>Miners Rest;</b> Clarke Street depth 0.34m Dundas Street/Place depth 0.41m James Street depth 0.47m Creek Street depth 0.81m	Refer to actions listed above.					
	January 2011 60 year event	11,232	~ 19		The embankment at Albert Street was overtopped, resulting in extensive flooding of properties in Dundas Place, James Court and Douglas Close. Miners Rest wetland overflowed causing widespread inundation of properties downstream. Approx 19 houses were flooded.			Refer to actions listed above.					
~85 mm in 5 hours to ~140 mm in 48 hours	100	13,392	178 (36)	(31)	Overtopping of wetland low flow outlet and inundation of properties along Raglan St and Sharpes Road. Extensive flooding of Creek Street and Hamlin St. Ford on Victoria Street is inundated. Overtopping of Albert St and inundation of Dundas Place, James Court and Douglas Close. Inundation of Howe St. Extensive inundation of Miners Rest Road (to the west of Albert Road)	Additional 18 buildings flooded above floor: X2 James Court (9, 12), 12 Dundas Place, 1 Dundas Street, 65 High Street, 47 Clarke Road, 9 Creek Street, X4 Albert Street (32, 36, 41, 98,) X7 Douglas Close (1, 2, 3, 4, 5, 11, 22)	<b>Railway Line</b> depth 0.79m <b>Midland Highway</b> depth 0.10m <b>Learmonth:</b> High Street depth 0.49m <b>Mount Rowan:</b> Olliers Road depth 0.68m <b>Miners Rest;</b> Clarke Street depth 0.47m Dundas Street/Place depth 0.56m James Street depth 0.67m Creek Street depth 0.99m	Refer to actions listed above.					
	200	15,638	187 (40)	(36)	Overtopping of Miners Rest Wetland southern spillway does not produce significant flooding.	Additional 4 buildings flooded above floor: 44 Dundas Street, 21 Clarke Road, 43 Albert Street, 8 Caldwell Street	<b>Railway Line</b> depth 0.83m <b>Midland Highway</b> depth 0.21m <b>Learmonth:</b> High Street depth 0.61m <b>Mount Rowan:</b> Olliers Road depth 0.81m <b>Miners Rest;</b> Clarke Street depth 0.52m Dundas Street/Place depth 0.63m James Street depth 0.77m Creek Street depth 1.03m	Refer to actions listed above.					



Miners Rest and Burrumbeet Creek Catchment 100 year ARI flood extent and above floor.





Miners Rest 100 year ARI flood extent and above floor building damages for a range of flood magnitudes (Water Technology 2013).

## Miners Rest and Burrumbeet Creek Catchment Property Inundation Table (Water Technology 2013)

Colours used in the property table below are the same used in the Miners Rest and Burrumbeet Creek Catchment above floor damages map above. Green, buildings flooded above floor in a 5 year ARI flood event. Pink, buildings flooded above floor in a 10 year ARI flood event, etc.

ID	Address	Depth of known building over-floor flooding for each ARI event (m)						Depth of known building over-floor flooding for each ARI event (m)						Building type and comments
		5	10	20	50	100	200	5	10	20	50	100	200	
1	4 Hakea Drive	3.89	3.94	4.06	4.15	4.25	4.33	0.2	0.23	0.3	0.39	0.44	0.49	Residential
2	36 - 62 High Street	0.97	1.01	1.08	1.14	1.18	1.23		0.07	0.15	0.21	0.25	0.31	Residential
3	15 Olliers Road	1	1.1	1.19	1.29	1.4	1.51			0.07	0.12	0.24	0.38	Ballarat Caravan Repairs
4	9 Douglas Close				0.44	0.68	0.78				1.64	1.88	1.98	House - brick veneer
5	23A Douglas Close				0.37	0.58	0.67				1.64	1.84	1.93	House - brick veneer
6	23 Douglas Close				0.34	0.56	0.65				1.59	1.81	1.9	House - brick veneer
7	5 James Court				0.31	0.51	0.61				1.44	1.65	1.75	House - brick veneer
8	24 cnr Douglas Cl/Clarke Rd				0.34	0.54	0.63				1.44	1.64	1.72	House - brick veneer
9	8 Douglas Close				0.33	0.58	0.67				1.3	1.55	1.64	House - brick veneer
10	3 Dundas Street				0.63	0.75	0.81				0.26	0.38	0.45	Residential
11	10 Dundas Close				0.48	0.72	0.82				0.22	0.46	0.56	Residential
12	22 Dundas Place				0.58	0.69	0.75				0.2	0.31	0.36	Residential
13	26 Dundas Place				0.49	0.61	0.68				0.18	0.3	0.37	Residential
14	7 James Court				0.42	0.61	0.71				0.13	0.32	0.42	Residential
15	14 Dundas Place				0.49	0.68	0.78				0.09	0.28	0.38	Residential
16	30 Albert Street				0.52	0.65	0.72				0.09	0.22	0.29	Residential
17	829 Midland Highway	0.68	0.71	0.75	0.81	0.85	0.89				0.08	0.12	0.15	Residential
18	5 Dundas Street				0.46	0.58	0.65				0.06	0.18	0.24	Residential
19	11 Douglas Close				0.26	0.5	0.59					1.62	1.71	House - brick veneer
20	4 Douglas Close				0.3	0.54	0.64					1.52	1.61	House - brick veneer
21	3 Douglas Close				0.35	0.59	0.68					1.48	1.58	House - brick veneer
22	47 Clarke Road					0.11	0.2					1.46	1.54	House - brick veneer
23	1 Douglas Close					0.21	0.28					1.46	1.53	House - brick veneer
24	12 James Court					0.18	0.31					1.41	1.53	House - brick veneer
26	2 Douglas Close				0.03	0.22	0.33					1.38	1.48	House - brick veneer
27	22 Douglas Close					0.24	0.33					1.38	1.47	House - brick veneer
29	36 Albert Street				0.15	0.31	0.38					1.17	1.24	House - weatherboard - portable
30	98 Albert Street	0.36	0.67	0.88	1.07	1.15	1.2					1.17	1.2	House - weatherboard
31	5 Douglas Close				0.18	0.51	0.58					1.12	1.2	House - brick veneer
33	41 Albert Street		0.32	0.53	0.73	0.81	0.87					0.87	0.96	House - hardiplank
34	12 Dundas Place				0.35	0.55	0.65					0.18	0.28	Residential
35	9 Creek Street		0.35	0.53	0.77	0.9	1.01					0.15	0.25	Residential - within 25mm of floor Jan11
36	9 James Court				0.55	0.75	0.85					0.13	0.23	Residential
37	32 Albert Street				0.63	0.77	0.84					0.14	0.21	Residential
38	65 - 67 High Street	0.72	0.8	0.88	0.94	0.98	1.04					0.09	0.15	Residential
39	1 Dundas Street				0.52	0.64	0.7					0.1	0.14	Residential

ID	Address	Depth of known building over-floor flooding for each ARI event (m)						Depth of known building over-floor flooding for each ARI event (m)						Building type and comments	
		5	10	20	50	100	200	5	10	20	50	100	200		
25	44 Dundas Street					0.11	0.18							1.49	House - brick veneer
28	21 Clarke Road					0.17	0.28							1.4	House - brick veneer
32	43? Albert Street				0.47	0.58	0.63							1.16	House - brick veneer
40	8 Caldwell Street	0.35	0.39	0.43	0.48	0.52	0.56							0.12	Residential

# 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.

## 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/ REGIONAL ROADS 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.

Landing zones for helicopters are located at:

- Ballarat Airport (if access is not cut by flooding)
- Ballarat Base Hospital

Special needs groups will be/are identified in Council's 'vulnerable persons register'. This can be done through community network organisations.

## 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

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 compounds will be established for domestic pets and companion animals of evacuees.

## **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.

# Appendix E: 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.

	<p><b>EMERGENCY ALERT</b></p> <p>As required, subject to individual circumstances, weather conditions, potential impacts and duration.</p> <p>Refer VICSES SOP057.</p>	<p>As required, based on conditions, changed conditions or impacts of the flood event.</p> <p>Circumstances which warrant the use of EA include:</p> <ul style="list-style-type: none"> <li>• EA is likely to contribute to saving lives and property</li> <li>• EA is likely to be the most effective way to warn the community in an actual or likely emergency</li> <li>• Alternative channels have been considered and alone may not achieve objectives</li> <li>• Time is of the essence and specific action following the receipt of the warning is required</li> </ul> <p>The message is of critical importance and needs to be delivered to a specific geographic area</p>
<p><b>Pre-populated Ballarat Emergency Alert key messages for a severe flash flood event</b></p> <p>High velocity floodwater may cause risk to life for pedestrians and motorist.          Access to main roads may be cut.          Advise to shelter in place if it is safe to do so.          The flood peak is likely to pass within 4 to 6 hours.</p>		

	<p><b>EMERGENCY ALERT</b></p> <p>As required, subject to individual circumstances, weather conditions, potential impacts and duration.</p> <p>Refer VICSES SOP057.</p>	<p>As required, based on conditions, changed conditions or impacts of the flood event.</p> <p>Circumstances which warrant the use of EA include:</p> <ul style="list-style-type: none"> <li>• EA is likely to contribute to saving lives and property</li> <li>• EA is likely to be the most effective way to warn the community in an actual or likely emergency</li> <li>• Alternative channels have been considered and alone may not achieve objectives</li> <li>• Time is of the essence and specific action following the receipt of the warning is required</li> </ul> <p>The message is of critical importance and needs to be delivered to a specific geographic area</p>
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**Pre-populated Ballarat Emergency Alert key messages for a severe flash flood event**

The BOM have issued a Severe Weather Warning: Heavy Rain

Heavy rainfall forecast by the BOM may lead to Flash Flooding **???**. Falls are expected to be between **???**mm and **???**mm. Locally heavier falls are possible due to a embedded thunderstorms that could cause severe flooding.

Locations which may be affected could include: Miners Rest, Ballarat CBD, Sebastopol, Redan, Lucas, Alfredton, Newington. Bonshaw, Delacombe, Eureka, Ballarat East, Canadian, Mount Pleasant, Ballarat North, Invermay,

Widespread flooding may occur.

Keep clear of creeks and storm drains

Stay clear of fast moving floodwater. Floodwater is expected to rise quickly and will cause risk to life for pedestrians and motorist.

Flooding may cause extensive inundation of buildings.

Properties are likely to be isolated. If your property is impacted by flooding, we advise you to shelter in place if it is safe to do so.

The flood peak is likely to pass quickly, within 4 to 6 hours from the start of rainfall.

Floodwater may cut access to main roads, avoid driving until the storm and floodwater has subsided.

Waterways likely to be affected include:

- Yarrowee River
- Gnarr Creek
- Canadian Creek
- Burrumbeet Creek
- Woody Yaloak River
- Kensington Creek
- Bonshaw Creek
- Redan Creek

SES advises that all community members should:

Never walk, ride or drive through floodwater, Never allow children to play in floodwater, Stay away from waterways and stormwater drains during and after heavy rain, Keep well clear of fallen power lines Be aware that in fire affected areas, rainfall run-off into waterways may contain debris such as ash, soil, trees and rocks, and heavy rainfall increases the potential for landslides and debris across roads.

**For emergency assistance contact the SES on 132 500.**

Current Road and Traffic Information is available at the VicRoads website: <http://traffic.vicroads.vic.gov.au>

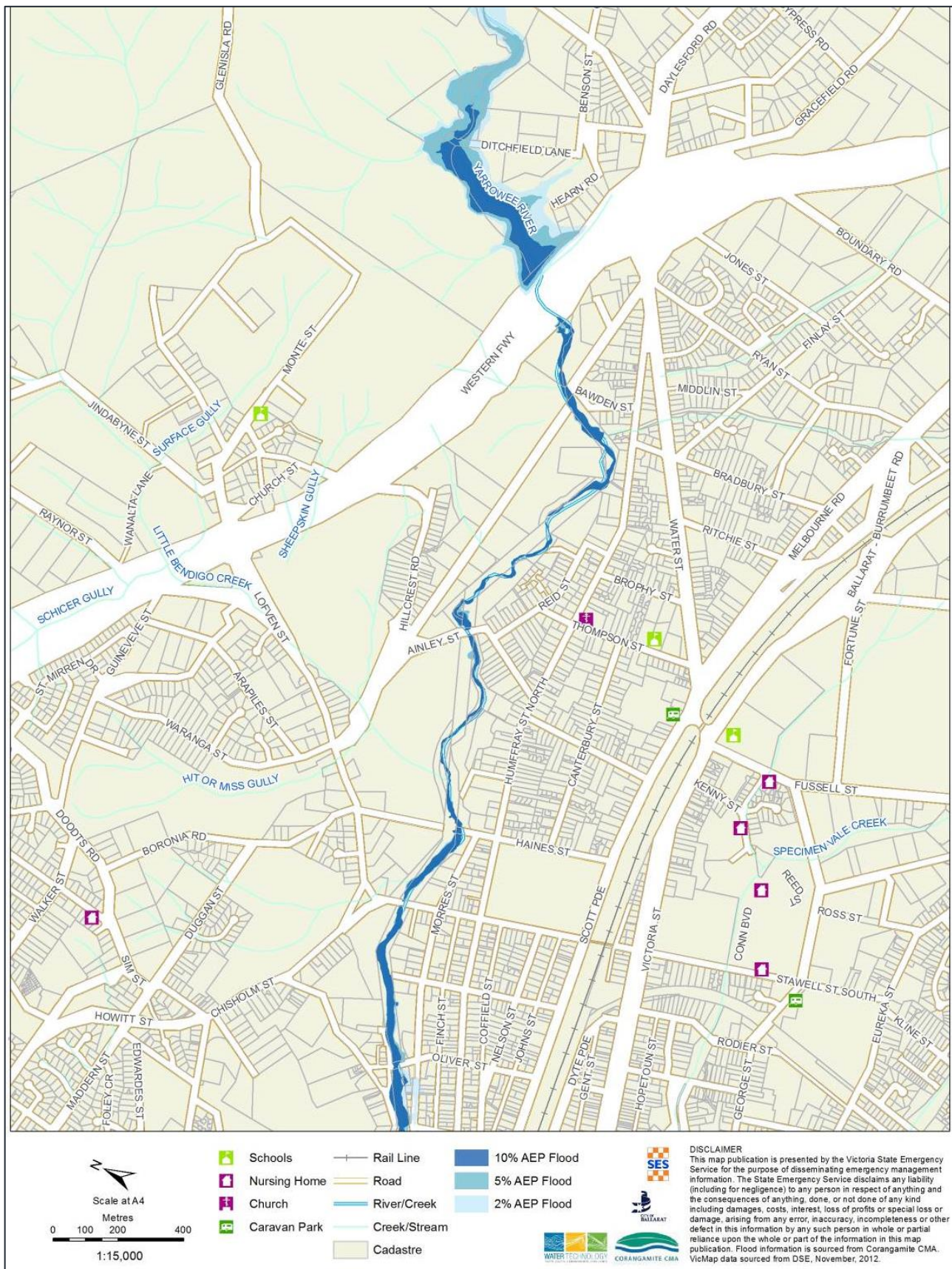
Weather Forecast:

For the latest weather forecast see <http://www.bom.gov.au/vic/forecasts/>

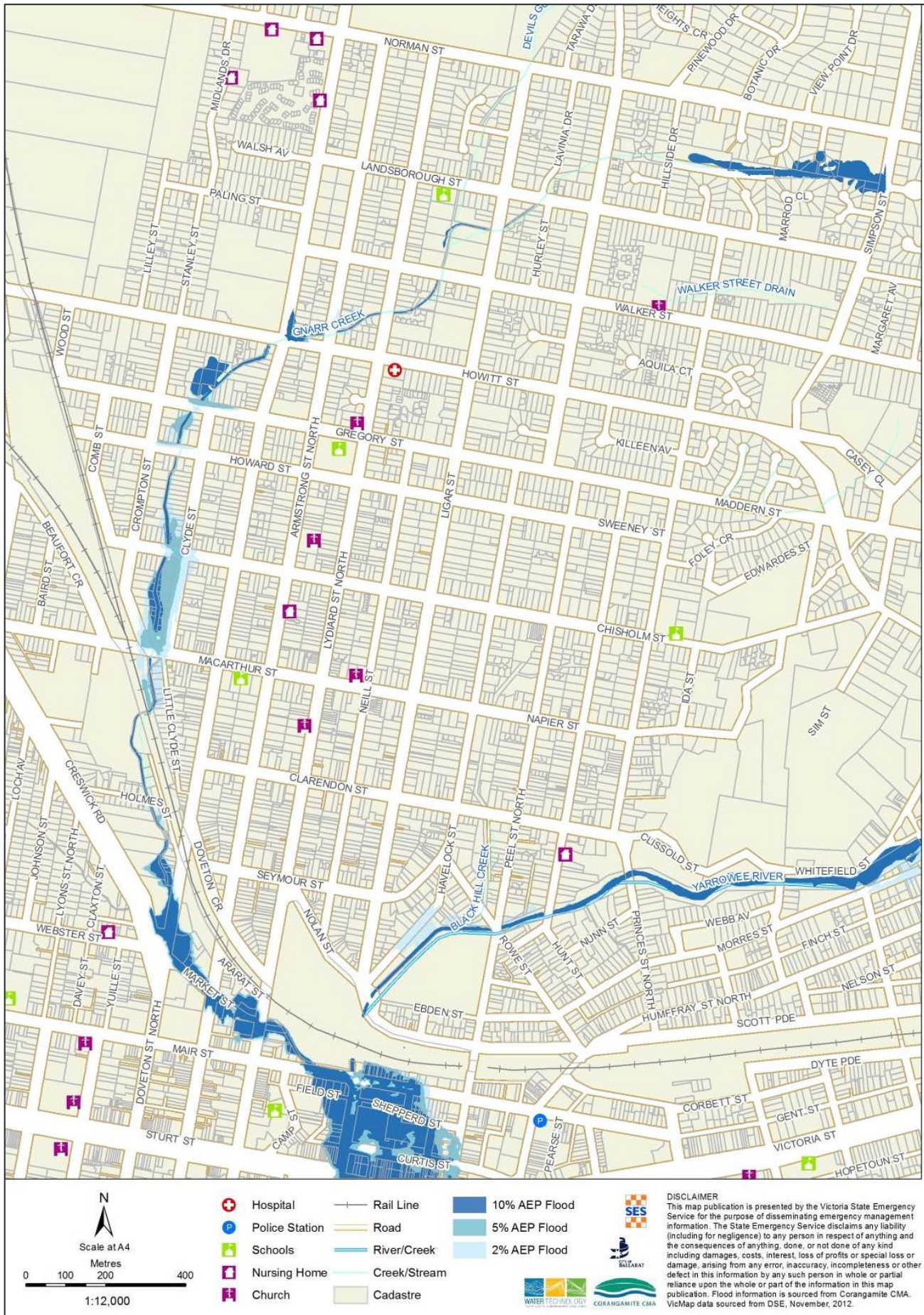


# Appendix F: Flood Maps

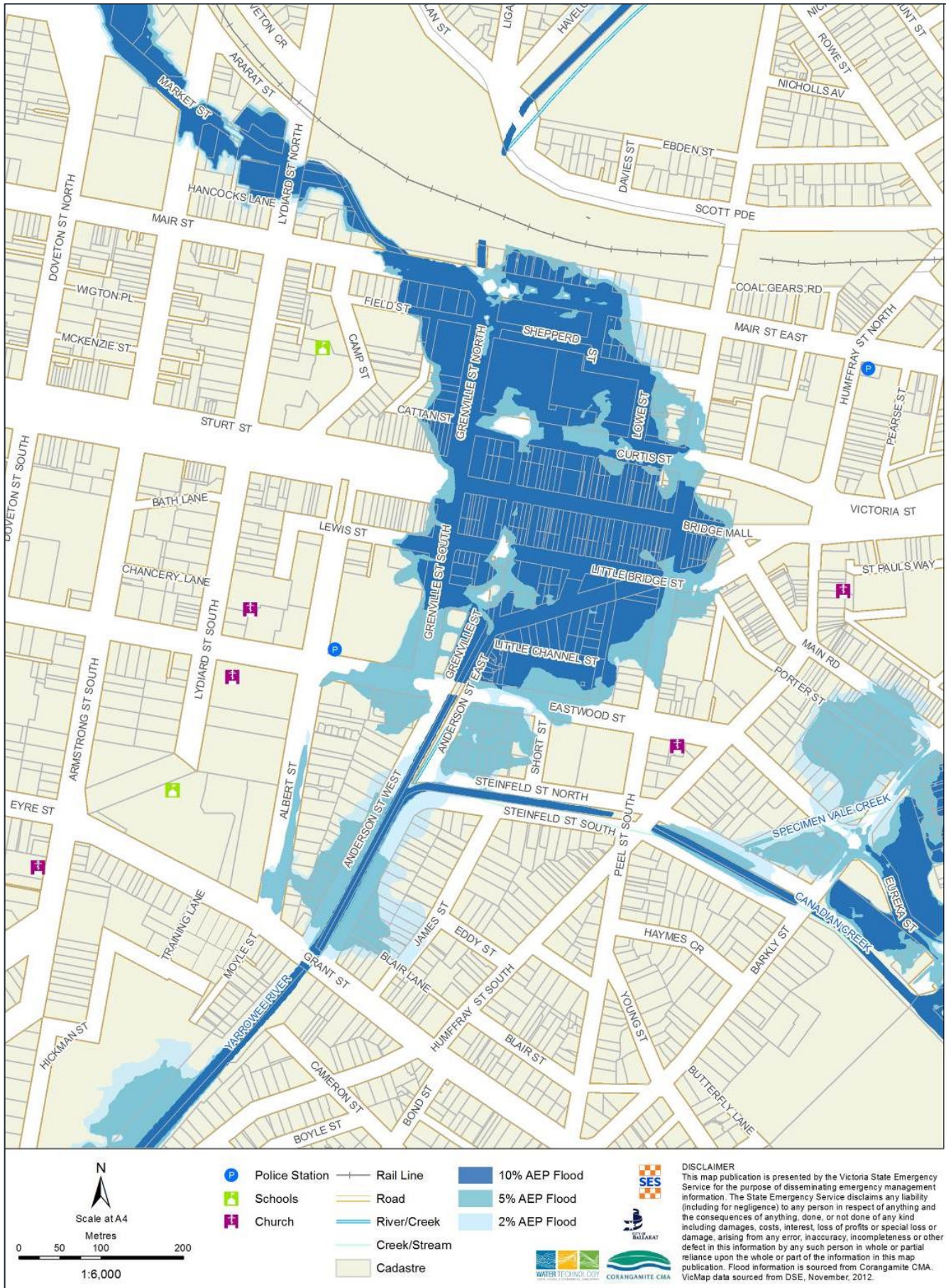
## 1.1. Ballarat Central Flood Extent Maps. Brown Hill (Upper Yarrowee River) 10, 20 and 50 year ARI flood extent map (Water Technology 2015).



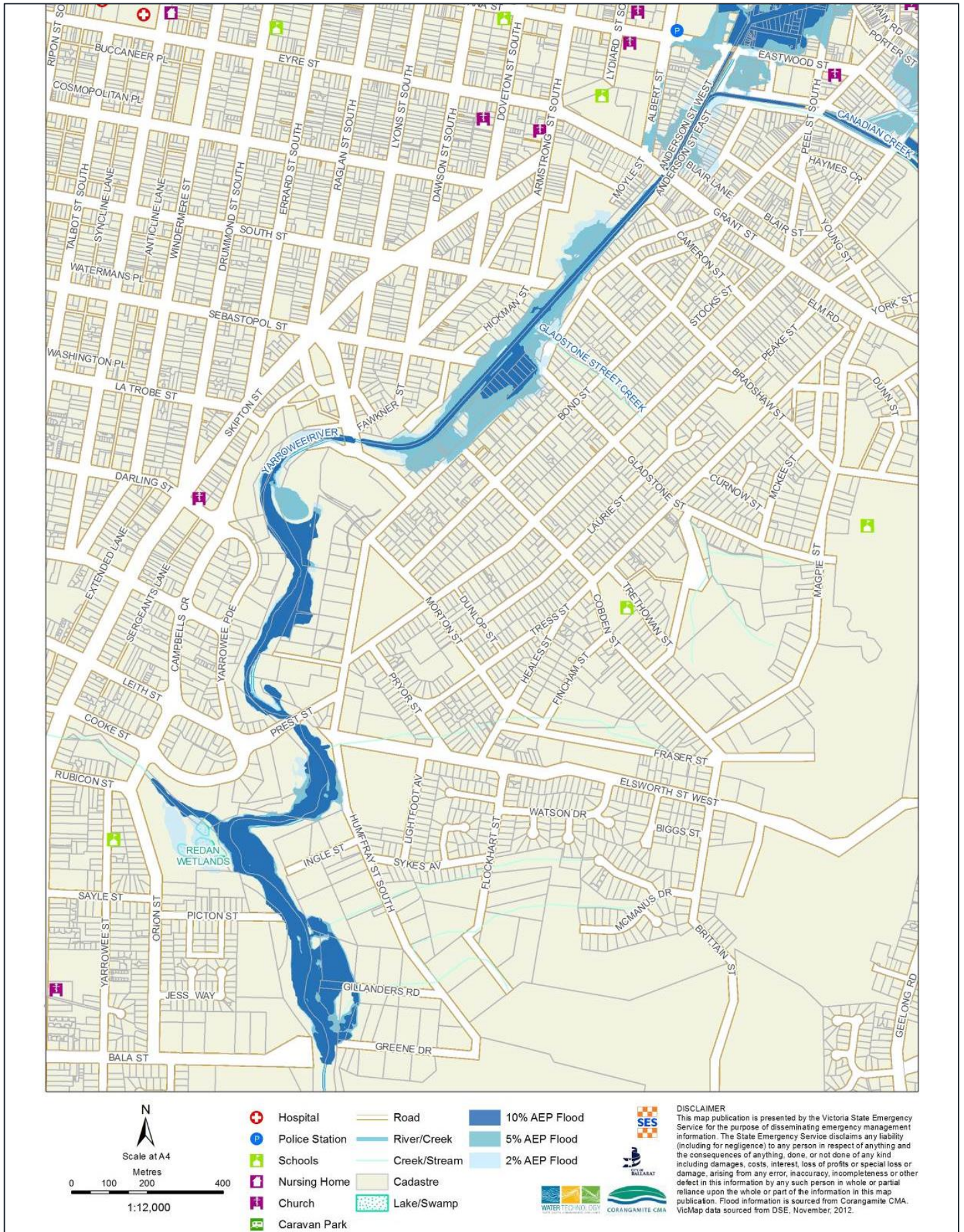
Ballarat North (Gnarr Creek) 10, 20 and 50 year ARI flood extent map (Water Technology 2015).



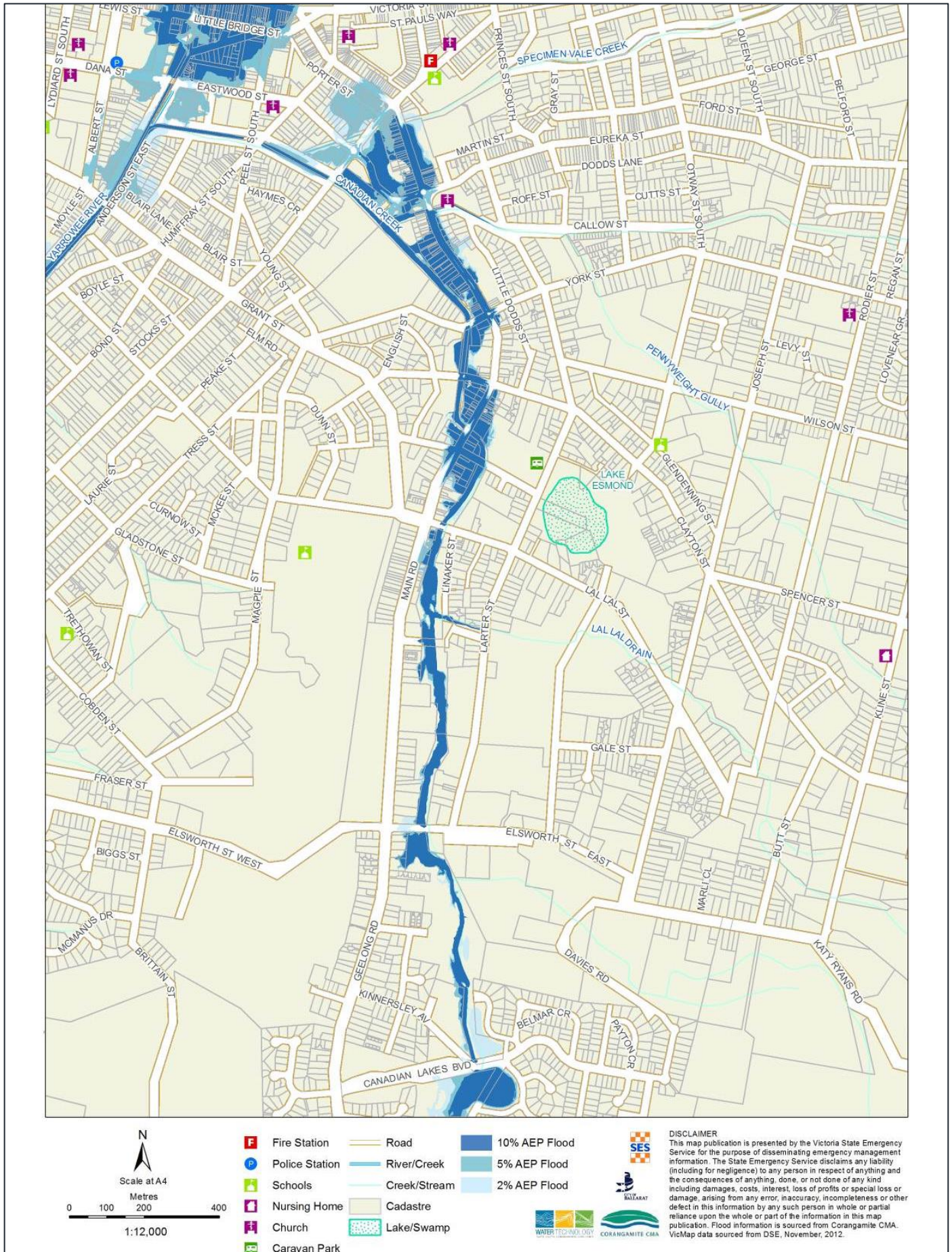
Ballarat Central (Yarrowee River, Canadian Creek and Gnarr Creek) 10, 20 and 50 year ARI flood extent map (Water Technology 2015).



Ballarat Central and Mount Pleasant (Yarrowee River, downstream of the Ballarat CBD) 10, 20 and 50 year ARI flood extent map (Water Technology 2015).



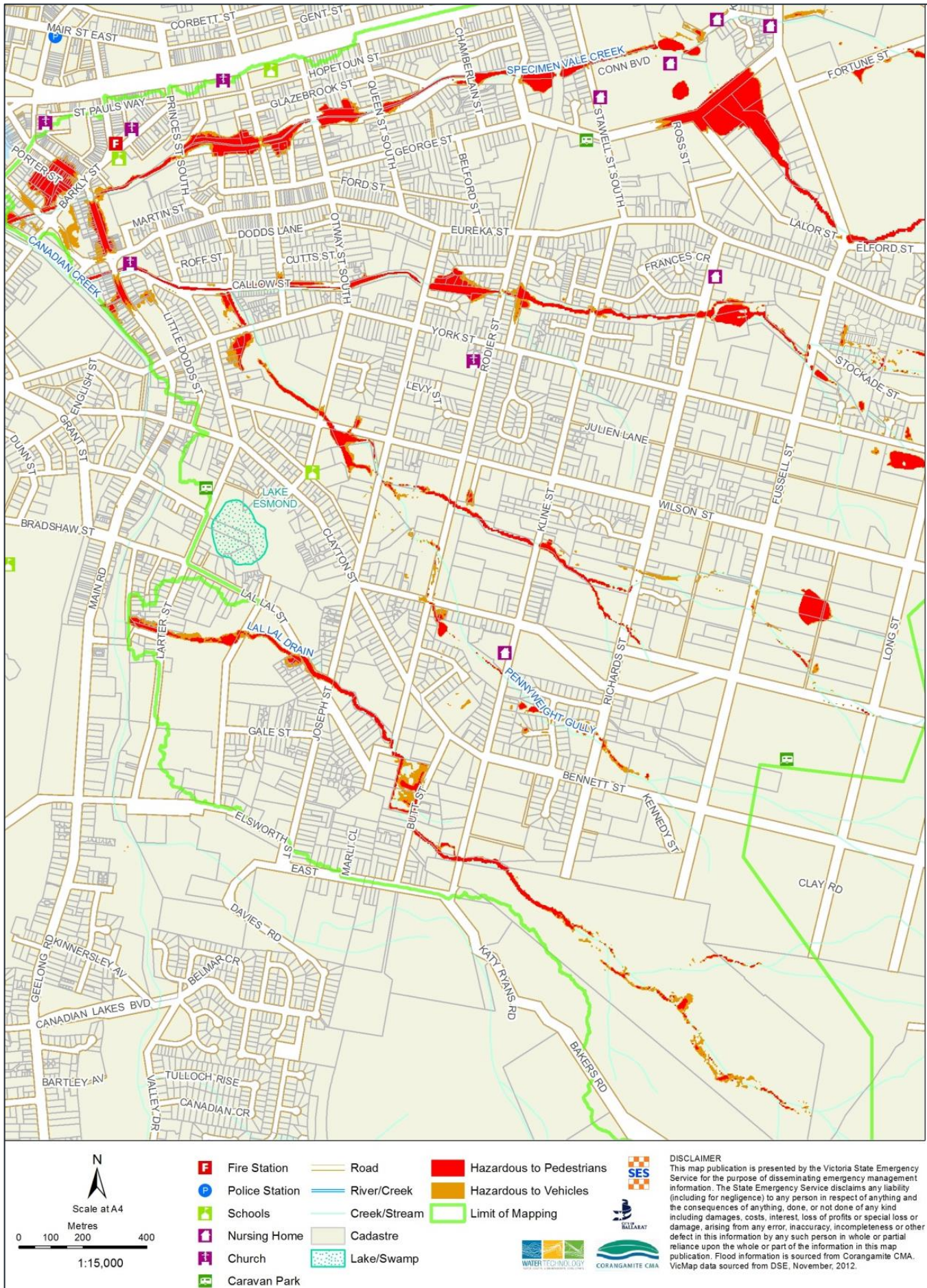
Ballarat Central and Golden Point (Canadian Creek) 10, 20 and 50 year ARI flood extent map (Water Technology 2015).



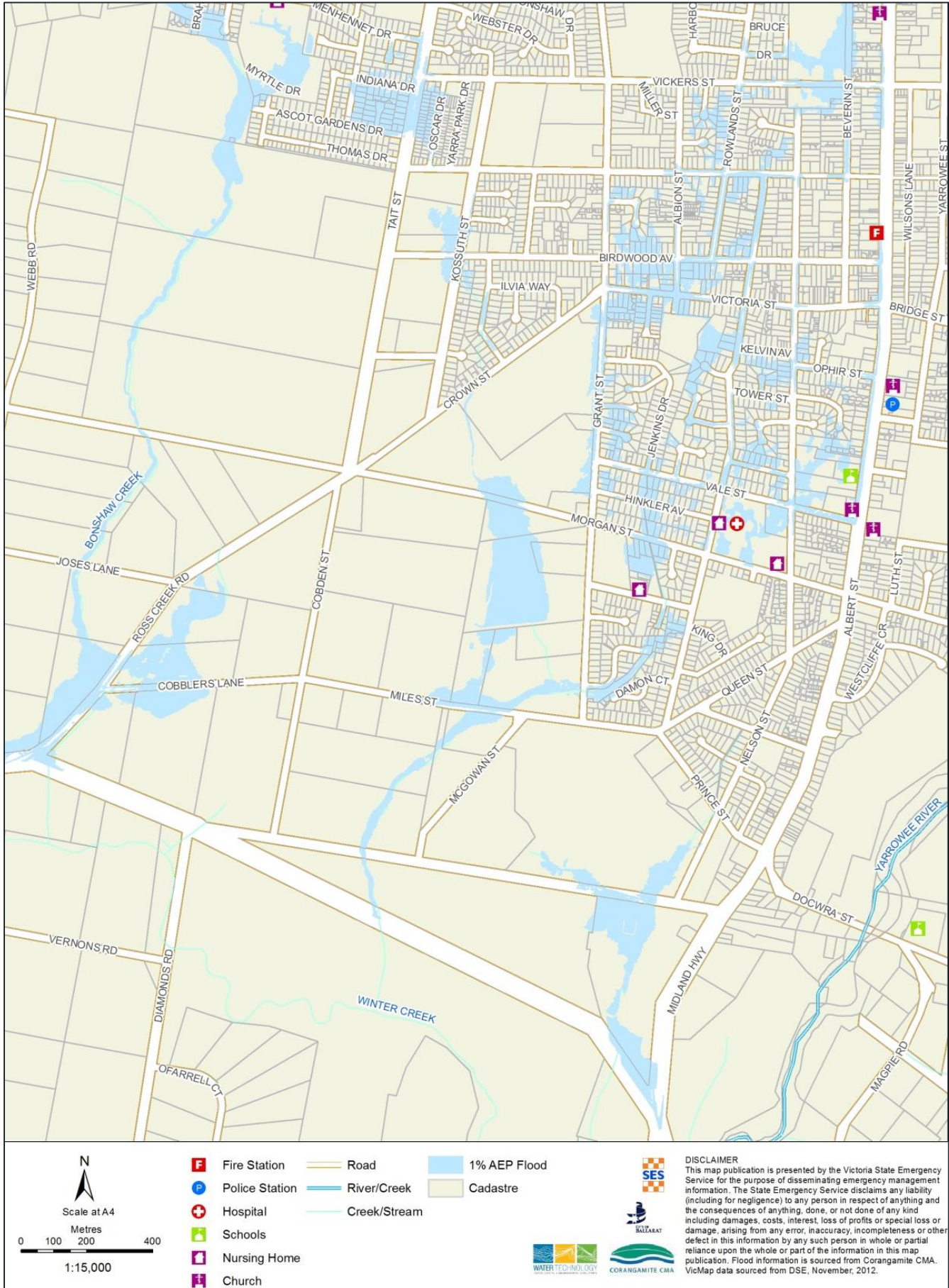
**1.2. Ballarat East Flood Extent Maps.** Canadian Creek tributaries 10, 20 and 50 year ARI flood extent map (Water Technology 2013).



Canadian Creek tributaries hazard map (Water Technology 2013).

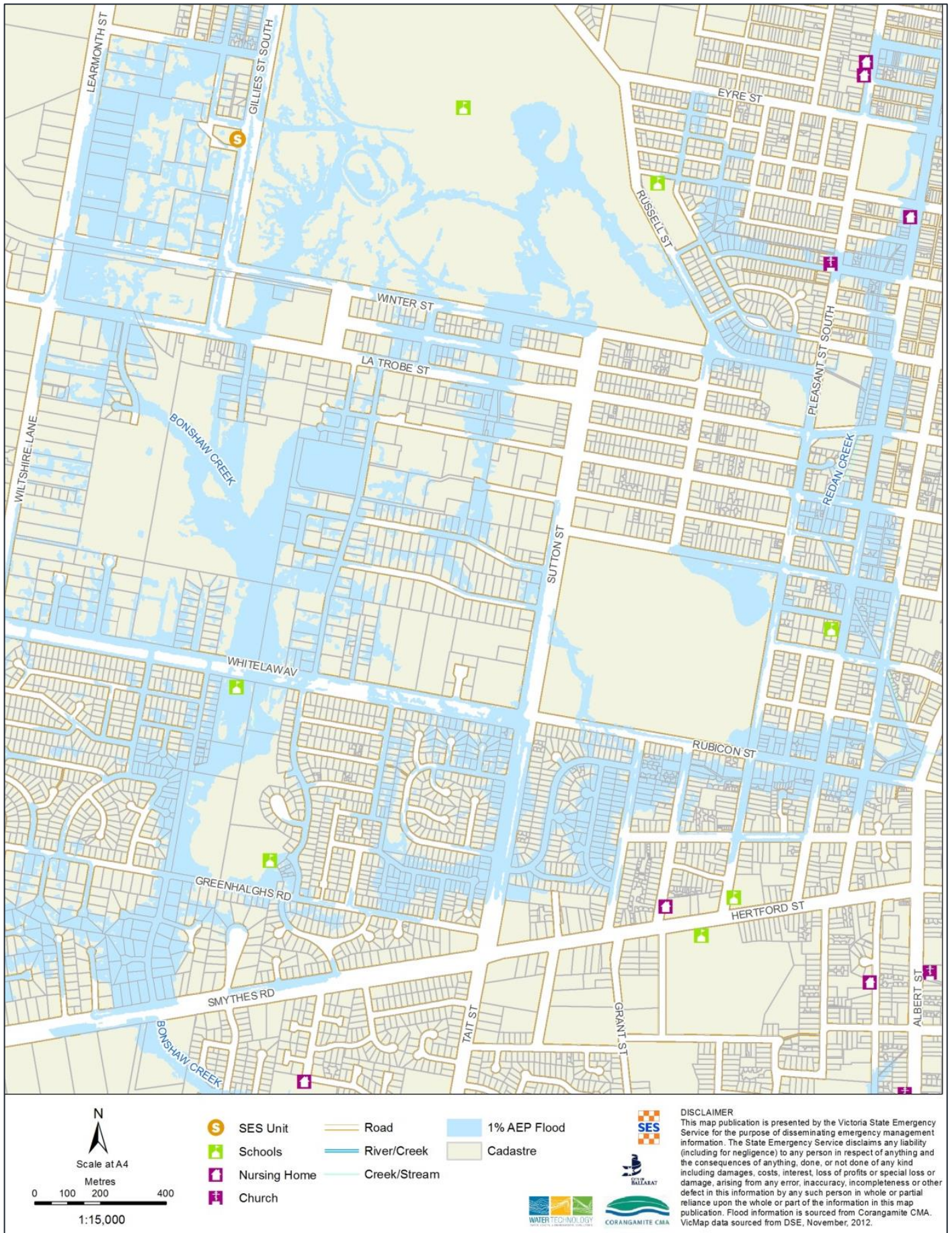


**1.3. Ballarat West Flood Extent Maps.** Sebastopol and Bonshaw (Bonshaw Creek) 100 year ARI flood extent map (Water Technology 2015).

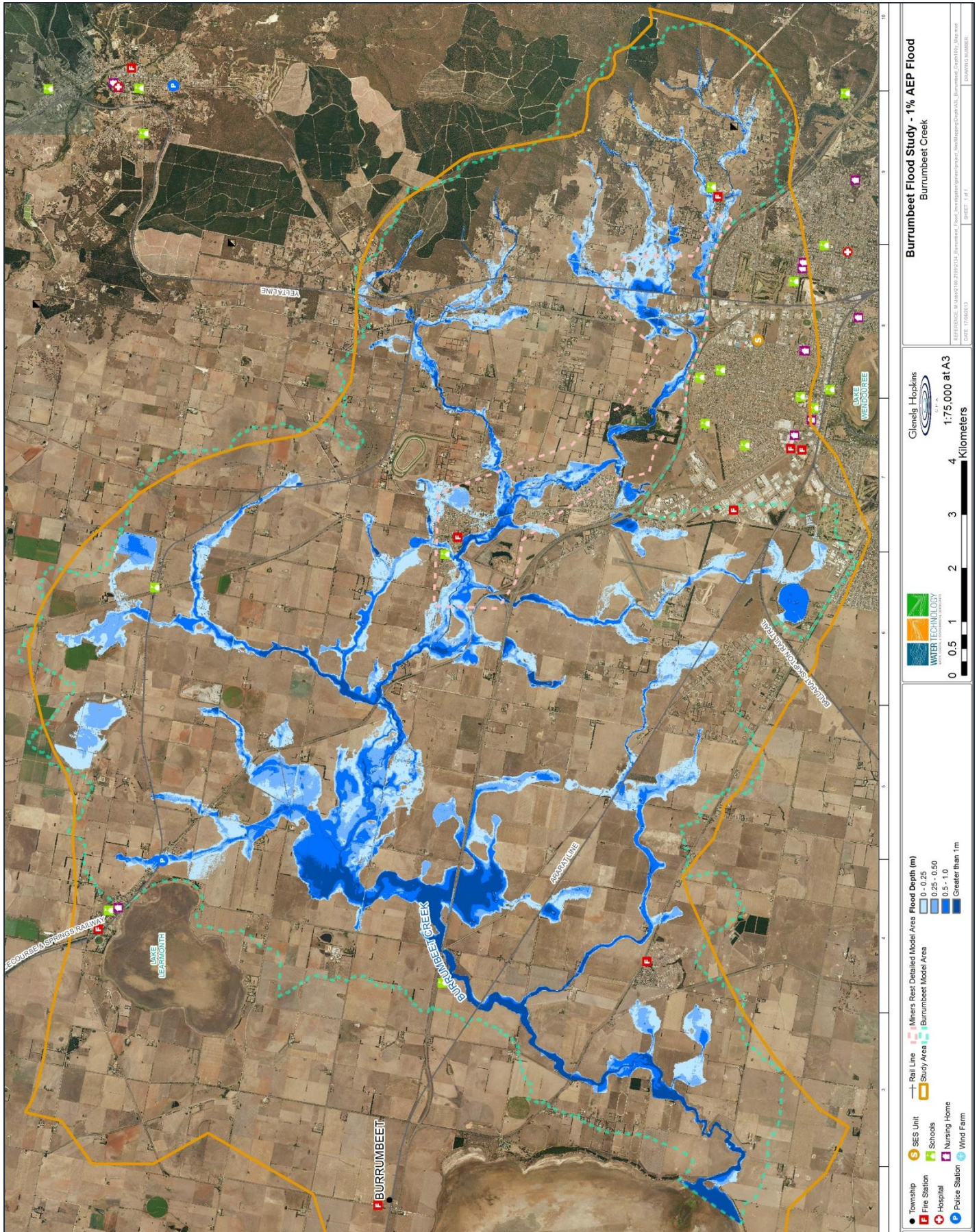




Delacombe and Redan (Bonshaw Creek) 100 year ARI flood extent map (Water Technology 2015).



1.4. **Miners Rest Flood Depth Map.** Burrumbeet Creek 100 year ARI flood depth map (Water Technology 2013)



## Appendix G: Local flood information

There have been three Local Flood Guides developed for the City of Ballarat Region;

- Refer to the link below for the Central Ballarat Local Flood Guide Casterton  
<https://www.ses.vic.gov.au/documents/112015/134591/2016+Ballarat+CBD+LFG+WEB+24+JANUAR+Y+2017.pdf/ee335757-fe08-4a41-ad74-f4582edf3399>

**SES** Local Flood Guide **FloodSafe**  
**Ballarat Central Business District**

Flood information for the Gnarr Creek and Yarrowee River at Ballarat Central Business District

Lydiard Street North, December 1991 (Photo courtesy of Ian Wilson)

BALLARAT CBD

CITY OF BALLARAT

CORANGAMITE CMA

VICTORIA State Government

FLOOD STORM EMERGENCY 132 500

For more information visit [ses.vic.gov.au](https://www.ses.vic.gov.au)

- Refer to the link below for the Ballarat East Local Flood Guide  
<https://www.ses.vic.gov.au/documents/112015/134591/Ballarat+East+Local+Flood+Guide.pdf/651ba213-2bfc-469e-9031-8f8e51ff77fc>

**SES** Local Flood Guide **FloodSafe**  
**Ballarat East**  
 Flood information for Canadian Creek and tributaries

Pennyweight Gully at Canadian Lead Primary School, Jan 2011.  
 Photo courtesy of Diane Chester

BALLARAT EAST

**CITY OF BALLARAT**  
**CORANGAMITE CMA**  
**VICTORIA**  
 State Government

FLOOD STORM EMERGENCY **132 500**  
 For more information visit **ses.vic.gov.au**

- Refer to the link below for the Miners Rest Local Flood Guide  
<https://www.ses.vic.gov.au/documents/112015/134591/EMPC-LFG-78+Miners+Rest+LFG+WEB/966c6c08-0d53-4251-a3f3-4d436041093c>

**SES** Local Flood Guide **FloodSafe**  
**Miners Rest**

Flood information for the Burrumbeet Creek at Miners Rest

MINERS REST

**CITY OF BALLARAT**

Glenelg Hopkins  
 C M A  
*Protecting our future - Naturally*

**VICTORIA**  
 State Government

FLOOD STORM EMERGENCY **132 500**

For more information visit **ses.vic.gov.au**

## Appendix H: 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. Community observers and agency staff will help support this process.

For the Ballarat City region community observers identified are:

Town	Observer Details	Community Observer Name	Contact Details
Ballarat East	Canadian Lead Primary School	Principal	5333 7170
Ballarat East	CFA Eureka Group, Region 15 Ground Observers	D15 RDO	53295500 1800 468115
Miners Rest	Miners Rest CFA, Region 15	D15 RDO	53295500 1800 468115
Ballarat (whole council area)	VICSES Unit Ballarat	Unit Duty Officer	0407 513755
Ballarat (whole council area)	Ballarat City Council	MERO	0407 453453

# Appendix I: Ballarat Community Sandbag Collection Points

Triggers to start prefilling sandbags and setting up community sandbag collection points;

- BOM flood watch has been issued for the town/catchment area
- Significant rainfall is predicted for the town/catchment area (greater than 50mm)
- BOM has high certainty the rainfall event will impact a town/catchment area listed below.
- Flooding is imminent

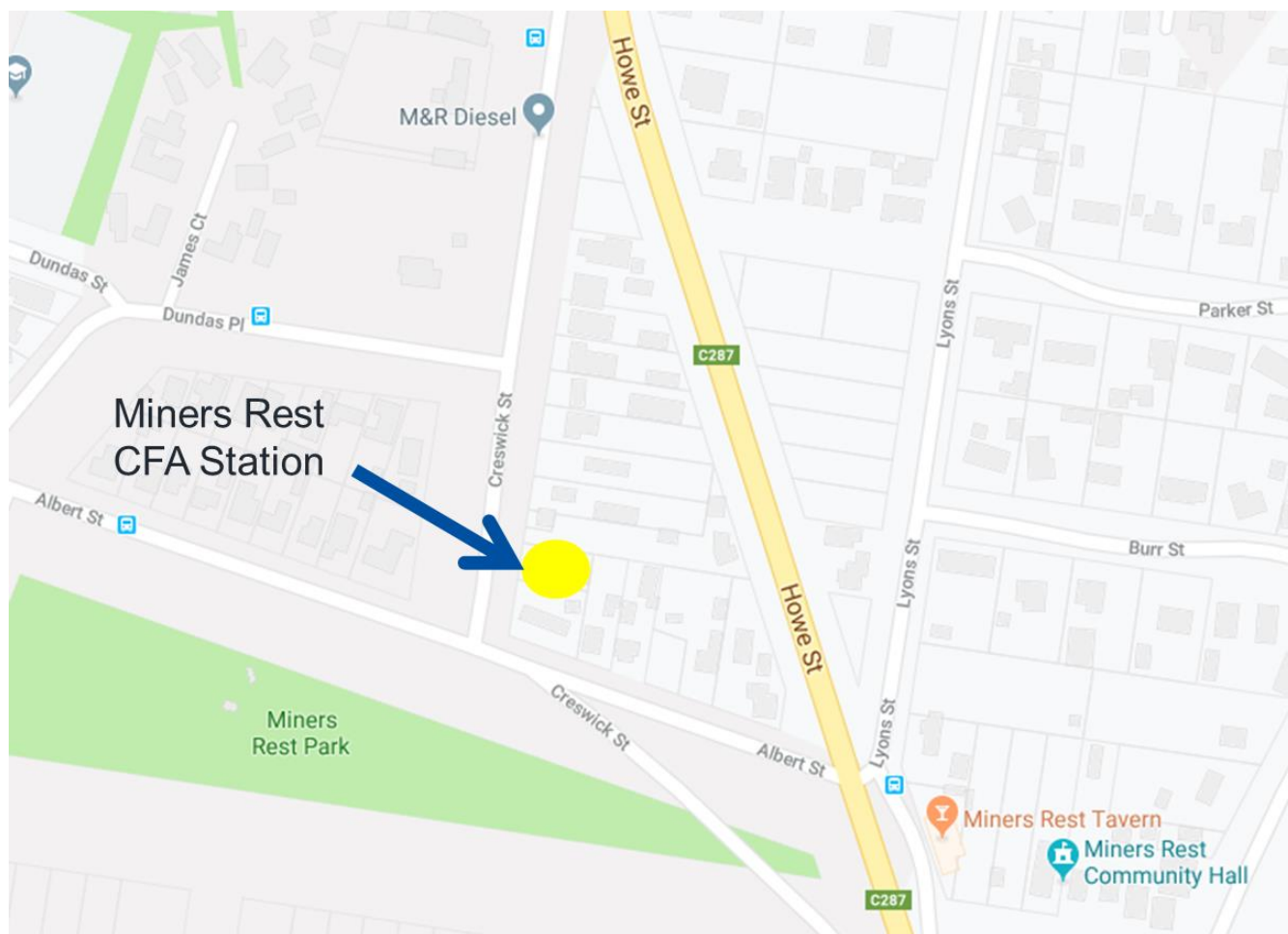
When needed community sandbag collection points will be set up at;

- Miners Rest CFA Station: 4 Creswick Street, Miners Rest.
- Ballarat VICSES: 115B Gillies Street, Ballarat.

Refer to the list below of key tasks that may be undertaken to prepare sandbag filling and community sandbag collection points.

Agency	Task Description
VICSES	Deliver sandbags to the council depot or other nominated sandbag filling point to prefill the sandbags.
City of Ballarat	Deliver sand to sandbag filling points documented below.
City of Ballarat / VICSES / CFA	Deliver prefilled sandbags either directly to buildings that need to be sandbagged or to the nominated community Sandbag collection point. Provide staff/volunteers to set up the community sandbag point. Provide staff/volunteers to distribute prefilled sandbags to the community.
City of Ballarat / VICSES	Notify the community of the location of the community sandbag collection point via local radio and social media channels.

**Miners Rest sandbag filling and community collection point:** the Miners Rest CFA Station, 4 Creswick Street, Miners Rest (refer to map and photo below).





**Ballarat sandbag filling and community collection point:** the Ballarat VICSES Unit, 115B Gillies Street, Alfredton (refer to map and photo below).



## References

City of Ballarat (2016), Flood Mitigation Strategy.

Lawson and Treloar (2003): Floodplain Management Plan for Lake Burrumbeet and Burrumbeet Creek Catchment. Report RM2049 Ver. 1.0 / J5350 prepared for Glenelg Hopkins Catchment Management Authority and Ballarat City Council, December 2003.

Water Technology (2007): Ballarat Urban Waterways Floodplain Mapping.

Water Technology (2013): Burrumbeet Flood Investigation Flood Warning Report.

Water Technology (2014): Canadian Creek Tributaries Flood Investigation.

Water Technology (2015): Ballarat Flood Modelling Update.

Water Technology (2017): Flood Risk and Opportunity Mapping Project for Ballarat.