

# Yarriambiack Shire Council

## FLOOD EMERGENCY PLAN

### A Sub-Plan of the Municipal Emergency Management Plan

For Yarriambiack Shire Council  
and

VICSES Dunmunkle, Warracknabeal, Woomelang Units

Version 2, February 2020



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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	Gavin Kelly	Draft Version
1.0	October 2019	Clare Mintern	Rewrite the report.
2.0	February 2020	Clare Mintern	Incorporate MEMPC feedback into the report.

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 Yarriambiack Shire Council website <https://www.yarriambiack.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>DELWP</b>	Department of Environment, Land, Water and Planning	<b>RDO</b>	Regional Duty Officer
<b>EMLO</b>	Emergency Management Liaison Officer	<b>SAC</b>	State Agency Commander
<b>EMMV</b>	Emergency Management Manual Victoria	<b>SBO</b>	Special Building Overlay
<b>EMT</b>	Emergency Management Team	<b>SCC</b>	State Control Centre
<b>ERC</b>	Emergency Relief Centre	<b>SDO</b>	State Duty Officer
<b>EO</b>	Executive Officer	<b>SERP</b>	State Emergency Response Plan
<b>FO</b>	Floodway Overlay	<b>SEWS</b>	Standard Emergency Warning Signal

# Part 1. Introduction

## 1.1 Approval and Endorsement

This Municipal Flood Emergency Plan (MFEP) has been prepared by VICSES, Mallee CMA and Yarriambiack Shire Council staff and with the authority of the Yarriambiack Shire Council Municipal Emergency Management Planning Committee (Yarriambiack Shire Council MEMPC) pursuant to Section 20 of the Emergency Management Act 1986 (as amended).

VICSES staff has undertaken consultation with the Yarriambiack Shire Council staff, Mallee CMA, Wimmera CMA staff and Warracknabeal, Dunmunkle and Woomelang VICSES Unit members regarding the arrangements contained within this plan.

This MFEP is a sub plan to the Yarriambiack Shire Council 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 Yarriambiack Shire Council MEMPC as a sub-plan to the MEMP.

### Approval

Stephen Warren

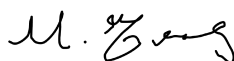
Date 7th February 2020

Grampians Mid West Region VICSES Regional Manager



### Endorsement

Michael Evans



Date 19th March 2020

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 Yarriambiack Shire Council.

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 Yarriambiack Shire Council 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), - Wimmera and Mallee
- Department of Health and Human Services (DHHS) as required,
- Department of Environment, Land, Water and Planning (DELWP) as required,
- GWMWater
- Bureau of Meteorology as required,
- Local community representatives and
- CFA D17 and D18

## 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 Yarriambiack Shire Council and Wimmera and Mallee 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

Yarriambiack Shire Council have undertaken extensive stormwater and riverine flood mitigation works in Warracknabeal, Beulah and Rupanyup. Refer Appendix C for more details regarding these flood mitigation works.

### 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 a bi-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 Yarriambiack Shire Council. 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 Yarriambiack Shire Council 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	Horsham ICC	North	Warracknabeal LHQ	Beulah	TBD as needed
Level 2-3	Horsham ICC	North	Warracknabeal LHQ	Brim	TBD as needed
Level 2-3	Horsham ICC	Central	Warracknabeal LHQ	Warracknabeal	TBD as needed
Level 2-3	Horsham ICC	South	Dunmunkle LHQ	Rupanyup	TBD as needed
Level 1	Beulah: Warracknabeal LHQ				
Level 1	Brim: Warracknabeal LHQ				
Level 1	Warracknabeal LHQ				
Level 1	Rupanyup: Dunmunkle 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 (IMSS).

### 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 Yarriambiack Shire Council, 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 Yarriambiack Shire Council 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 Yarriambiack Shire Council to assist with rescue operations:

- Flood Rescue boats are located at Stawell and Nhill Units.
- Ballarat and Ararat Units have a land based Swift Rescue Team.
- HEMS 4 Rescue helicopter is located at the Warrnambool Aerodrome. Fixed wing and helicopter airbase facilities are located at the Horsham, Warracknabeal and the Hopetoun Airfield.

### 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:

- Horsham Aerodrome, 288 Geodetic Road, north east of Horsham.
- Warracknabeal Aerodrome, along the Henty Highway, 8km south of Warracknabeal.
- Hopetoun Aerodrome, 78 Hopetoun-Aerodrome Road, north of Hopetoun.

### 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 Yarriambiack Shire 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 Yarriambiack Shire Council 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 Yarriambiack Shire Council.

### 3.12 Road Closures

Yarriambiack Shire Council 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. Yarriambiack Shire Council 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 Yarriambiack Shire Council 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 Yarriambiack Shire Council 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 Yarriambiack Shire Council is detailed in the Yarriambiack Shire Council 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 Agriculture Victoria.

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

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 Yarriambiack Shire Council

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

## 5.1 Stormwater and Riverine Flooding

Yarriambiack Shire Council is subject to both stormwater and riverine flooding. Flooding affects a large number of buildings, properties, many local and larger roads and, within urban areas as well as rural areas along the Yarriambiack Creek and Dunmunkle Creek.

The Yarriambiack Shire Council has a long history of riverine flood events. Towns impacted by riverine flooding include; Warracknabeal, Brim, Beulah, Murtoa and Rupanyup. These towns are also prone to stormwater flooding. Refer to the map below.

Flood events within the Yarriambiack Shire Council have been infrequent over the last decade. The most recent flood event was recorded in 2016, refer to a list of flood events below.

Year	Description
September 2016	Minor flooding along Yarriambiack Creek and Dunmunkle Creek.
January 2011	Major flooding along Yarriambiack Creek and Dunmunkle Creek impacting Warracknabeal, Brim, Beulah, Rupanyup. Towns impacted by stormwater flooding include Warracknabeal, Brim, Beulah, Rupanyup and Murtoa.
September 2010	Minor flooding along Yarriambiack Creek and Dunmunkle Creek.
1993	Flooding along Yarriambiack Creek and Dunmunkle Creek.
1996	Flooding along Yarriambiack Creek impacting Warracknabeal.
1992	Flooding along Yarriambiack Creek and Dunmunkle Creek.
1988	Flooding along Yarriambiack Creek impacting Warracknabeal.
1985	Flooding along Yarriambiack Creek impacting Warracknabeal.
1983	Flooding along Yarriambiack Creek impacting Warracknabeal.
1981	Significant flooding along Yarriambiack Creek impacting Warracknabeal. Minor flooding in Beulah.
1975	Flooding along Yarriambiack Creek and Dunmunkle Creek.
1974	Flooding along Yarriambiack Creek and Dunmunkle Creek.
1973	Flooding along Yarriambiack Creek impacting Warracknabeal.
1956	Flooding along Yarriambiack Creek and Dunmunkle Creek.
1916	Flooding along Yarriambiack Creek and Dunmunkle Creek.
1915	Major flooding along Yarriambiack Creek impacting Warracknabeal.
1909	About 82 mm of rain fell over the catchment during the 19 hours on the 19 <sup>th</sup> of August 1909, causing widespread flooding. The Warracknabeal Herald reported Yarriambiack Creek rose suddenly, residents on the western side of town (Warracknabeal) had to evacuate, water inundated houses to a depth of 1m to 1.3m. Boats were being rowed in the town's streets. The Horsham Times reported widespread flooding in Warracknabeal, <i>'all the residents of Woolcock, Devereux, Molyneaux and Lyle Streets have been flooded out. There are few places of the town not under water....the depth of water in some parts of the main street is 3 feet'</i> . Major flooding also occurred in Dunmunkle Creek impacting Rupanyup, floodwater was 1.4m deep across Rupanyup and flowing in a Creek 5.3km wide. At Beulah, residents built levees to save the township from flooding.



## 5.2 Major Waterways

The major waterways within the Yarriambiack Shire Council are listed in the table below.

Waterway	Description
<b>Yarriambiack Creek</b>	<p>Yarriambiack Creek is a distributary of the Wimmera River. It leaves the Wimmera River near Longerenong through an uncontrolled off-take structure and includes Darlot Swamp, which is fed by Two-Mile Creek another effluent waterway of the Wimmera River. Yarriambiack Creek flows north a distance of some 135km via Jung, Warracknabeal, Brim and Beulah to terminate in a series of lakes, Lake Corrong (south east of Hopetoun) and Lake Lascelles (east of Hopetoun). During very large flood flow events the Creek has flowed to a series of terminal wetlands further north of Hopetoun.</p> <p>Flood flows travel very slowly along Yarriambiack Creek due to the flat grade and riparian vegetation.</p> <p>The Creek only flows intermittently during non-flood periods.</p> <p>Weir pools are maintained at Jung, Warracknabeal, Brim, Beulah and Lake Lascelles at Hopetoun.</p> <p>During large floods, water breaks out of the Wimmera River at a number of locations. The upper reaches of Yarriambiack Creek starts to experience localised flooding soon after the Wimmera River reaches minor flood level, a stream height of 4.0m at the Glenorchy gauge.</p> <p>During large flood events, significant areas of flat rural land are flooded by Yarriambiack Creek and access to properties along the Creek may be affected for extended periods. Access to roads are also cut where roads cross the Creek. Large floods are likely to cause flooding in Warracknabeal, Brim, Beulah and Hopetoun.</p>
<b>Dunmunkle Creek</b>	<p>Dunmunkle Creek is a distributary of the Wimmera River. It leaves the Wimmera River upstream of the Glenorchy township and flows, intermittently, in a northerly direction through the eastern part of the Shire, becoming part of the channel system that eventually reaches Lake Tyrell north of Sea Lake, approximate 188km long. The Creek is reasonably well defined between the Wimmera River and Rupanyup but downstream, past the Minyip-Banyena Road, it becomes progressively less defined. Generally flood flows do not spread over a wide area apart from into the adjoining swamps and waterholes. Downstream of the Minyip-Banyena Road however, the watercourse changes, a combination of poor drainage and channel works results in the inundation of large areas.</p> <p>Flows begin in the upper reaches of Dunmunkle Creek when the Wimmera River at Glenorchy approaches a gauge height of around 4.65m (0.10m below the moderate flood level for Glenorchy).</p> <p>Flood flows travel very slowly along Dunmunkle Creek due to the flat grade and riparian vegetation.</p> <p>During large flood events, significant areas of flat rural land are flooded by Dunmunkle Creek and access to properties along the Creek may be affected for extended periods. Access to roads are also cut where roads cross the Creek. Large floods are likely to cause flooding in Rupanyup, the only town along the length of the Creek.</p>
<b>Wimmera River</b>	<p>There are no towns within the Shire at risk of flooding from the Wimmera River. However, flat rural land in the south west corner of the Shire is flooded and access to properties is affected for extended periods during large flood events.</p>

## 5.3 Building Damages

Refer to the table below for property and building damages for flood events within the Yarriambiack Shire 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.

Average Recurrence Interval (ARI)	Total number of properties at risk of flooded (buildings flooded above floor)				Total damages for the Yarriambiack Shire Council.
	Warracknabeal (Appendix C1)	Rupanyup (Appendix C2)	Beulah (Appendix C3)	Brim (Appendix C4)	
5	0 (0)	0 (0)		0 (0)	0 (0)
10	1 (1)	2 (0)	0 (0)*	0 (0)	3 (1)
20	1 (1)	10 (0)*	0 (0)*	0 (0)	11 (1)
50	1 (1)	13 (1)*	0 (0)*	0 (0)	123 (2)
100	2 (2)	23 (1)*	4 (0)*	0 (0)	29 (3)
200	293 (57)	61 (5)*	4 (0)*	0 (0)	358 (62)

\* Estimated property and building damages following the implementation of flood mitigation works in Beulah and Rupanyup. There is uncertainty regarding these estimates given there were changes to the planned flood mitigation works that were modelled.

Level 2 ICC

Level 3 ICC

## 5.4 Dams or Lakes that influence flooding

Dams or lakes that influence flooding within the Yarriambiack Shire Council area are listed below.

Location	Owner	Full Supply level/volume	Comments
Lake Lonsdale	GWMWater	65,480 ML	Refer to the detailed description of flood impacts provided below.
Lake Belfield	GWMWater	78,560 ML	Refer to the description of flood impacts provided below.

## Lake Lonsdale

Lake Lonsdale is a large shallow reservoir located on Mount William Creek, 20 km upstream of Dadswells Bridge, refer to map below. Lake Lonsdale has a very large catchment area, the Mount William Creek can be a substantial producer of water during wetter years. During the January 2011 flood event Lake Lonsdale's peak spill was 38,527 ML/d for several days.

Lake Lonsdale was originally developed to supply the Wimmera-Mallee Domestic and Stock channel system, however its role has changed considerably following the completion of the Wimmera Mallee Pipeline. Lonsdale continues to play a significant role in the overall supply system as a key source of water for the environment and is highly valued for its recreational use.

With a full storage capacity of 65,480 ML, Lake Lonsdale has a long history of contributing flood flows to Yarriambiack Creek via Mount William Creek and the Wimmera River. During flood events, Lake Lonsdale spills exacerbate flood impacts along Yarriambiack Creek.



Flow path from Lake Lonsdale to Yarriambiack Creek.



While Lake Lonsdale has a long history of spills occurring during flood events, the January 2011 flood event was the largest event on record. During January 2011 Lake Lonsdale's peak spill was 38,527 ML/d for several days. This spill increased the peak flood flows along Yarriambiack Creek. Refer to the photos below showing Lake Lonsdale spilling during the January 2011 flood event.



Lake Lonsdale spilling during the January 2011 flood event.



Lake Lonsdale spilling during the January 2011 flood event.



To monitor the contribution of flood flows from Lake Lonsdale, refer to the Mount William Creek stream tail gauge, downstream of Lake Lonsdale (415203). Also refer to the table below that relates stream height to flow (Water Technology 2016). It is important to note that this stream gauge is only accurate for in channel flows. VICSES can request ALS to use stream monitoring equipment to more accurately estimate the peak spill volume to enable the assessment of downstream flood impacts.

<b>Mount William at Lake Lonsdale tail gauge height (m) * only within channel flows are accurate</b>	<b>Design flow (ML/d)</b>	<b>Average Recurrence Interval (ARI)</b>
2.7	32,420	200
2.65	29,400	January 2011
2.54	23,570	100
2.38	26,200	50
2.0	7,990	20
1.4	3,420	10
0.85	980	5

Lake Bellfield also has the potential to spill and contribute flood flows to Yarriambiack Creek. Although Lake Bellfield hasn't spilled during several recent flood events it's important to keep an eye on storage levels and the potential for this storage to spill when there is a flood watch or significant rainfall is forecast for the Wimmera Catchment.

For current storage level data for Lake Lonsdale, Lake Bellfield and other storages in this region refer to the GWM Water Storage Manager Website: [http://www.storagemanager.com.au/reservoir-levels-and-other-information/reservoir-levels?chart=cumulative\\_inflows&primary=0](http://www.storagemanager.com.au/reservoir-levels-and-other-information/reservoir-levels?chart=cumulative_inflows&primary=0)

GWMWater maintains a Dam Safety Plan for Lake Lonsdale and Lake Belfield.

## 5.5 Levees and Flood Mitigation Works

Over the last decade the Yarriambiack Shire Council has worked closely with DELWP, Wimmera and Mallee CMA's to undertake significant stormwater and riverine flood mitigation works. These works have been undertaken along both Yarriambiack Creek and Dunmunkle Creek, with the majority of these works being undertaken in Warracknabeal and Rupanyup. A detailed account of flood mitigation works undertaken for these towns can be found in **Appendix C**.

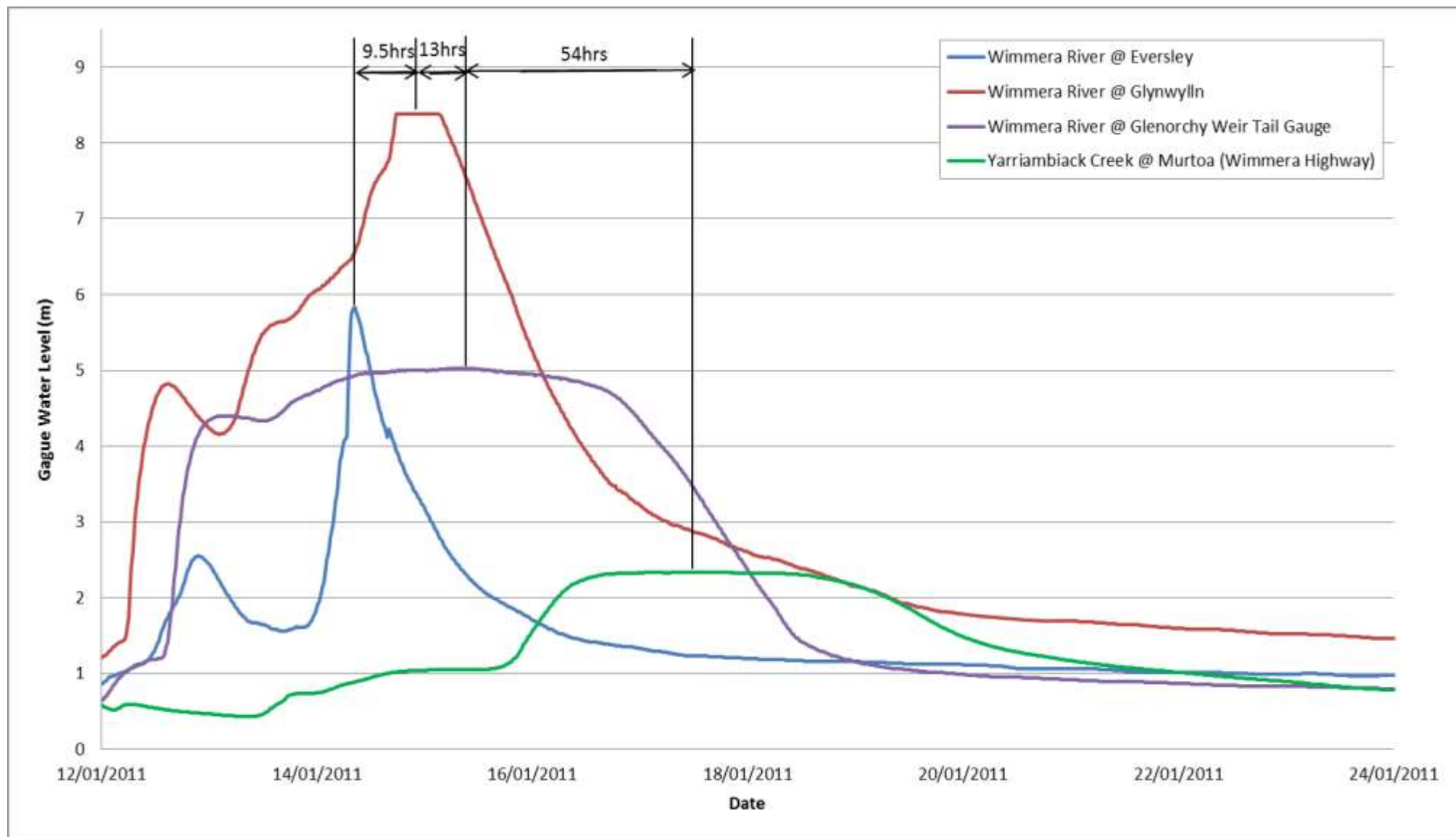
## Appendix B: Typical flood peak travel times

Source (Mid West Catchment Flood Intelligence Summary)

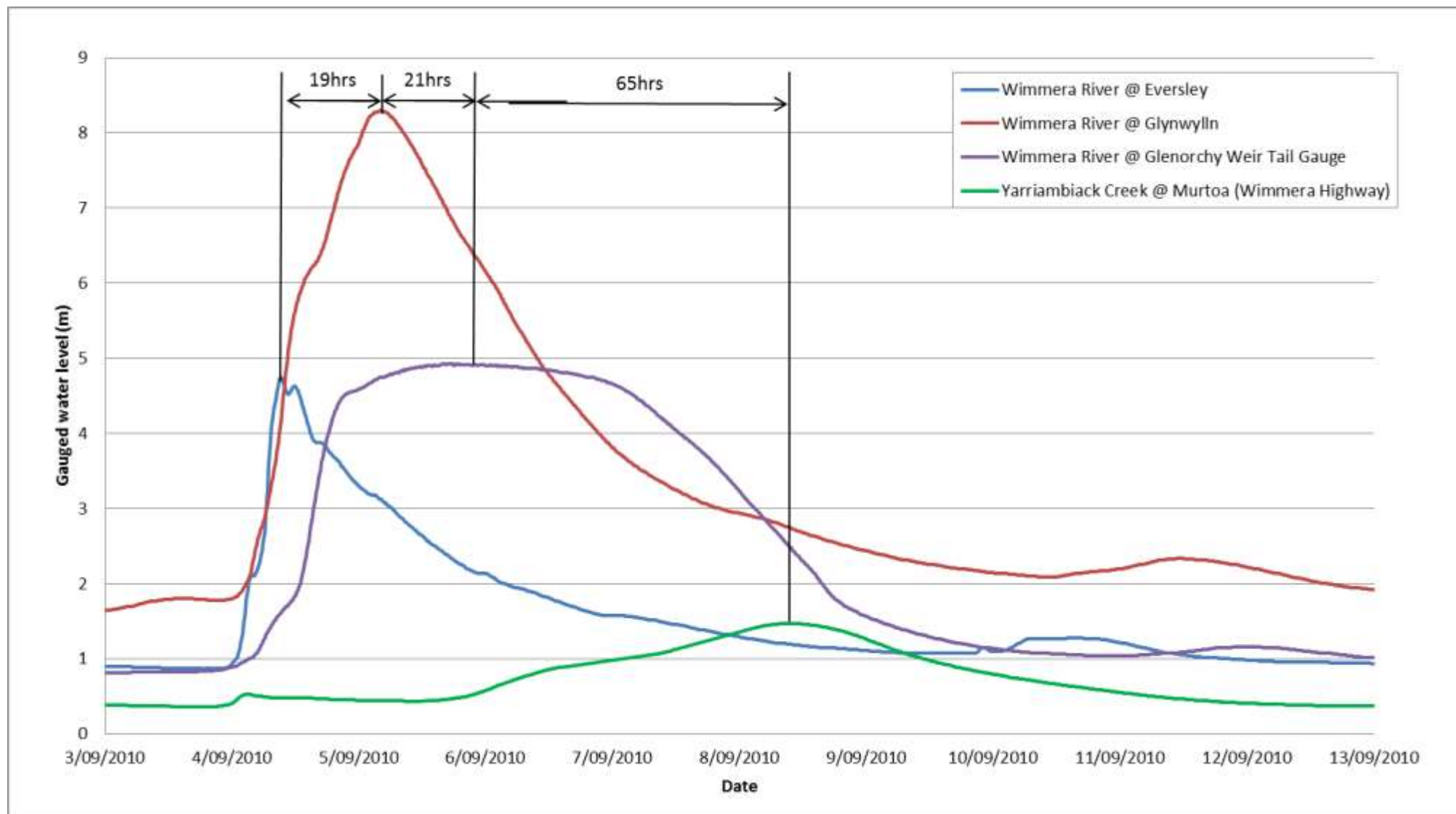
Location From	Location To	Typical Travel Time	Comments	Duration
Rupanyup (Yarriambiack Creek)				
Start of rainfall (upper catchment)	Rupanyup	18 – 30 hours	Begin to rise from normal levels	2 - 3 days
Peak travel time from Glenorchy	Rupanyup	22 - 40 hours	To peak	
Warracknabeal (Yarriambiack Creek)				
Peak travel time from Glenorchy	Warracknabeal	2 -3 days	Begin to rise from normal levels	2 - 3 days
Peak travel time from Glenorchy	Warracknabeal	2.5 – 6.2 days	To peak	
Brim (Yarriambiack Creek)				
Peak travel time from Warracknabeal	Brim	0.5 – 3.0 days	Begin to rise from normal levels	2 - 4 days
Peak travel time from Warracknabeal	Brim	1.5 – 5.3 days	To peak	
Beulah (Yarriambiack Creek)				
Peak travel time from Brim	Beulah	0.5 – 3.0 days	Begin to rise from normal levels	2 - 4 days
Peak travel time from Brim	Beulah	1.5 – 5.3 days	to peak	

Yarriambiack Creek peak travel times for design and historic flood events, refer to table and graphs below.

<b>Location</b>	<b>5 year ARI (hours)</b>	<b>10 year ARI (hours)</b>	<b>20 year ARI (hours)</b>	<b>September 2010 (hours)</b>	<b>50 year ARI (hours)</b>	<b>100 year ARI (hours)</b>	<b>January 2011 (hours)</b>	<b>200 year ARI (hours)</b>
Wimmera River at Glenorchy	0	0	0	0	0	0	0	0
Yarriambiack Creek at Murtoa (Wimmera Highway)	53	47	23	63 (2.6 days)	35	31	53 (2.2 days)	35
Yarriambiack Creek at Ailsa Road	89	85	72	127 (5.29 days)	72	56	89 (3.7 days)	53
Yarriambiack Creek at Warracknabeal	107	97	85	151 (6.29 days)	86	67	99 (4.12 days)	61
Yarriambiack Creek at Brim	161	150	133	223 (9.29 days)	135	100	137 (5.7 days)	86



Yarriambiack Creek (Murtoa gauge) flood peak travel time during the January 2011 flood event.



Yarriambiack Creek (Murtoa gauge) flood peak travel time during the September 2010 flood event.

## Appendix C1: Warracknabeal (Yarriambiack Creek) Flood Emergency Plan

Warracknabeal is impacted by flooding from both the Yarriambiack Creek and stormwater flooding from local rainfall.

Flooding in Yarriambiack Creek is driven by high flows in the Wimmera River, with the Wimmera River distributing flood flows to Yarriambiack Creek. Yarriambiack Creek leaves the Wimmera River near Longerenong through an uncontrolled off-take structure and flows north a distance of 135km via Jung, Warracknabeal Brim and Hopetoun.

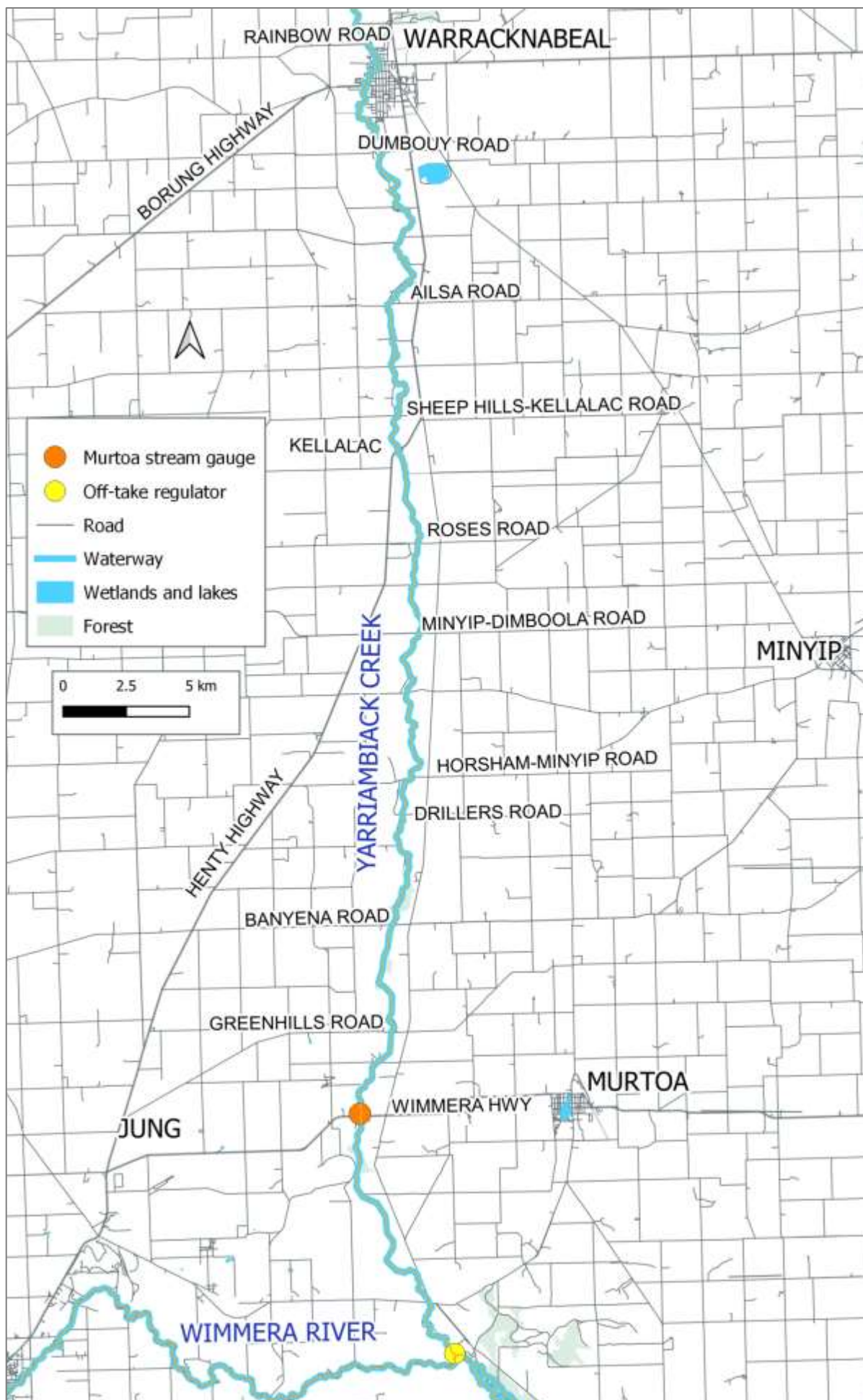
The required flow rates in the Wimmera River to commence flow in Yarriambiack Creek is estimated at 3,900 ML/d. These flows are driven by high rainfall in the upper Wimmera River Catchment. Several stream gauges; the Wimmera River gauge at Glenorchy (415201) and Yarriambiack Creek gauge at Murtoa (415241). The locations of these gauges are shown in the map below.

The off-take regulator structure at the Wimmera River / Yarriambiack Creek confluence is uncontrolled and during normal low flow periods allows approximately one third ( $\frac{1}{3}$ ) of the Wimmera River flow to enter Yarriambiack Creek, refer to image below. During periods of higher flood flow the structure is overtopped and somewhere between 5% and 15% of the Wimmera River flow makes its way into Yarriambiack Creek (Fluvial Systems, 2006).



Yarriambiack Creek off-take regulator structure (WCMA).





## Historic Flood Events

Warracknabeal and Yarriambiack Creek has experienced flooding in 1909, 1915, 1916, 1923, 1930, 1955, 1956, 1960, 1964, 1973, 1974, 1975, 1983, 1985, 1988, 1992, 1993, 1996, 2010, 2011 and 2016. Refer to the photo below.



Flooding along Yarriambiack Creek at the Wimmera Highway Bridge during the September 2010 flood event.

The largest recent flood event on record was the January 2011 flood event. Warracknabeal was significantly impacted by both riverine and stormwater flooding during this event. Warracknabeal recorded rainfall of 151mm over five days between Monday 10<sup>th</sup> to Friday 14<sup>th</sup> of January 2011. Direct runoff caused localised flooding in and around Warracknabeal. For more details regarding areas impacted, refer to the Stormwater Flood Risk section below.

Riverine flooding impacted Warracknabeal between Tuesday 18<sup>th</sup> and Thursday 20<sup>th</sup> of January, with the flood peak occurring approximately 10:45am on Wednesday 19<sup>th</sup> of January. Local residents in Warracknabeal constructed a 6km temporary earthen levee to protect the town. The levee dramatically altered the flood extent and protected numerous houses and businesses. Refer to the photo and map below showing the location of the levee.

Approximately 117 homes were sandbagged in Warracknabeal. The Warracknabeal Caravan Park, the Warracknabeal Bowels Club, 5 houses and a childcare centre were inundated. A relief and recovery centre was opened in Warracknabeal. The Warracknabeal-Rainbow Road was cut adjacent to the Warracknabeal levee to increase the flow capacity (reduce flood levels) during the flood event, refer to the photos below.

Flooding along Yarriambiack Creek cut access to all main and minor roads, refer to the photo at Kellalac below.





The temporary earthen Warracknabeal Levee constructed during the January 2011 flood event.



Location of the Warracknabeal Levee during the January 2011 flood event.





Flooding in the Yarriambiack Creek cut access along the Henty Highway at Kellalac during the January 2011 flood event (source YSC).



Warracknabeal-Rainbow Road was cut to the north of Warracknabeal during the January 2011 flood event (source YSC).





Flooding impacting the Warracknabeal Caravan Park during the January 2011 flood (source YSC).



The Warracknabeal Bowling Club impacted by flooding during the January 2011 flood event (source YSC).



Flooding adjacent to the Warracknabeal Cemetery, along Dumbuoy Road (source: Wimmera Mail Times).



## Stormwater Flood Risk

Warracknabeal is particularly susceptible to stormwater flooding. During the January 2011 flood event, Warracknabeal recorded 151mm of rainfall over five days, between Monday the 10<sup>th</sup> and Friday the 14<sup>th</sup> of January. This rainfall caused extensive stormwater flooding from local runoff. Areas across Warracknabeal that suffered extensive stormwater flooding include;

- Lyle Street
- Borung Highway
- Gardiner Street
- McIntyre Street
- Asquith Reserve

The Yarriambiack Shire Council received anecdotal accounts that several houses in Lyle Street were flooded over floor on the eastern end of Lyle Street. Also several houses along the Borung Highway, east of Warracknabeal were very close to being flooded above floor, refer to flood photos below.



Stormwater flooding east of Warracknabeal during the January 2011 flood event (source YSC).



Stormwater flooding along the Borung Highway, east of Warracknabeal during the January 2011 flood event (source YSC).



Stormwater flooding in Warracknabeal surrounding Elizabeth Avenue during the January 2011 flood event (source Wimmera Mail Times).





Stormwater flooding on the western side of Warracknabeal surrounding Gould Street during the January 2011 flood event (source Wimmera Mail Times).

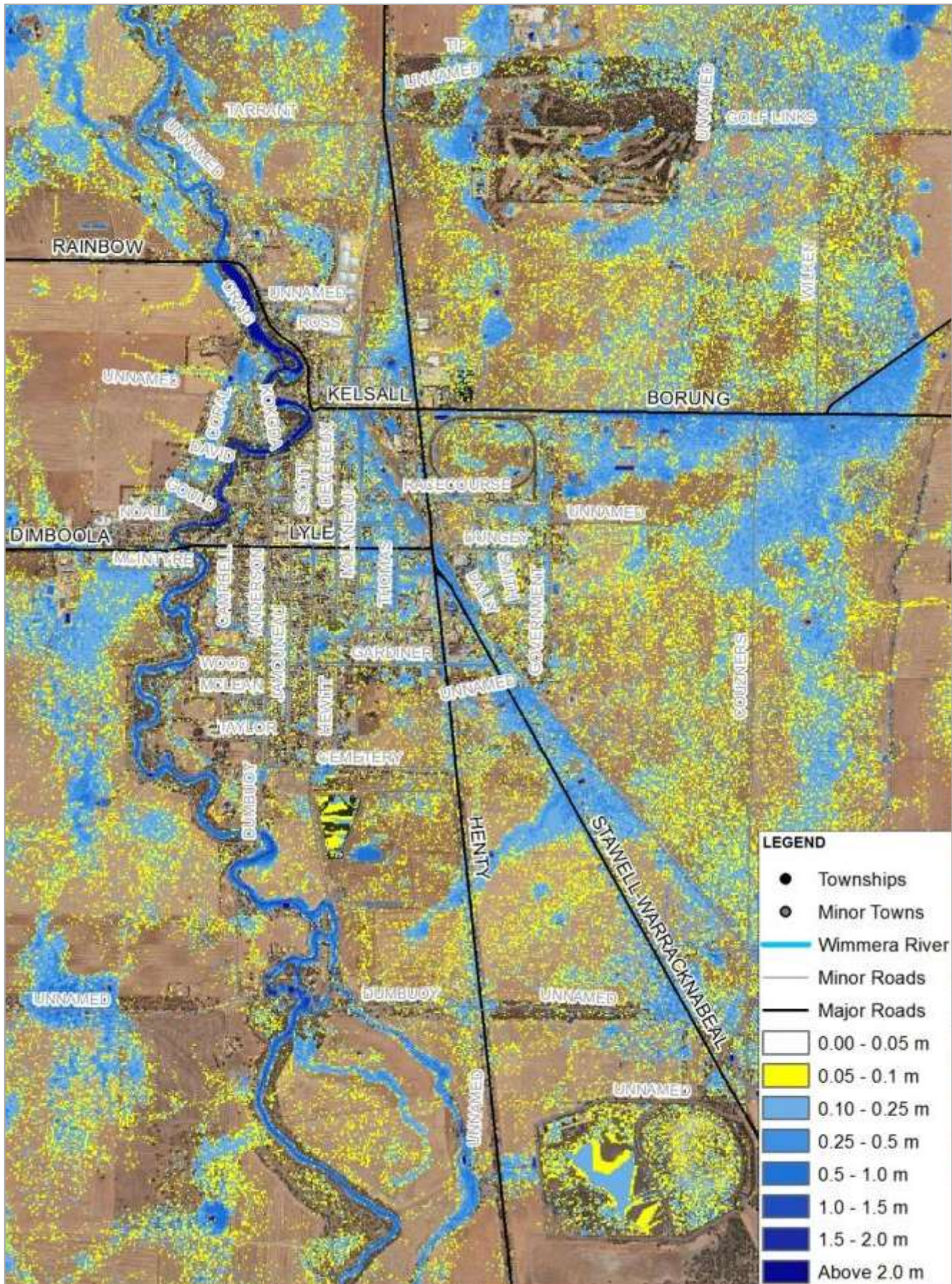
Since the January 2011 flood event the Yarriambiack Shire Council have undertaken significant mitigation works to reduce the stormwater flood risk in Warracknabeal. For more detail regarding mitigation works undertaken, refer to the Flood Mitigation Works section below.

An assessment of stormwater flood risk (Water Technology 2016) shows that the majority of Warracknabeal's streets experience nuisance flooding although flows tend to drain into Anzac Park (town sports complex on the corner of Gardiner Street and Scott Street). Refer to stormwater maps below. Considerable ponding occurs along Tarrant Street adjacent to the Warracknabeal Railway Station and will affect properties in the area bounded by Tarrant, Woolcock, and Molyneaux streets. Further ponding occurs in the residential area bounded by Woolcock, Thomas, Franklin and Molyneaux streets. To the west of Yarriambiack Creek, overland runoff from the area adjacent to the Hospital, collects to an overland flow path (depression) that runs from near the corner of Watson and Gould Streets and continues in a north easterly direction across Tobruk Avenue and along Coral Avenue to the Creek on the west side of town.

The stormwater analysis reveal that a major part of runoff from the Whitton Swamp catchment flows overland on the eastern side of the Henty Highway towards the racecourse.

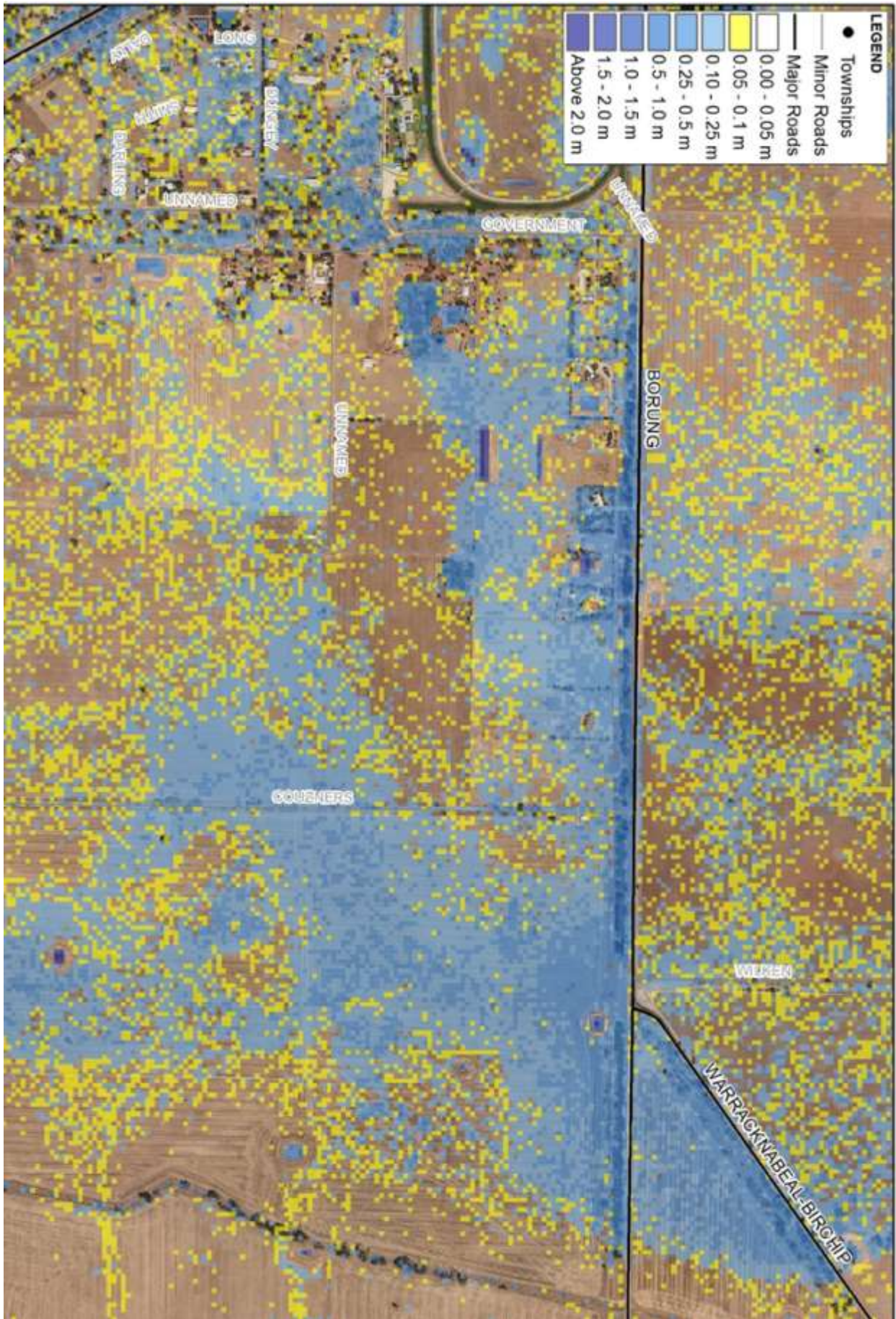
Stormwater flooding can develop quickly as a result of local heavy rainfall. Heavy rainfall events can cause rapid rise of floodwater. The warning time available from rainfall to stormwater flood impacts occurring can range between 2 to 3 hours depending on the rainfall intensity.





Warracknabeal stormwater flood mapping, 100 year ARI 2 hr duration event (Water Technology 2016).





Borong Highway east of Warracknabeal, 100 year ARI 2 hr duration event (Water Technology 2016).



## Flood mitigation works since January 2011

Since January 2011 the Yarriambiack Shire Council has spent significant time and resources to implement flood mitigation works for Warracknabeal. These works include;

- Expanding the capacity of the Warracknabeal weir from one undershot weir gate to eight.
- Five additional culverts were installed to the west of the Warracknabeal Weir and three east of the Weir to further increase flood flow capacity in Warracknabeal.
- Flap valves on priority stormwater pipes and culverts.



Warracknabeal Weir Pool gates (Water Technology 2016)



Warracknabeal Weir Pool western culverts (Water Technology 2016)



Warracknabeal Weir Pool eastern culverts (Water Technology 2016).



One way flap valve on a stormwater drain at Lyle Street Warracknabeal Weir Pool eastern culverts (Water Technology 2016).

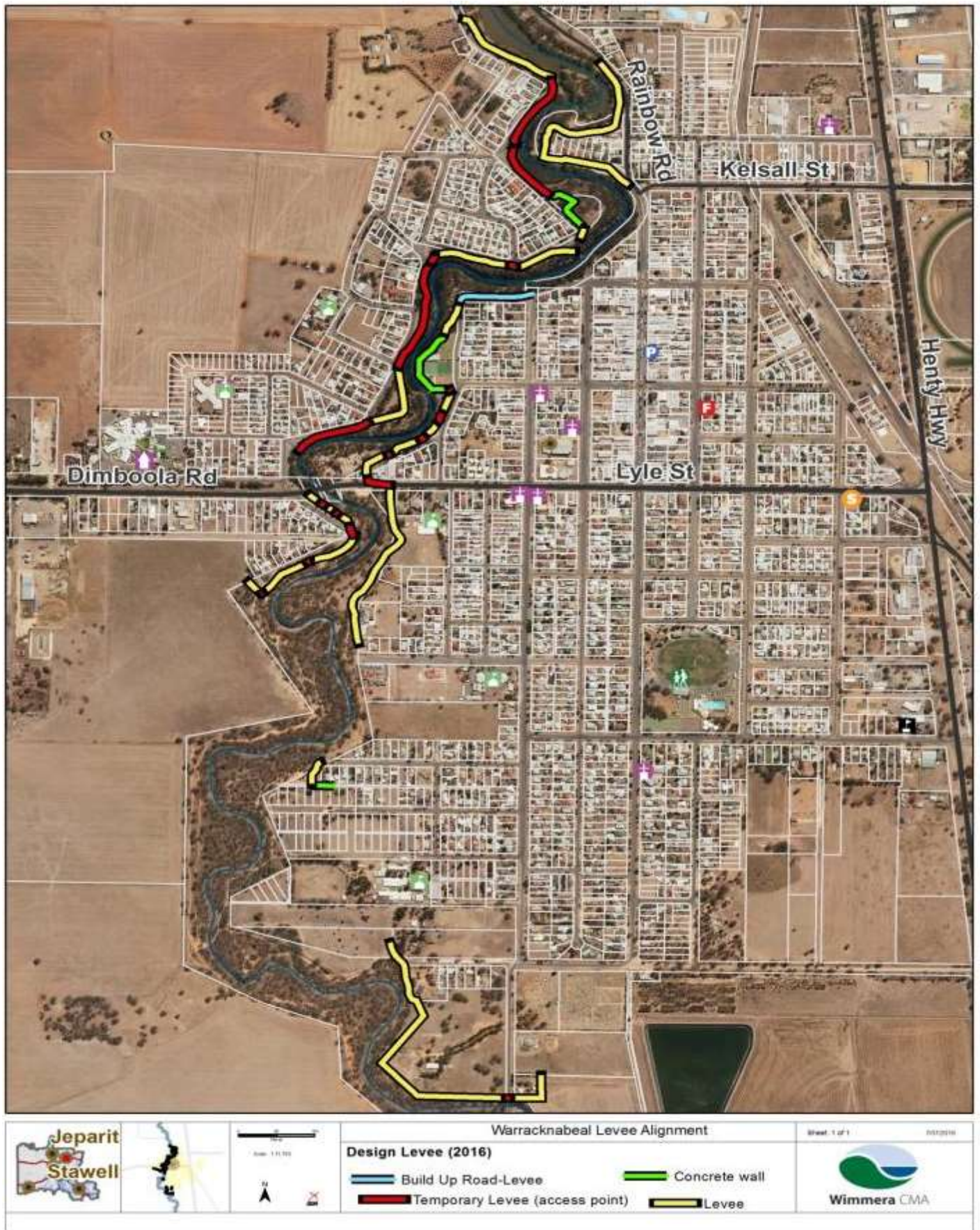




One way culvert flap valves at Asquith Reserve/McIntyre Street Warracknabeal Weir Pool eastern culverts  
(Water Technology 2016)

Yarriambiack Shire Council has received close to \$1,000,000 in April 2017 to construct a levee to provide flood protection in Warracknabeal up to a 100 year ARI flood event, with 100 mm freeboard. The construction of the Warracknabeal levee has started. Refer to the map below showing the proposed Warracknabeal levee design (Water Technology 2016).





Warracknabeal proposed levee.

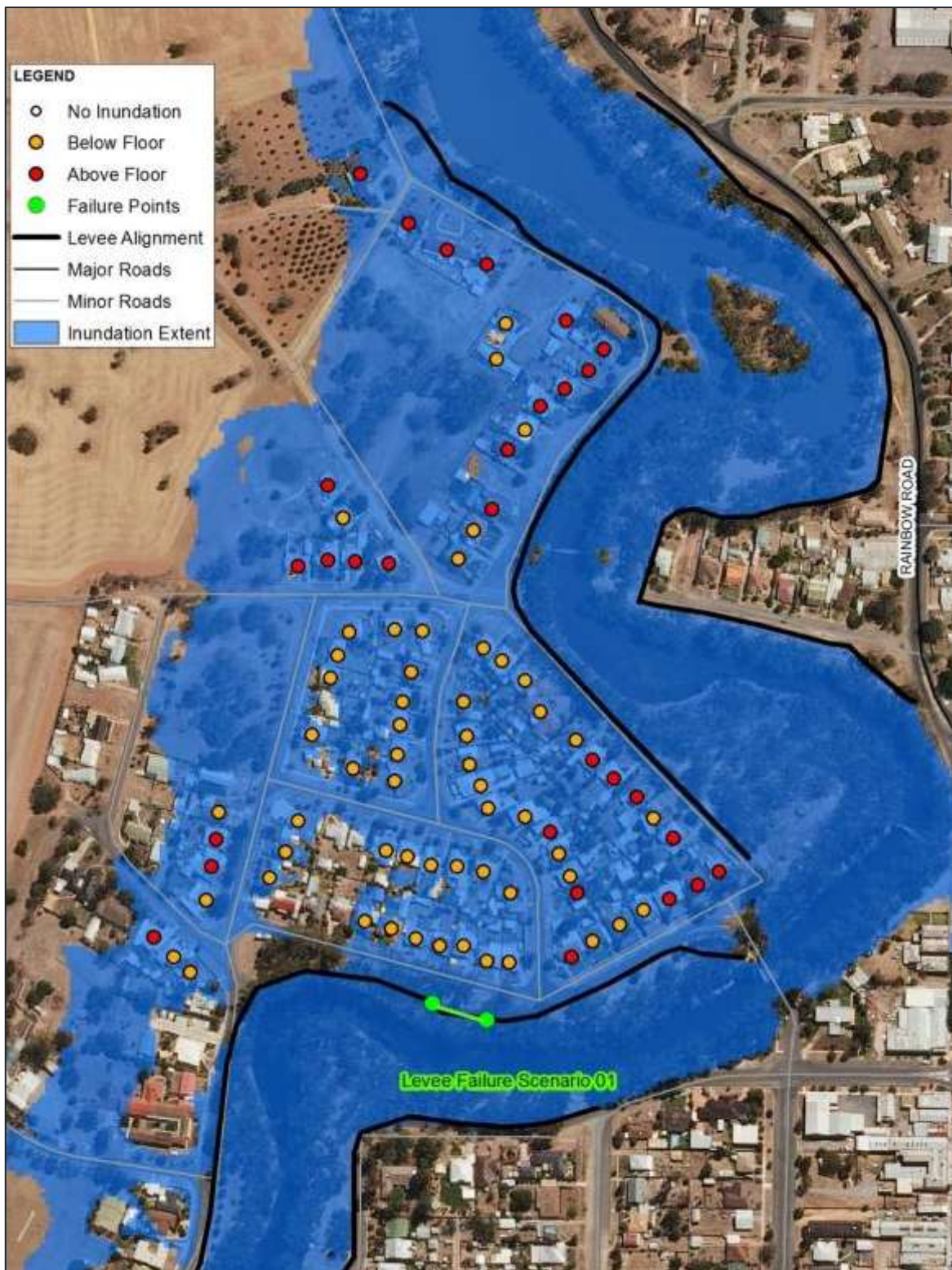


## Levee failure impact assessment

With the construction of any flood protection levee there is a risk the levee may fail. The most likely points of levee failure are on the outside of bends where the velocity is the highest and there is a chance of the creek migrating and the bank collapsing, or where there are points of weakness in the levee such as cracks, holes, poorly constructed sections, informal crossings which lower the crest over time, services such as pipes that run through the levee which have not been adequately set in, etc (Water Technology 2016).

The levee failure section is approximately 15 m length at the peak height of the 100 year ARI event, with an hour duration for the levee failure to breach to ground level. The levee failure assessment assists in understanding the potential result of a levee failure. Refer to the map shown below for the inundation extent and properties flooded above floor. For the existing conditions (without the levee being constructed) 10 buildings would be flooded above floor. In the levee failure scenario in the map below 29 buildings are flooded above floor and 55 below floor. This demonstrates that failure of the levee will cause a significant impact. The area inundated is limited to the area of levee failure with flood water unable to re-enter Yarriambiack Creek, being trapped outside of the levee (Water Technology 2016).

These results demonstrate the residual risk of living behind a levee. There is a danger that complacency may set in with residents and authorities lulled into a false sense of security, with the assumption that all risk has been removed because they are behind a levee. It is important for the community to understand that larger flood events can overtop or outflank a levee, and a levee can fail. For these reasons it is imperative that a levee system is maintained, that flood related planning conditions are in place and that communities are educated to their risk and understand what it means for them (Water Technology 2016).



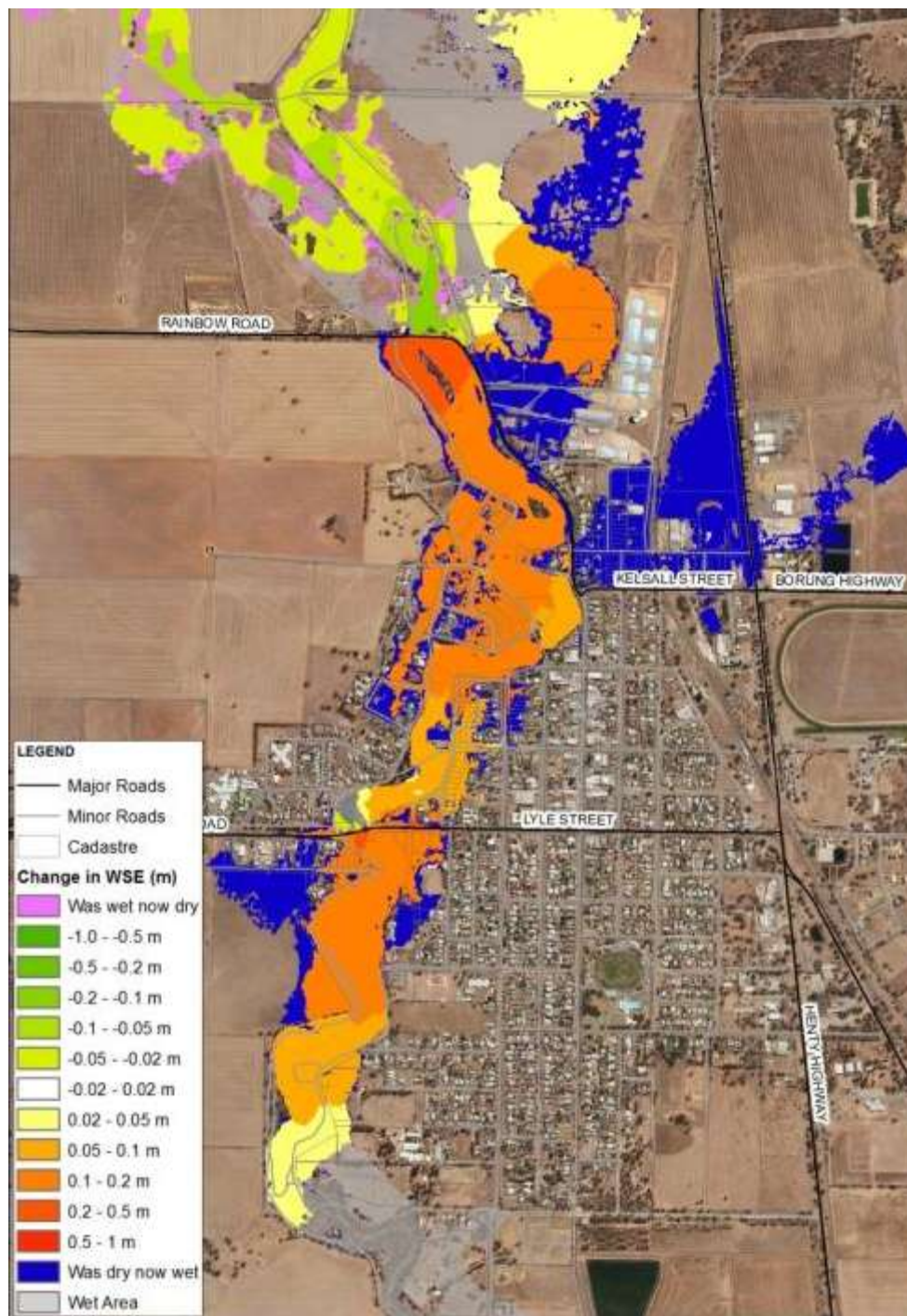
Impact assessment of the levee failure scenario.



## Blockage of structures impact assessment

To assess the potential impact of structure blockage the major Yarriambiack Creek structures were blocked to 100% as a sensitivity test. The blocked structures included Dimboola Road, Jamouneau Street and the Warracknabeal Weir (Water Technology 2016).

The difference in flood level caused by blockage of all three structures is shown in the map below. There is a significant increase in inundation extent north of Kelsall Street and with the maximum increase in flood levels observed upstream of the Warracknabeal Weir at around 0.2-0.25 m. The blockage of all three structures simultaneously and to 100% is over-conservative, but provides a worst case scenario (Water Technology 2016).



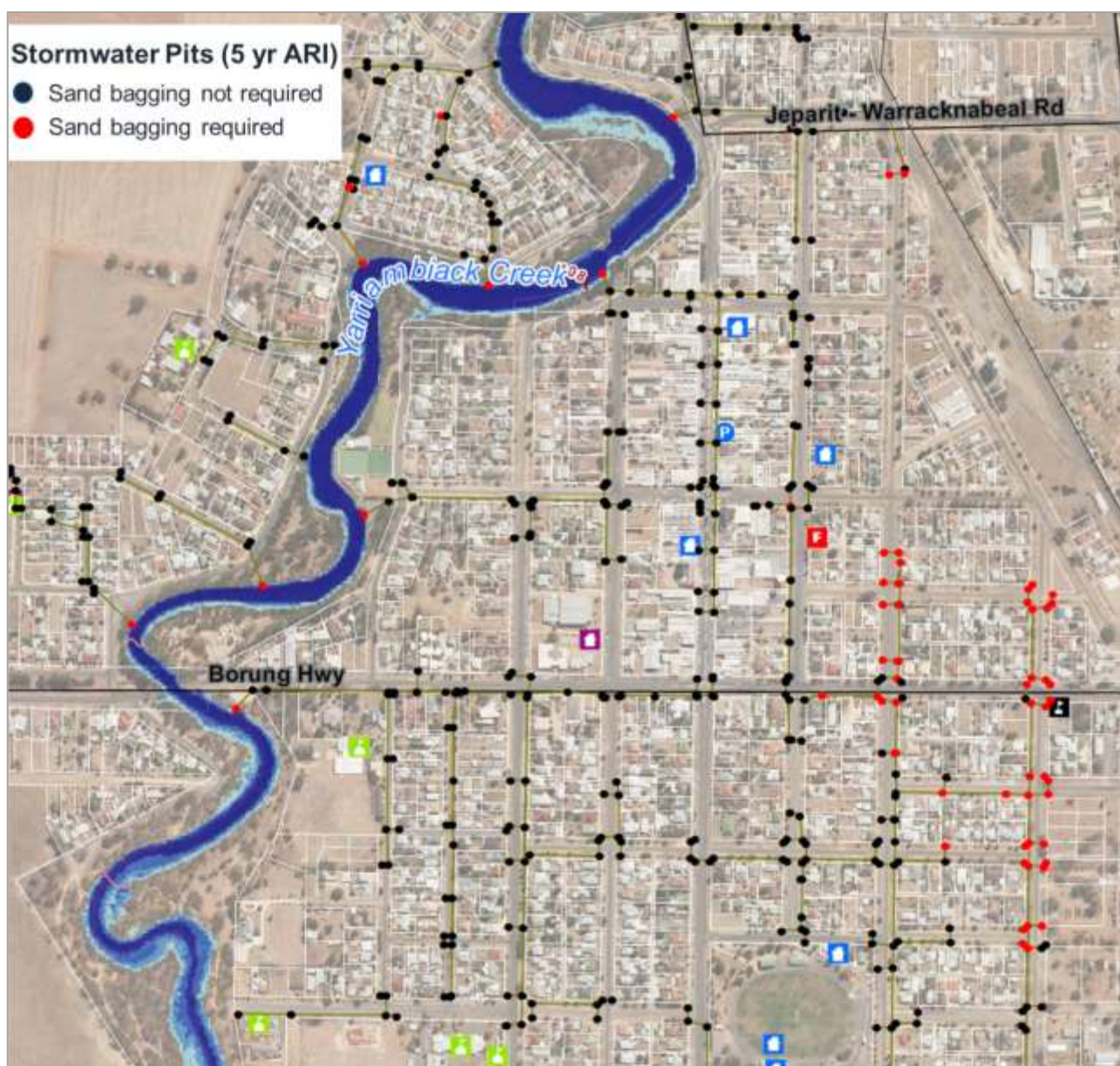
Blockage of structures along Yarriambiack Creek (Water Technology 2016).



## Stormwater pipe and pit management

There are numerous stormwater pipes and pits throughout Warracknabeal, all eventually draining to Yarriambiack Creek. During flood events in Yarriambiack Creek floodwater is able to flow backwards through the stormwater network and surcharge through the stormwater pits into suburban areas. To prevent this occurring Yarriambiack Shire Council have installed non return valves on a number of their stormwater outlets. The type of outlets used are being trialled and will need to be monitored.

If there are no non return valves installed on a stormwater network, stormwater pits can be sandbagged to prevent surcharging. This must be completed around the pit creating an open unpressurised opening as it was noted during January 2011 issues were created by sandbag placed directly on top of or in stormwater pits. To gain an understanding of the stormwater pits require sandbagging, a relationship between Yarriambiack Creek water levels and the stormwater outlets was developed and linked to each pit. This identified which pits had levels below the Yarriambiack Creek height at their corresponding pipe outlet for each design flood event, refer to the 5 year ARI map below.



## Channel network

During January 2011 there were several irrigation channels that interacted with the Yarriambiack Creek Floodplain influencing drainage and floodwater. A number of these channels have since been removed or modified post January 2011 but may still require attention during a flood event.

Channels with the potential to cause significant impact on flood levels and extents listed south to north are:

- Kellalac Channel (Decommissioned)
- Whitton Supply Channel (Decommissioned)
- Craigs Channel (Decommissioned)

Even though these channels were decommissioned they may be providing a drainage path for localised catchment flows.

Under no circumstance should irrigation channels be filled/excavated/blocked or altered in any way preceding or during a flood event without a full understanding of the potential consequences and approval from the relevant authority.

## Warracknabeal Weir Management during floods

The Warracknabeal Weir consists of eight weir gates and has a capacity of 227 ML (Alluvium 2014), refer to the image below. The Weir is located to the north of Warracknabeal where Rainbow Road intersects Yarriambiack Creek, refer to the map below. Water in the Weir has a significant social value, serves to provide the community with both a recreational asset, but also a sense of place and forms part of the identity of the town. The weir pool is very important to the Warracknabeal community for recreation use.

The maximum flow rate of the Warracknabeal Weir is 405 ML/d. Triggers that the Yarriambiack Shire Council may use in their decision making to open the Warracknabeal Weir gates include;

- When flooding occurs at Glenorchy, stream gauge height of 4.67m (flow of 14,531 ML/d) or greater
- When flooding occurs along the lower Yarriambiack Creek, Murtoa stream gauge height of 0.84m (flow of 905 ML/d) or greater
- When the Warracknabeal Weir gauge board height reaches 1.44m, water will be released from the Weir.



Warracknabeal Weir.





Location of the Warracknabeal Weir.



## Flood Impacts and Actions Required

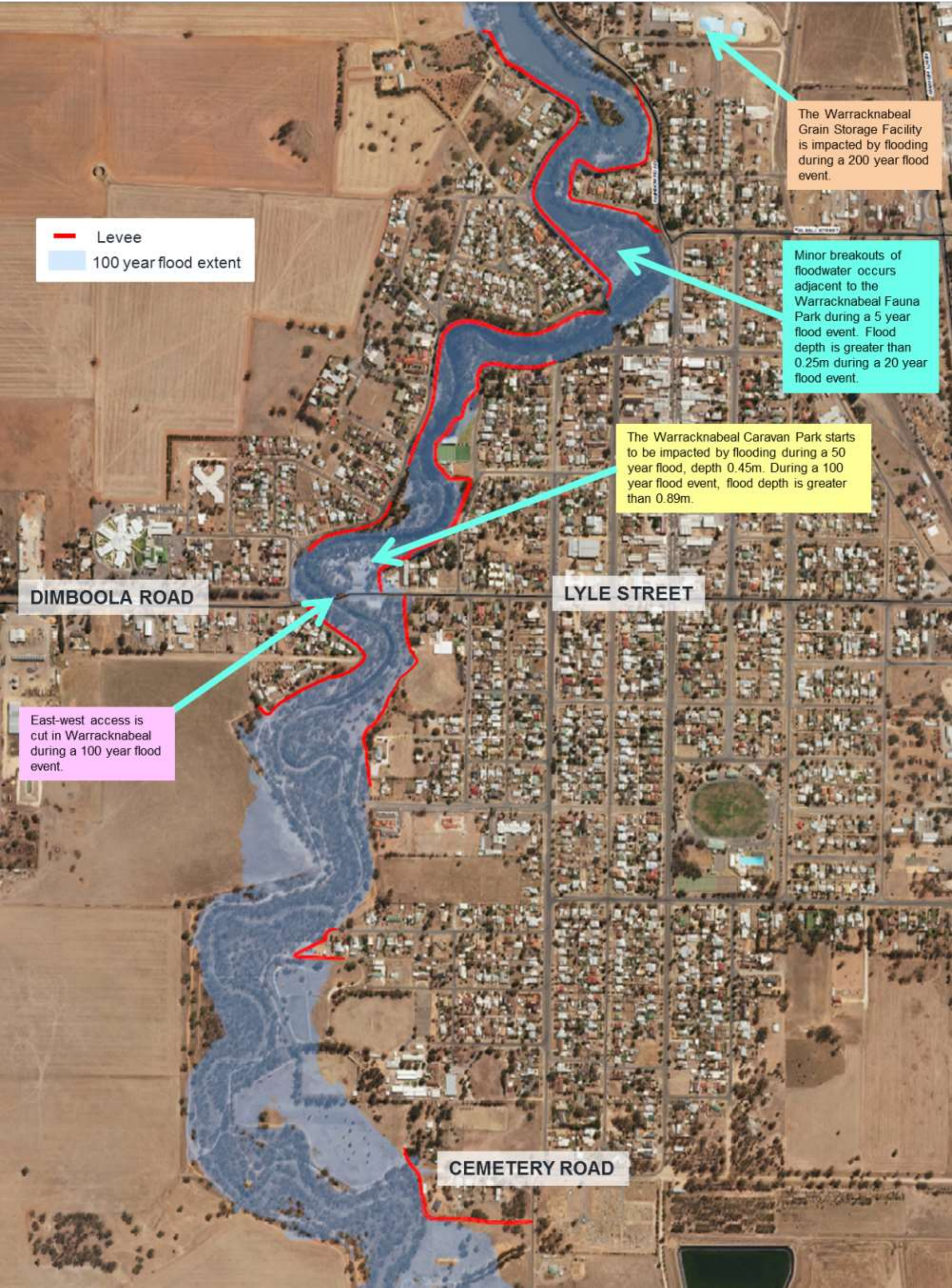
Key assets at risk of flooding in Warracknabeal and along the Yarriambiack Creek are listed in the table below.

Asset register				
Asset Name and location	Average Recurrence Interval (ARI)	Consequence / Impact	Mitigation/ Action	Lead Agency
Access to a houses/buildings at 189 Dumbuoy Road	5 year flood	Access/egress to buildings may be impacted by flooding.	Notify the landholder that access may be cut by flooding	Yarriambiack Shire Council
Warracknabeal Fauna Park, Craig Avenue, Warracknabeal.	5 year flood	Minor flooding occurs adjacent to the Fauna Park during a 5 year flood. Flood depth is greater than 0.25m during a 20 year flood event.	Relocate the animals from the Fauna Park.	Yarriambiack Shire Council
Access to Dumbuoy Road, at the Yarriambiack Creek crossing.	5 year flood	Access/egress may be cut by flooding, flood depth may be 0.30m.	Deploy road closure signs and undertake traffic management	Yarriambiack Shire Council
Access to Ailsa Road, at the Yarriambiack Creek crossing.	5 year flood	Access may be impacted by flooding in a 5 year flood, flood depth may be 0.24m. Access may be cut in a 10 year flood, flood depth greater than 0.30m.	Deploy road closure signs and undertake traffic management	Regional Roads Victoria
Lower level of the Rusty Nail Restaurant, 189 Dumbuoy Road	Between 5 and 10 year flood event	The Lower Level of the Rusty Nail Restaurant is flooded above floor.	Sandbag / evacuate as needed	VICSES Victoria Police
Access to the Henty Highway at Kellalac Yarriambiack Creek crossing.	10 year flood	Access may be impacted by flooding in a 10 year flood, flood depth 0.09m. Access may be cut in a 50 year flood, flood depth greater than 0.41m.	Deploy road closure signs and undertake traffic management	Regional Roads Victoria
Access to a house at 111 Roses Road, south of Kellalac	10 year flood	Access/egress to a house at 111 Roses Road may be impacted by flooding.	Notify the landholder that access may be cut by flooding	Yarriambiack Shire Council
Warracknabeal Industrial area, Rainbow Road, north east of the Warracknabeal Weir.	20 year flood	Flooding breaks out into the Warracknabeal Industrial area, flooding may impact buildings above floor if the temporary sections of the Warracknabeal Levee aren't installed	Install temporary sections of the Warracknabeal Levee (road crossings, walkways).	Yarriambiack Shire Council
Access to a house on Drillers Road, south of the Horsham-Minyip Road, west of Yarriambiack Creek.	20 year flood	Access/egress to a house on Drillers Road may be impacted by flooding.	Notify the landholder that access may be cut by flooding	Yarriambiack Shire Council
Access to a house at 1125 Greenhills Road, north of Jung and the Wimmera Highway.	50 year flood	Access/egress to a house at 1125 Greenhills Road may be impacted by flooding.	Notify the landholder that access may be cut by flooding	Yarriambiack Shire Council
Warracknabeal Caravan Park, Lyle Street, eastern side of Yarriambiack Creek.	50 year flood	The Warracknabeal Caravan Park starts to be impacted by flooding during a 50 year flood, depth 0.45m. During a 100 year flood event, flood depth is greater than 0.89m.	Evacuate the Warracknabeal Caravan Park	Yarriambiack Shire Council
East West access is cut to Warracknabeal along the Borung Highway, Lyle Street/Dimboola Road.	100 year flood	Access/egress may be cut by flooding during a 100 year flood event.	Deploy road closure signs and undertake traffic management	Regional Roads Victoria
Upper Level of the Rusty Nail Restaurant, 189 Dumbuoy Road	100 year flood event	The Lower Level of the Rusty Nail Restaurant is flooded above floor.	Sandbag / evacuate as needed	VICSES Victoria Police

The Warracknabeal Grain Storage Facility, north of Warracknabeal, adjacent to Rainbow Road and the Henty Highway.	200 year flood	The Warracknabeal Grain Storage Facility is impacted by flooding.	Sandbag or build a levee around the perimeter.	VICSES/ landholder
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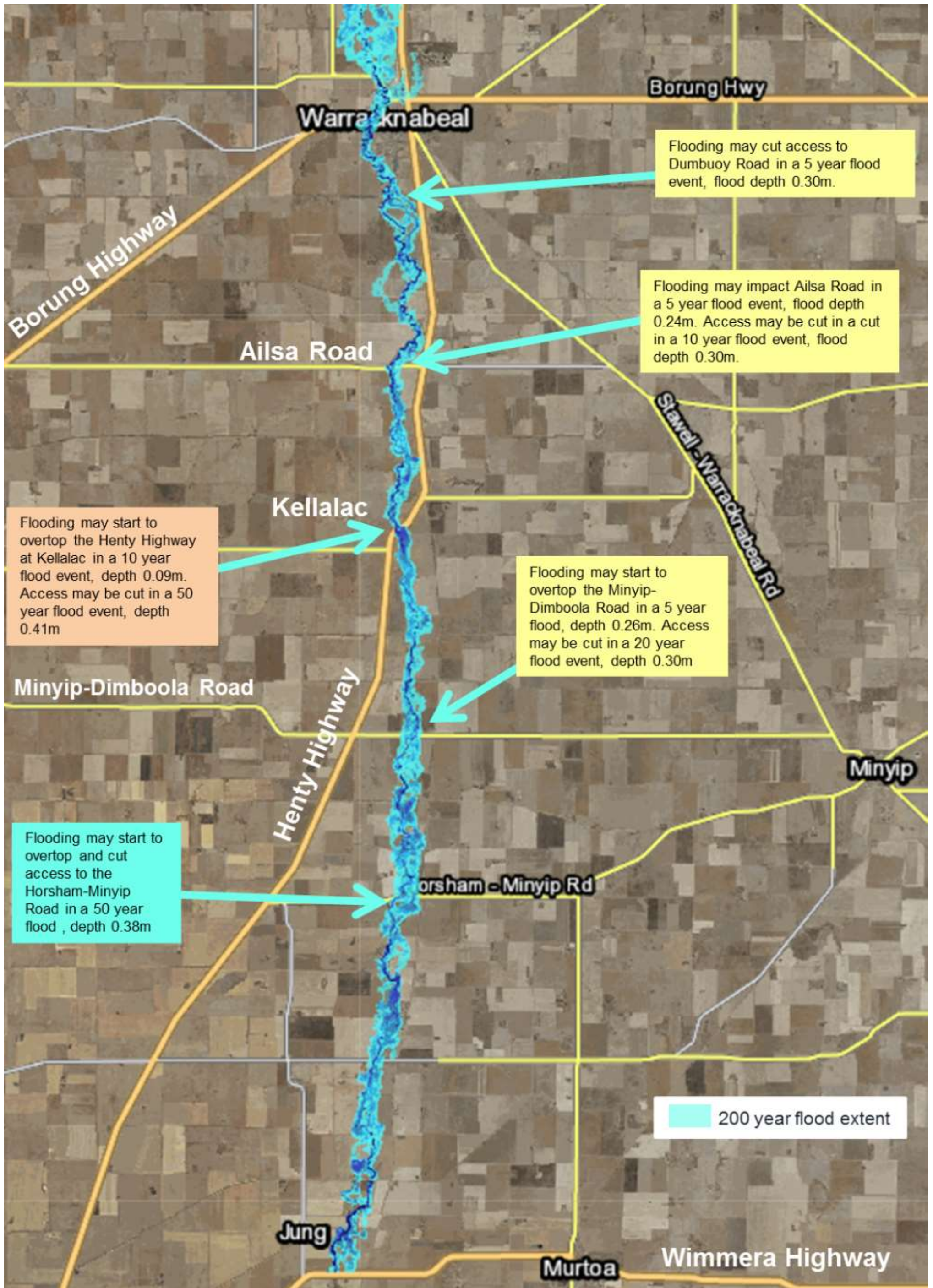
For more detailed information regarding buildings and roads impacted refer to the Warracknabeal and Yarriambiack Creek Flood Intelligence Card and flood impact maps below. Also refer to the Warracknabeal and Yarriambiack Creek flood depth maps in **Appendix F**, a list of flood observers in **Appendix H** and community sandbag collection point in **Appendix I**.





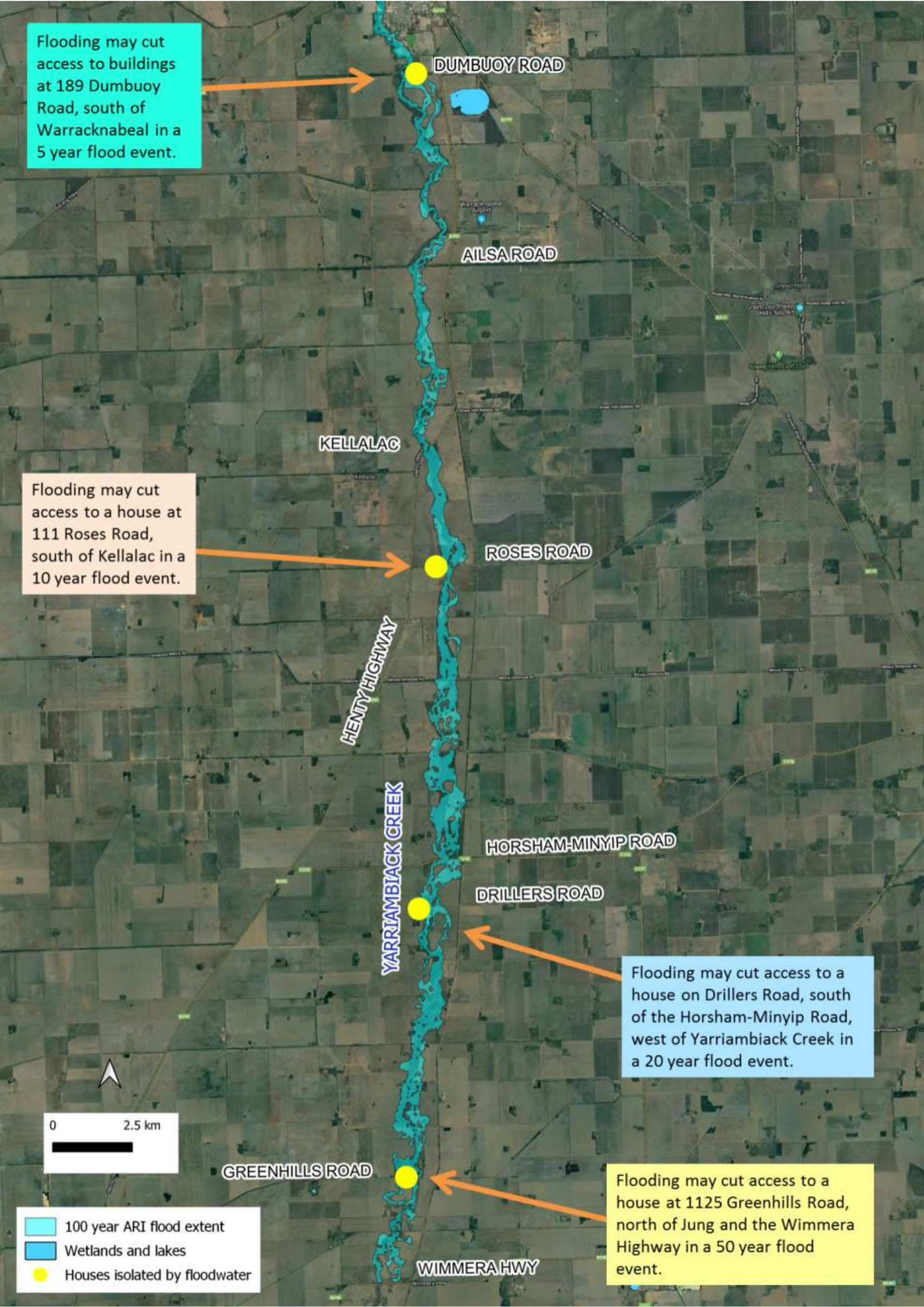
Roads and assets impacted by flooding in Warracknabeal, with the proposed levee and 100 year ARI extent (Water Technology 2016).





Roads impacted by flooding along Yarriambiack Creek, south of Warracknabeal.





Buildings isolated by flooding along Yarriambiack Creek, south of Warracknabeal.



# Warracknabeal and Yarriambiack Creek Flood Intelligence Card

Flood travel time						Stormwater flooding time from start of rain to flooding 2-3 hours			
						Time between Glenorchy peak to steep rise in Warracknabeal 2 days			
						Time between Glenorchy and Warracknabeal peak 2.5 to 6.2 days			
						Flooding duration: 2 - 3 days			
Wimmera River at Glenorchy gauge height 415201 (m) Water Tech 2016	Yarriambiack Creek at Jung gauge height 415241 (m)	Yarriambiack Creek at Warracknabeal gauge board height (m)	Average Recurrence Interval (ARI)	Yarriambiack Creek flow at Jung gauge (ML/d) Water Tech 2016	Warracknabeal and Yarriambiack Creek damages (excluding Rupanyup) total number (above floor)	Consequences/ Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action
2.82 (3,900 ML/d)						Flooding along Yarriambiack Creek is driven by high flows in the Wimmera River, with the Wimmera River distributing water to the Yarriambiack Creek. Required flow rates in the Wimmera River to commence flow to Yarriambiack Creek is estimated to be 3,900 ML/d (Water Tech 2016). Several stream flow gauges along the Wimmera River can provide early guidance to the expected flooding along Yarriambiack Creek, these include the Glenorchy gauge (shown in this table) and Glynwylln (415206).			
4.68 (14,531 ML/d)	0.84	1.44	5	905	0 (0)	The trigger for Yarriambiack Shire Council to open the Warracknabeal weir gates is 1.44m. There are minor breakouts of floodwater at Dumbuoy Road cutting access to more than three buildings at 189 Dumbuoy Road (a house, the Rusty Nail Restaurant and Leura Log Cabin accommodation building) south of Warracknabeal. Minor breakouts of floodwater also occur north of the Warracknabeal Weir and adjacent to the Warracknabeal Fauna Park. South of Warracknabeal minor breakouts of floodwater occur adjacent to the Henty Highway at Kellalac, at the Minyip-Dimboola Road, and the Horsham Minyip Road. Floodwater may cut access to numerous road crossings and private crossings along Yarriambiack Creek.	X3 buildings may be isolated south of Warracknabeal; House, Rusty Nail Restaurant Leura Log Cabin Accommodation at 189 Dumbuoy Road.	Craig Avenue depth 0m Cemetery Road depth 0.21m <b>South of Warracknabeal:</b> Dumbuoy Road depth 0.30m access cut Ailsa Road 0.24m Henty Highway at Kellalac depth 0m	Council and Regional Roads Victoria to deploy road closure signs and undertake traffic management as needed. VICSES activate ground observers as needed.
4.81	1.46	1.85	September 2010		1 (1)	The lower level of the Rusty Nail Restaurant is flooded over floor.	The lower level of the Rusty Nail Restaurant (189 Dumbuoy Road, south of Warracknabeal) is flooded above floor.		In addition to actions listed above: VICSES sandbag buildings impacted by flooding as needed.
4.81 (19,884 ML/d)	0.95	1.92	10	1,166	1 (1)	Increasing flood depths may cut access to additional major and minor road crossings along Yarriambiack Creek. Access/egress may be cut to a number of rural dwellings along Yarriambiack Creek, causing people to be isolated.	X1 house may be isolated south of Warracknabeal; 111 Roses Road.	Craig Avenue depth 0m Cemetery Road depth 0.33m <b>South of Warracknabeal:</b> Dumbuoy Road depth 0.38m Ailsa Road 0.28m Henty Highway at Kellalac depth 0.09m	In addition to actions listed above: Council to check flap valves on pipes, sandbag pits as needed.
4.89 (25,020 ML/d)	1.21	1.99	20	1,743	1 (1)	Flooding breaks out into the Warracknabeal industrial area, north east of the Warracknabeal Weir, Rainbow Road. Floodwater may impact buildings below floor if the temporary sections of the Warracknabeal Levee are not installed.	X1 house may be isolated south of Warracknabeal, on Drillers Road, south of Horsham-Minyip Road, west of Yarriambiack Creek.	Craig Avenue depth 0.07m Cemetery Road depth 0.47m <b>South of Warracknabeal:</b> Dumbuoy Road depth 0.45m Ailsa Road 0.30m access cut Henty Highway at Kellalac depth 0.10m	In addition to actions listed above: Yarriambiack Shire Council ensure the gates and temporary sections of the Warracknabeal Levee are in place, are sealed and operational.
4.89	1.35	1.69	September 2016						Refer to actions listed above.
	1.80		Minor flood level						In addition to actions listed above: Council install temporary sections in the Warracknabeal levee as needed.
	2.00		Moderate flood level						Refer to actions listed above.

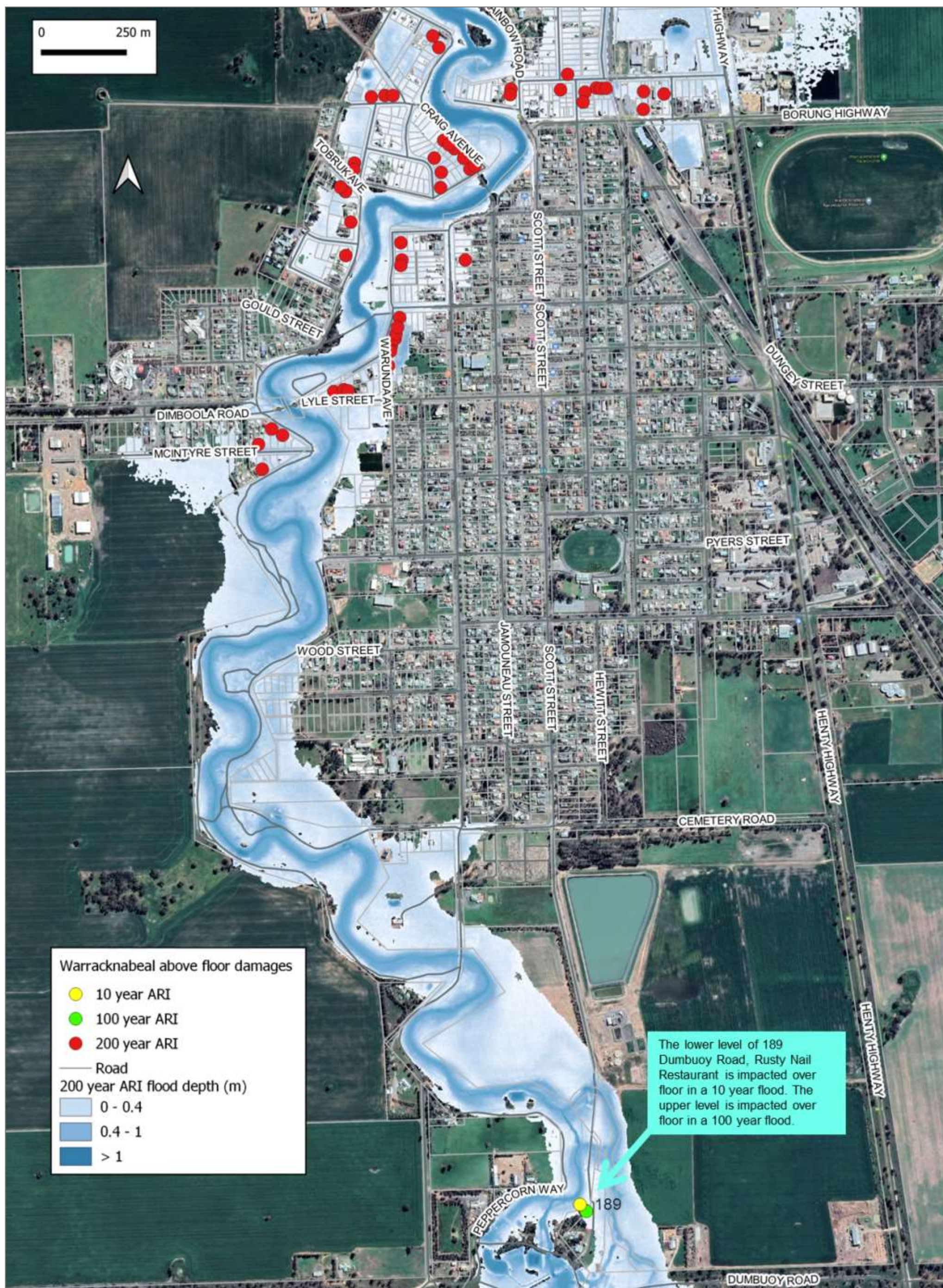


	2.06		1983 and 1981						Refer to actions listed above.
	2.10		Major flood level						Refer to actions listed above.
4.96 (31,667 ML/d)	2.17	2.22	50	3,368	1 (1)	Apex Park and most of the Caravan Park is flooded. The Jeparit - Warracknabeal Road is closed due to flooding impacts. Floodwater may overtop the Henty Highway at Kellalac to a depth of 0.20m. Two houses may be isolated by floodwater west of Cemetery Road, and may be flooded below floor. Two houses may be isolated by floodwater south of Warracknabeal on Greenhills Road and Daveys Road.	Warracknabeal Caravan Park starts to be impacted by flooding depth 0.45m X2 houses may be isolated; 7 and 9 Cemetery Road. X2Houses may be isolated <b>South of Warracknabeal:</b> 1125 Greenhills Road. House on north of Daveys Road east of Yarriambiack Creek	Craig Avenue depth 0.34m Cemetery Road depth 0.69m <b>South of Warracknabeal:</b> Dumbuoy Road depth 0.50m Ailsa Road 0.59m Henty Highway at Kellalac depth 0.41m access cut	Refer to actions listed above.
5.01 (36,648 ML/d)	2.30	2.35	100	5,028	2 (2)	Access may be cut to all major and minor roads, overtopped by floodwater. In addition to the lower level, the upper level of the Rusty Nail Restaurant (189 Dumbuoy Road) may be flooded above floor.	Warracknabeal Caravan Park is impacted by flooding depth 0.89m. The upper level of the Rusty Nail Restaurant (189 Dumbuoy Road, south of Warracknabeal) may be flooded above floor.	Craig Avenue depth 0.48m Cemetery Road depth 0.83m <b>South of Warracknabeal:</b> Dumbuoy Road depth 0.62m Ailsa Road 0.62m Henty Highway at Kellalac depth 0.57m	Refer to actions listed above.
5.03 (39,527 ML/d)	2.335	2.36	January 2011			Warracknabeal rain gauge recorded 151 mm over five days. A number of houses were impacted above floor by stormwater flooding in Lyle Street (one house was 75 Lyle Street) and the Borung Highway (east of the Racecourse). In addition, roads that were impacted by stormwater flooding include: Gardiner Street, McIntyre Street and Asquith Reserve. Since this event council have undertaken significant works to upgrade drainage infrastructure to reduce the impact stormwater flooding. Local residents in Warracknabeal constructed a temporary 6 km levee, in addition 50,000 sandbags were used, approx 117 homes were sandbagged within Warracknabeal. The Warracknabeal Caravan Park, Warracknabeal Bowls Club, a Child Care Centre, Rusty Nail Restaurant (south of Warracknabeal), 4001 Borung Highway, x2 Cemetery Road (3,9) and 16 Dumbuoy Road. In Brim, stormwater flooding caused damage and below floor inundation to properties at the eastern end of Swan Street and both the eastern and Western end of King Street. The majority of these buildings are no longer subject to flooding due to extensive flood mitigation works.			
5.05 (41,611 ML/d)	2.39	2.49	200	6,567	> 293 (59)	The Warracknabeal levee is overtopped, there is significant number of buildings flooded over floor. There is uncertainty surrounding the buildings subject to flooding over floor. Revised modelling needs to be developed to incorporate the final levee alignment. The changes to the Warracknabeal Levee alignment will significantly change the current damage estimates.	Warracknabeal Caravan Park is impacted by flooding depth 1.09m	Craig Avenue depth 0.60m Cemetery Road depth 0.93m <b>South of Warracknabeal:</b> Dumbuoy Road depth 0.73m Ailsa Road 0.68m Henty Highway at Kellalac depth 0.65m	
Forecast gauge: Wimmera River at Glenorchy gauge 415201									









Warracknabeal above floor damages during a 200 year ARI flood event (Water Technology 2016)



## Warracknabeal and Yarriambiack Creek (south of Warracknabeal) Property Inundation Table (Water Technology 2016)

Currently the construction of the Warracknabeal Levee is close to completion. The Levee protects buildings in Warracknabeal to 100 mm above the 100 year ARI flood event. The Rusty Nail Restaurant (189 Dumbuoy Road, south of Warracknabeal) is not protected by the Warracknabeal Levee.

The table below of buildings at risk of over floor flooding during a 200 year ARI flood event needs to be revised based on changes to the alignment of the Warracknabeal Levee. Please note the addresses listed in this table will be subject to change and should be used as a guide only.

ID	Address	Depth of over floor flooding for each ARI event (m)					Building type and comments
		10	20	50	100	200	
1	189 DUMBUOY ROAD, south of Warracknabeal.	0.1	0.26	0.49	0.72	> 0.72	Lower level of the Rusty Nail Restaurant
2	189 DUMBUOY ROAD, south of Warracknabeal.				0.15	0.22	Upper level of the Rusty Nail Restaurant
3	23 BOWMAN					0.444	SHED
4	5 WARUNDA AVE			0.073	0.228	0.351	BRICK, SLAB
5	3 WARUNDA AVE			0.063	0.217	0.34	BRICK, SLAB
6	1 WARUNDA AVE			0.063	0.217	0.338	BRICK, SLAB
7	1 KOKODA AVE			0.033	0.173	0.282	BRICK, SLAB
8	13 THE AVENUE			-0.026	0.135	0.246	BRICK, SLAB
9	33 ROSS STREET					0.225	IRON (SILO), SLAB
10	7 MENIN AVE					0.217	FIBRO, SLAB
11	2 RAINBOW ROAD				0.127	0.206	IRON (SHED)
12	189 DUMBUOY ROAD					0.204	Restaurant, STUMPS
13	11 ANDERSON					0.193	IRON (SHED)
14	1 CLIFFORD					0.176	WEATHERBOARD, STUMPS
15	41 off RAINBOW ROAD (UNNAMED ROAD)			0.063	0.13	0.176	IRON (SHED)
16	13 BOWMAN					0.174	CLADDING, STUMPS
17	82 CRAIG AVE			-0.081	0.062	0.174	WEATHERBOARD, STUMPS
18	26 KELSALL					0.174	IRON (SHED), SLAB
19	2 BOWMAN					0.167	IRON (SHED), SLAB
20	4 JEPARIT RD				0.088	0.166	BRICK (SHED), SLAB
21	2 ASQUITH RES RD			-0.155	0.041	0.15	WEATHERBOARD, STUMPS
22	78 CRAIG AVE			-0.103	0.04	0.15	WEATHERBOARD, STUMPS
23	8 TOBRUK AVE				-0.026	0.144	HARDI PLANK
24	4 ASQUITH RES RD			-0.175	0.022	0.132	CLADDING, STUMPS

ID	Address	Depth of over floor flooding for each ARI event (m)					Building type and comments
		10	20	50	100	200	
25	80 CRAIG AVE			-0.126	0.017	0.127	CLADDING, STUMPS
26	1 WOOLCOCK			-0.158	-0.006	0.113	BRICK, STUMPS
27	52 CRAIG AVE					0.098	BRICK, SLAB
28	68 CRAIG AVE, VIC			-0.163	-0.018	0.091	BRICK, STUMPS
29	2 LYLE					0.089	CLADDING
30	5 DEVEREUX					0.085	WEATHERBOARD, STUMPS
31	4 LYLE STREET				-0.07	0.085	HOUSE
32	76 CRAIG AVE			-0.169	-0.025	0.084	WEATHERBOARD, STUMPS
33	88 CRAIG AVE			-0.177	-0.031	0.082	WEATHERBOARD, STUMPS
34	3 MENIN AVE				-0.053	0.082	WEATHERBOARD, STUMPS
35	90 CRAIG AVE			-0.172	-0.036	0.079	WEATHERBOARD, STUMPS
36	1 SCHICKERLING ST					0.078	IRON (SHED), SLAB
37	1 MENIN AVE				-0.063	0.077	WEATHERBOARD, STUMPS
38	122 CRAIG AVE			-0.233	-0.04	0.076	CLADDING, STUMPS
39	3 DEVEREUX					0.076	RENDERED, STUMPS
40	9 WARUNDA AVE			-0.209	-0.051	0.075	BRICK, SLAB
41	86 CRAIG AVE			-0.188	-0.041	0.074	WEATHERBOARD, STUMPS
42	6 ASQUITH RES RD				-0.038	0.073	WEATHERBOARD, STUMPS
43	2A LYLE STREET					0.072	Motel
44	15 BOWMAN					0.064	WEATHERBOARD, STUMPS
45	9 THE AVENUE				-0.06	0.061	WEATHERBOARD, STUMPS
46	18 ASQUITH RES RD				-0.064	0.056	CLADDING, STUMPS
47	4 CORAL AVE				-0.102	0.055	WEATHERBOARD, STUMPS
48	6 CORAL AVE				-0.112	0.041	CLADDING, STUMPS
49	7 KOKODA AVE			-0.217	-0.072	0.037	WEATHERBOARD
50	7 WARUNDA AVE			-0.247	-0.092	0.031	BRICK, SLAB
51	11 BOWMAN					0.024	CLADDING, STUMPS
52	46 CRAIG AVE					0.022	BRICK, SLAB
53	13 WARUNDA AVE			-0.277	-0.118	0.01	BRICK, SLAB
54	116 CRAIG AVE			-0.321	-0.115	0.008	CLADDING, STUMPS
55	4 TOBRUK AVE				-0.165	0.007	CLADDING, STUMPS
56	7 THE AVENUE				-0.121	0.003	CLADDING, STUMPS
57	7 ASQUITH RES RD				-0.122	0.002	HOUSE

## Appendix C2: Brim (Yarriambiack Creek) Flood Emergency Plan

Brim is located 26km north of Warracknabeal along the Yarriambiack Creek. The focus of this section includes Brim and Yarriambiack Creek north of Warracknabeal to Galaquil East Road, refer to the map below.

### Historic Flood Events

Brim and Yarriambiack Creek has experienced flooding in 1909, 1981, 1983, 2010, 2011 and 2016. The largest recent flood event on record was the January 2011 flood event. Brim was significantly impacted by both riverine and stormwater flooding during this event. Rainfall in Warracknabeal of 151mm was recorded over five days. Direct runoff caused localised flooding in and around Brim on the 13<sup>th</sup> and 14<sup>th</sup> of January 2011. During the January 2011 flood event, stormwater flooding caused damage and below floor inundation to properties at the east end of Swan Street and both eastern and western ends of King Street. For more details regarding impacted areas, refer to the Stormwater Flood Risk section below.

Riverine flooding impacted Brim on the 21<sup>st</sup> of January. Local residents constructed temporary earthen levee to protect Brim, refer to the Brim Levees section below for more details.

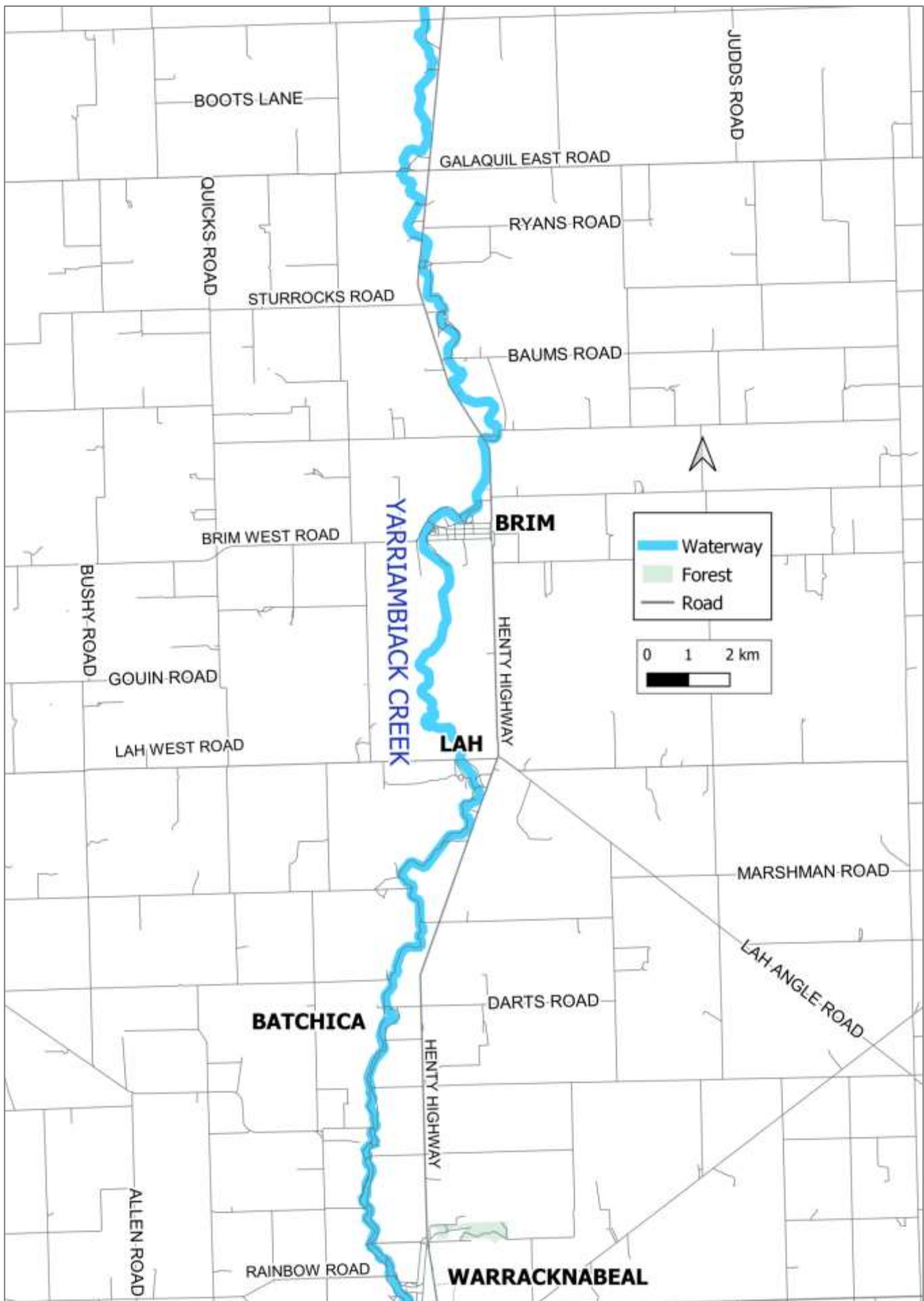
While there were no buildings impacted by over floor flooding, one house north of Brim along the Henty Highway (2690 Henty Highway) was at risk of over floor flooding, refer to photo below. Significant sandbagging and flood protection works were undertaken to protect this house from flooding. Since this flood event the landholders have constructed an earthen levee to protect their house from future flood events. The protection level of the levee is unknown.

Flooding along Yarriambiack Creek cuts access to all main and minor roads, refer to the photo below at Lah. While the main town centre of Brim is largely not impacted by flooding during major flood events, the town is often isolated due to access being cut to the Henty Highway in several locations north and south of Brim. Within Brim, access is cut to Wurfel Road and Brim West Road causing houses to be isolated. For details regarding roads impacted and houses isolated refer to the flood impacts maps and Flood Intelligence table below.



A house 6.5km north of Brim along the Henty Highway at risk of flooding during the January 2011 flood event.







Yarriambiack Creek crossing at Lah during the January 2011 flood event (source: Brett and Rebecca Lewis).

The January 2011 flood event in Brim was estimated to be approximately the 100 year ARI design flood event, refer to the map below.

Within Brim flooding impacted the Golf Course and a shed adjacent to the Recreation Reserve, refer to photos below. Flooding also damaged the Brim Weir, pipes, culvers and road crossings in Brim and along the Yarriambiack River. Yarriambiack Shire Council undertook extensive works to repair assets damage caused by flooding.





Flooding impacting the Brim Golf Course during the January 2011 flood event.



Brim culvers on the Brim West Road, adjacent to the Weir during the January 2011 flood event.





Flooding adjacent to Brim West Road during the January 2011 flood event.

### Flood Warning Time

There are no stream monitoring gauges north of the Murtoa gauge along the Yarriambiack Creek. A series of stream gauge boards along Yarriambiack Creek are used to track peak flood flows. A stream gauge board located at the Brim Weir is regularly monitored during flood events to track the flood peak and assist with estimating the peak travel time along Yarriambiack Creek. Refer to **Appendix H** for a map of the gauge board locations.

During the January 2011 flood event, the flood peak took approximately 38 hours to travel between Warracknabeal and Brim. The flood peak was maintained at Brim for 2 to 3 days. An analysis undertaken (Water Technology 2016) of flood peak travel times between Warracknabeal and Brim show that historic and design flood peak travel times vary between 25 hours and 128 hours, refer to table below.

Average Recurrence Interval (ARI)	September 2010	5	10	20	50	January 2011	100	200
Flood peak travel time from Warracknabeal to Brim (hours) (Water Technology 2016)	128	54	53	48	49	38	33	25



## Brim Levees

Levees were also constructed in Brim during the January 2011 flood event, refer to map below. However these levees were not required. Modelling (Water Technology 2016) has shown these levees are unnecessary up to a 200 year ARI flood event.



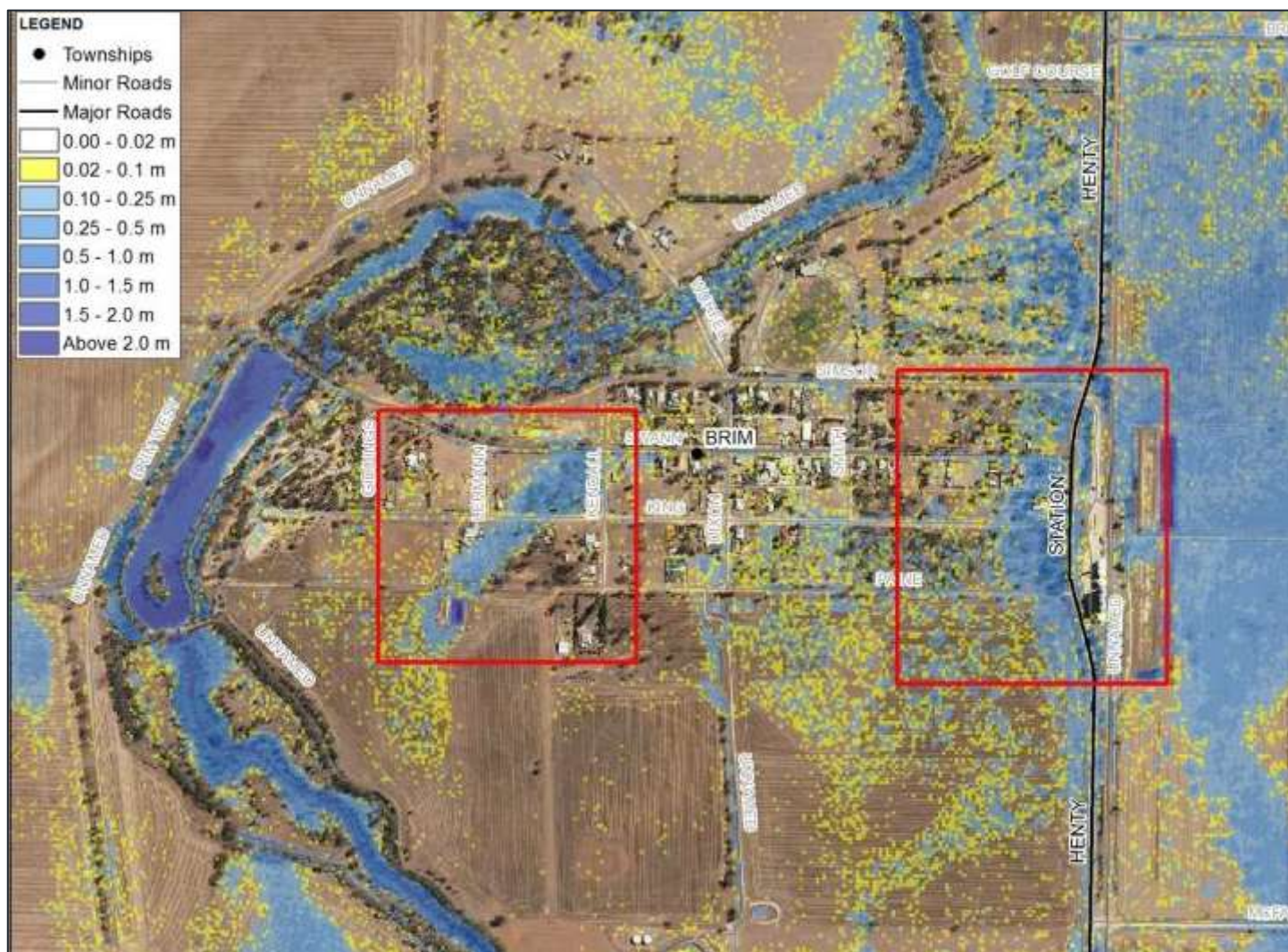
Brim levees during the January 2011 flood event.

## Stormwater flooding

Stormwater flood risk is not as significant in Brim as in Warracknabeal, aerial imagery of the January 2011 flood event show some localised pooling of water however there were no reports of buildings impacted by flooding.

Stormwater modelling was completed for the 100 year ARI for a 2 hour duration, refer to the map below. The results show Brim has two localised catchment areas: immediately south of Brim between Yarriambiack Creek and the Henty Highway and east of the Henty Highway contributing water to north of Brim.

As was seen in the January 2011 stormwater flood event, stormwater flooding can cause damage and below floor inundation to properties at the eastern end of Swan Street and both the eastern and western ends of King Street.



Brim stormwater flood mapping, 100 year 2hr duration (Water Technology 2016).



## Brim Weir Management during floods

The Brim Weir consists of four weir gates and has a capacity of 94 ML (Alluvium 2014), refer to the photo below. The Weir is located to the west of Brim, where Brim West Road intersects Yarriambiack Creek, refer to the map below. Water in the Weir has a significant social value, serves to provide the community with both a recreational asset, but also a sense of place and forms part of the identity of the town. The maximum flow rate of the Brim Weir is 691 ML/d (Alluvium 2014).

Yarriambiack Shire Council will monitor flow rates at the Warracknabeal Weir and will open the Brim Weir if flooding or high flows are likely to occur in Brim. Triggers that the Yarriambiack Shire Council may use in their decision making to open the Brim Weir gates include;

- When flooding occurs at Glenorchy, stream gauge height of 4.67m (flow of 14,531 ML/d) or greater
- When flooding occurs along the lower Yarriambiack Creek, Murtoa stream gauge height of 0.84m (flow of 905 ML/d) or greater



Brim Weir.



Location of the Brim Weir.



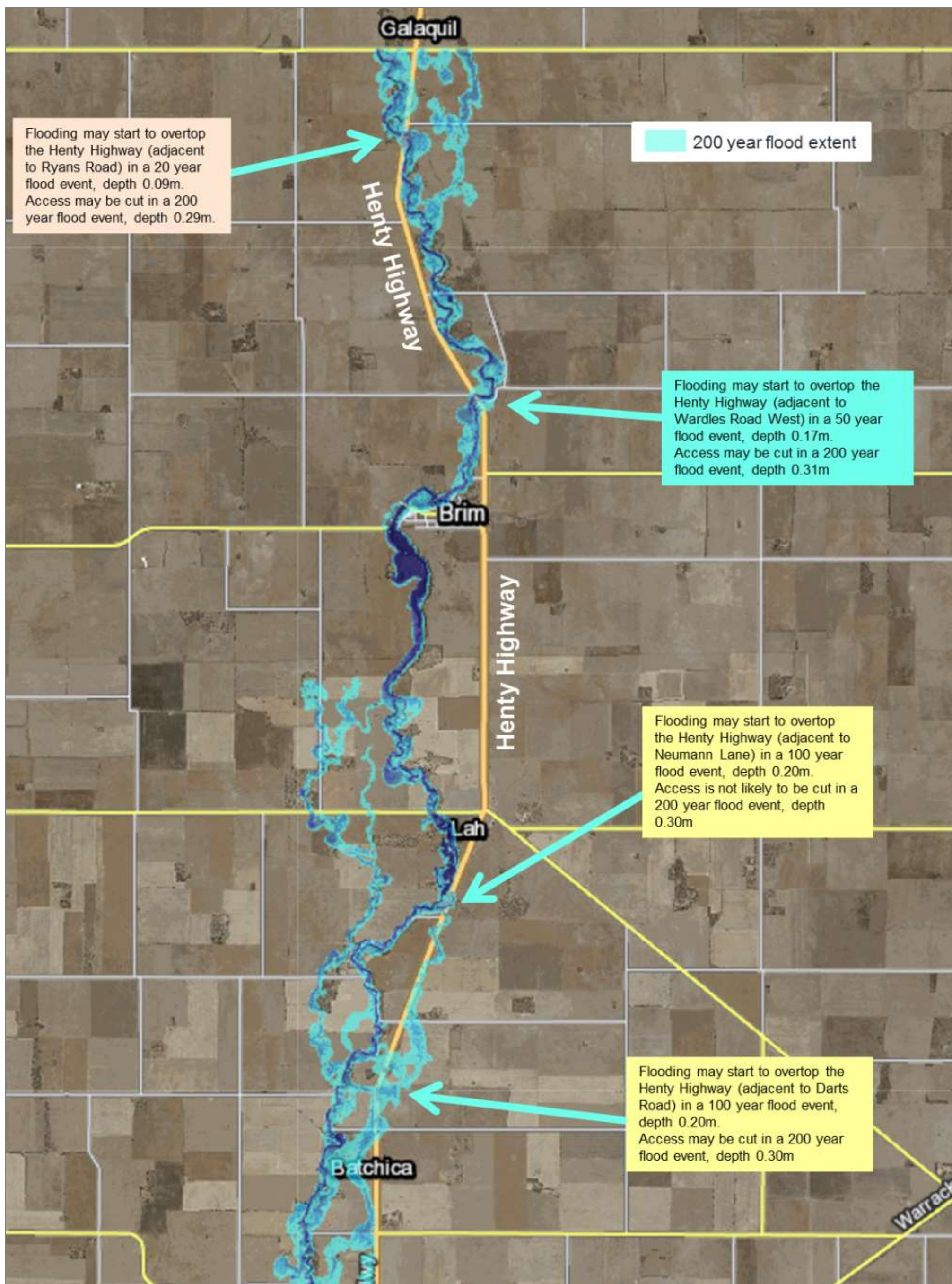
## Brim Flood Impacts and Required Actions

Key assets at risk of flooding in Brim and Yarriambiack Creek (north of Warracknabeal to Galaquil East Road) are listed in the table below.

Asset register				
Asset Name and location	Average Recurrence Interval (ARI)	Consequence / Impact	Mitigation/ Action	Lead Agency
Access to a house at 2690 Henty Highway, north of Brim, east of Henty Highway, south of Ryans Road.	5 year flood	Access/egress to a house at 2690 Henty Highway may start to be impacted by flooding in a 5 year event, depth 0.19m. Access may be cut in a 20 year flood, depth 0.30m	Notify the landholder that access may be cut by flooding	Council
Access to a house at 2560 Henty Highway, north of Brim, east of Henty Highway, south of Sturrocks Road.	5 year flood	Access/egress to a house at 2787 Henty Highway may start to be impacted by flooding in a 5 year flood, depth 0.15m. Access may be cut in a 20 year flood, depth 0.37m	Notify the landholder that access may be cut by flooding	Council
Access to a houses on Wurfel Road, north of Brim, north of Yarriambiack Creek.	5 year flood	Access/egress to on Wurfel Road may be impacted by flooding.	Notify the landholder that access may be cut by flooding. Deploy road closure signs as needed	Council
Access to a house at 2787 Henty Highway, west of the Henty Highway, north of Ryans Road.	10 year flood	Access/egress to a house at 2787 Henty Highway may start to be impacted by flooding in a 10 year event, depth 0.14m. Access may be cut in a 50 year flood, depth 0.31m	Notify the landholder that access may be cut by flooding.	Council
Access to a house at 2827 Henty Highway, north of Brim, west of Henty Highway, north of Ryans Road.	10 year flood	Access/egress to a house at 2827 Henty Highway may start to be impacted by flooding in a 10 year event, depth 0.10m. Access may be cut in a 50 year flood, depth 0.34m	Notify the landholder that access may be cut by flooding.	Council
Brim Golf Course, Simon Street, north of Brim.	50 year flood	The Brim Golf Course may start to be impacted by flooding during a 50 year flood, depth 0.21m.	Notify the Brim Golf Course committee that flooding is likely.	Council
Brim Caravan Park	50 year flood	The Brim Caravan Park may start to be impacted by flooding during a 50 year flood.	Evacuate the Caravan Park.	Victoria Police
House at 2690 Henty Highway, north of Brim, east of Yarriambiack Creek.	100 year flood	A house at 2690 Henty Highway may be impacted by over floor flooding. The landholders have constructed a levee to protect their property. The protection level of the levee is unknown.	Contact the landholder to ask if they need additional support.	Council
Brim West Road, west of Brim	100 year flood	Access may be cut to Brim West Road during a 100 year flood event, depth 0.55m	Deploy road closure signs as needed.	Council

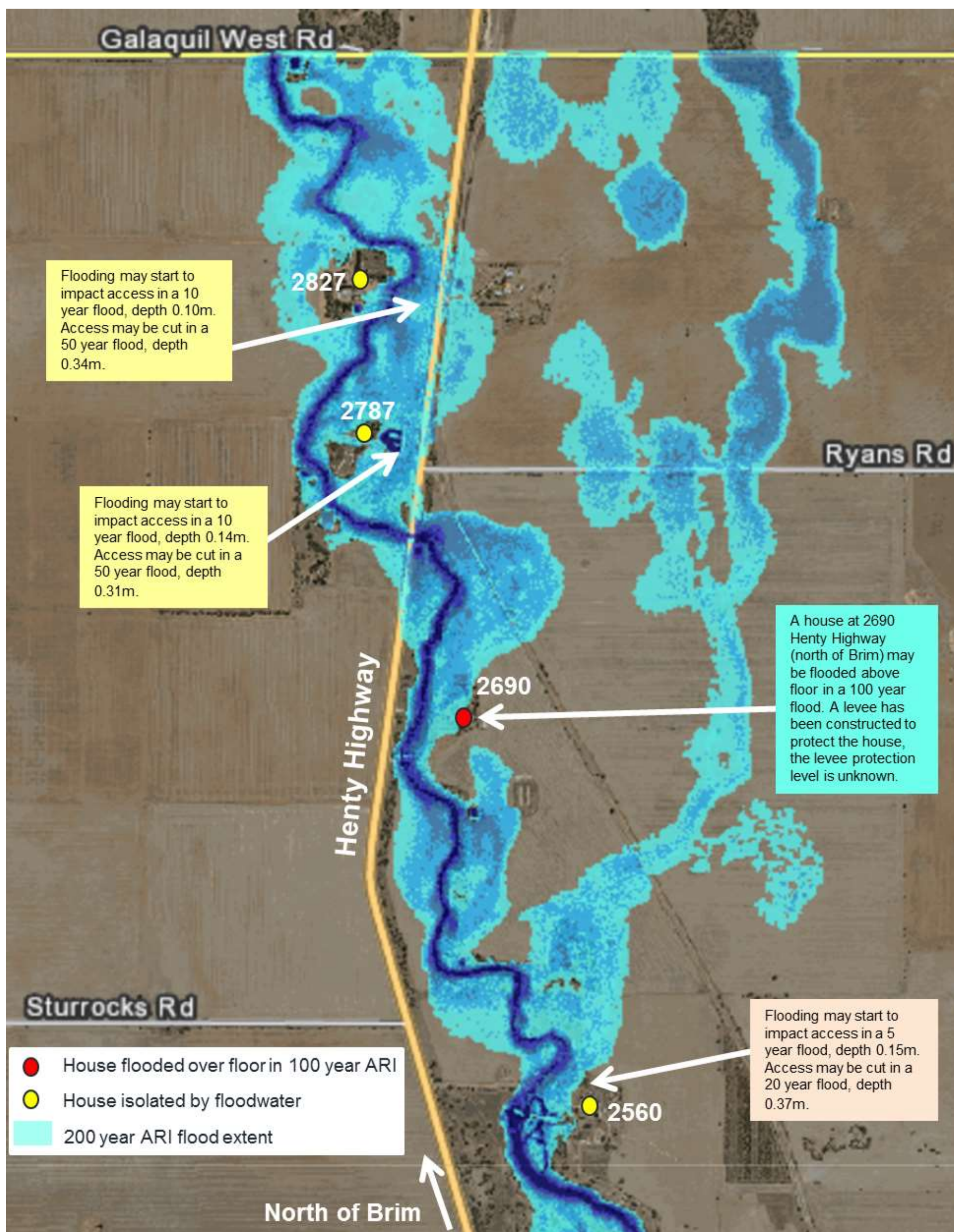
For more detailed information regarding buildings and roads impacted refer to the Brim Flood Intelligence Card and flood damages/impact maps below. Also refer to the Brim flood depth maps in **Appendix F**, a list of flood observers in **Appendix H** and community sandbag collection points in **Appendix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





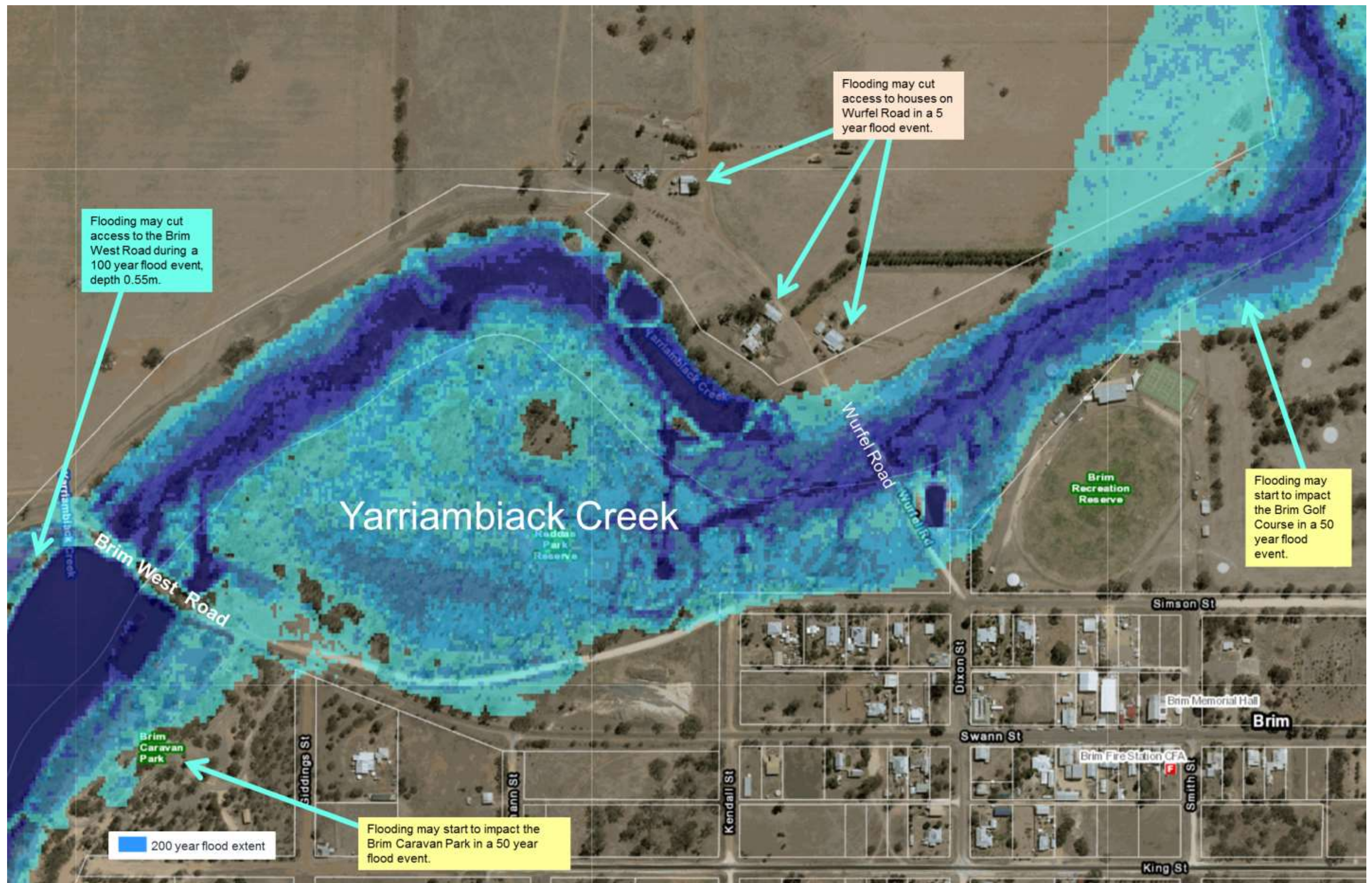
Roads impacted by flooding along the Yarriambiack Creek, north of Warracknabeal with the 200 year ARI flood extent.





Houses impacted by Yarriambiack Creek flooding north of Brim with the 200 year ARI flood extent.





Brim assets impacted by flooding during a range of design flood events (Water Technology 2016)



## Brim and Yarriambiack Creek (north of Warracknabeal to Galaquil East Road) Flood Intelligence Card (Water Technology 2016)

Flood travel time						Stormwater flooding time from start of rain to flooding 2-3 hours		
						Time between Warracknabeal peak to steep rise in Brim 0.5 to 4 days		
						Time between Warracknabeal and Brim peak 1 to 5.3 days		
						Flooding duration: 2 - 3 days		
Wimmera River at Glenorchy gauge height 415201 (m) Water Tech 2016	Yarriambiack Creek at Jung gauge height 415241 (m)	Yarriambiack Creek at Warracknabeal gauge board height (m)	Average Recurrence Interval (ARI)	Yarriambiack Creek flow at Jung gauge (ML/d) Water Tech 2016	Consequences/ Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action
2.82 (3,900 ML/d)					Yarriambiack Shire Council will monitor flow rates at the Warracknabeal Weir and will open the Brim Weir if flooding or high flows are likely to occur in Brim.			VICSES activate ground observers as needed.
4.68 (14,531 ML/d)	0.84	1.44	5	905	Yarriambiack Shire Council will open the Brim Weir when flooding is likely to occur. Residents of Brim can become isolated via the inundation of the Henty Highway north of Brim and south of Lah.	Houses north of Brim may be isolated, flooding cuts access to Wurfel Road: 22 Wurfel Road Brim and others adjacent are isolated.	Lah West Road depth 0m Wurfel Road depth 0.34m Brim West Road depth 0m	Council open the Brim Weir when needed. Council and Regional Roads Victoria to deploy road closure signs and undertake traffic management as needed.
4.81	1.46	1.85	September 2010		Minor breakout of flooding along the floodplain. Yarriambiack Shire Council should open the Brim Weir.			Refer to actions listed above.
4.81 (19,884 ML/d)	0.95	1.92	10	1,166	Significant breakout of floodwater upstream of the Brim Weir.		Lah West Road depth 0m Wurfel Road depth 0.45m Brim West Road depth 0m	Refer to actions listed above.
4.89 (25,020 ML/d)	1.21	1.99	20	1,743	Floodwater overtops the Henty Highway south of Ryans Road to a depth less than 0.2m (south of Galaquil East Road, north of Brim). Flood water may isolate two houses north and south of Ryans Road, north of Brim.	Additional houses north of Brim are isolated; 2787 Henty Highway (west of Henty Highway, north of Ryans Road), 2690 Henty Highway (east of Henty Highway, south of Ryans Road).	Lah West Road depth 0m Wurfel Road depth 0.59m Brim West Road depth 0m	Yarriambiack Shire Council notify landholders that access/egress may be cut to their house by flooding.
4.89	1.35	1.69	September 2016					Refer to actions listed above.
	1.80		Minor flood level					
	2.00		Moderate flood level					Refer to actions listed above.
	2.06		1983 and 1981					Refer to actions listed above.
	2.10		Major flood level					Refer to actions listed above.
4.96 (31,667 ML/d)	2.17	2.22	50	3,368			Lah West Road depth 0m Wurfel Road depth 0.77m Brim West Road depth 0m	Refer to actions listed above.
5.01 (36,648 ML/d)	2.30	2.35	100	5,028	A house at 2690 Henty Highway (north of Brim) may be flooded above floor. A levee has been constructed to protect this property, however the protection level the levee provides is unknown. The Brim Caravan Park is impacted by flooding. Flooding overtops Lah West Road (south of Brim) and Brim West Road.	A house at 2690 Henty Highway (south of Beulah) may be flooded above floor. The Brim Caravan Park is impacted, depth 0.41m	Lah West Road depth 0.36m Wurfel Road depth 0.90m Brim West Road depth 0.55m	In addition to actions listed above: VICSES sandbag buildings impacted by flooding as needed.
5.03 (39,527 ML/d)	2.335	2.36	January 2011		The Brim Golf Course and a shed at the Brim Recreational Reserve was impacted by flooding. Access was cut to a large number of buildings along Yarriambiack Creek and within Brim. Access was cut to buildings located in Brim to the north of Yarriambiack Creek			Yarriambiack Shire Council notify landholders that access/egress may be cut to their house by flooding.
5.05 (41,611 ML/d)	2.39	2.49	200	6,567		The Brim Caravan Park is impacted, depth 0.54m	Lah West Road depth 0.42m Wurfel Road depth 1.04m Brim West Road depth 0.69m	

## Appendix C3: Beulah (Yarriambiack Creek) Flood Emergency Plan

Beulah is located 37 km north of Warracknabeal and 120 km north of the Yarriambiack Creek offtake.

There are no stream gauges along Yarriambiack Creek north of Jung, however there is a network of gauge boards that are used to track the flood peak during flood events. This is done by flood observers taking a series of photos at each gauge board, refer to **Appendix H**.





## Historic Flood Events

Beulah has experienced flooding in 1894, 1909, 1915, 1923, 1955, 1956, 1960, 1964, 1974, 1975, 1981, 2010 and 2011. The largest recent flood event on record was the January 2011 flood event, severely impacting Beulah.

During January 2011 Beulah received 106mm over three days. Direct runoff caused localised flooding in and around Beulah. This flood event caused considerable damage to buildings, roads and bridges, refer to flood photos below.

The magnitude of this event was documented to be between a 100 year ARI and a 200 year ARI event. If significant flood mitigation measures had not been in place in Beulah, flood inundation in excess of the 100 year ARI would have occurred.

Flooding throughout Beulah was not as severe as expected due to a number of mitigation actions undertaken prior to and during the event. These included;

- Upstream end of the Beulah Weir Pool was excavated
- Luna Park Road, the downstream end of the Beulah Weir Pool was excavated
- Birchip-Rainbow Road excavated, downstream of town.
- Numerous levees and sandbagging

Post January 2011 the reinstatement of the excavated infrastructure was undertaken. The capacity of the infrastructure was increased to a 200 year ARI event, significantly reducing the flood risk.



Flooding adjacent to the Beulah oval during the January 2011 flood event.





Flood protection works undertaken for 1 Molony Street Beulah during the January 2011 flood event.



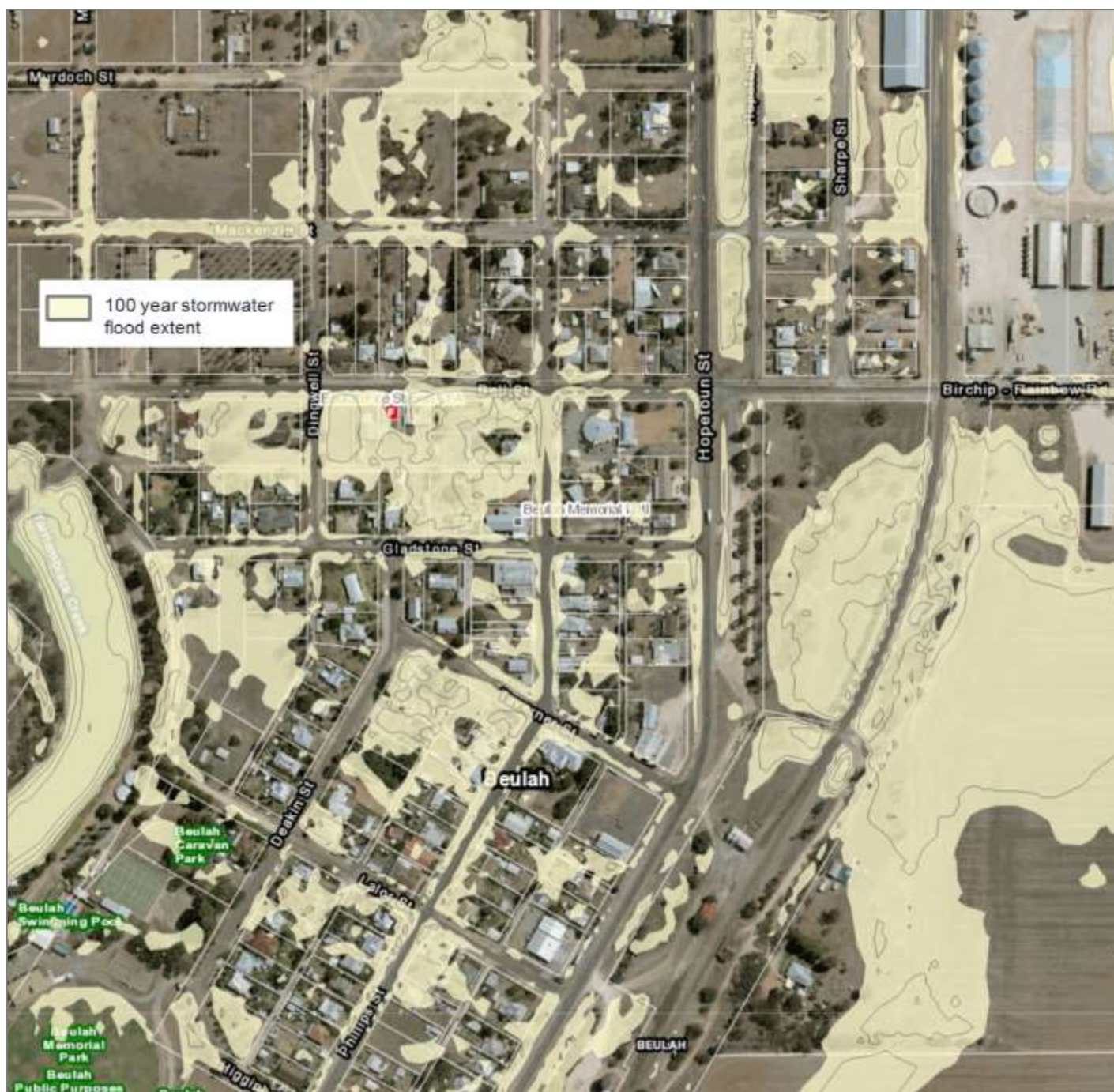
Flooding from Yarriambiack Creek cutting access is cut to a house during the January 2011 flood event.



## Stormwater flooding

Stormwater flood risk is not as significant in Beulah as in Warracknabeal, aerial imagery of the January 2011 flood event show some localised pooling of water however there were no reports of buildings impacted by flooding.

Stormwater modelling shows that limited ponding occurs in the area bounded by Bell, Phillips, Gladstone and Dingwell Streets, refer to the map below. This ponding appears to result from the raised road crest in Bell Street. Improved drainage under Bell Street is likely to reduce the ponding extent. From Bell Street, a small overland flow path continues north to the stormwater dam located at Lascelles Street. Further limited ponding occurs in the area bounded by Tavernor, Phillips, Lalor and Deakin Streets.



Beulah stormwater flood mapping, 100 year 2 hour duration (Water Technology 2006)

## Flood Warning Time

There are no stream monitoring gauges north of the Murtoa gauge along the Yarriambiack Creek. A series of stream gauge boards along Yarriambiack Creek are used by the Yarriambiack Shire Council to track peak flood flows. A stream gauge board located at the Beulah Weir is regularly monitored during flood events to track the flood peak and assist with estimating the peak travel time along Yarriambiack Creek, refer to map above. Also refer to **Appendix H** for a map of the gauge board locations along Yarriambiack Creek.

During the January 2011 flood event, the flood peak took approximately 76 hours to travel between Brim and Beulah. The flood peak was maintained at Brim for 2 to 3 days. An analysis undertaken (Water Technology 2016) of flood peak travel times between Brim and Beulah show that historic and design flood peak travel times vary between 25 hours and 128 hours, refer to table below.

Average Recurrence Interval (ARI)	September 2010	10	20	50	January 2011	100	200
Flood peak travel time from Brim to Beulah (hours) (Water Technology 2016)	128	53	48	49	38	33	25

## Mitigation works

Since the January 2011 flood event the Yarriambiack Shire Council has spent a significant amount of time and resources to implement flood mitigation works within Beulah. These works include;

- Installing culverts along the Birchip-Rainbow Road
- Upgrade the Beulah Downstream Weir

An analysis undertaken (Water Technology 2013) of the impact these mitigation works have on flood risk, refer to the map below. This analysis shows the mitigation works prevent floodwater from breaking out through the town of Beulah, significantly reducing the number of buildings impacted by flooding. The upgrade to the downstream weir structure is the primary driver for the reduction in flood risk (Water Technology 2013).

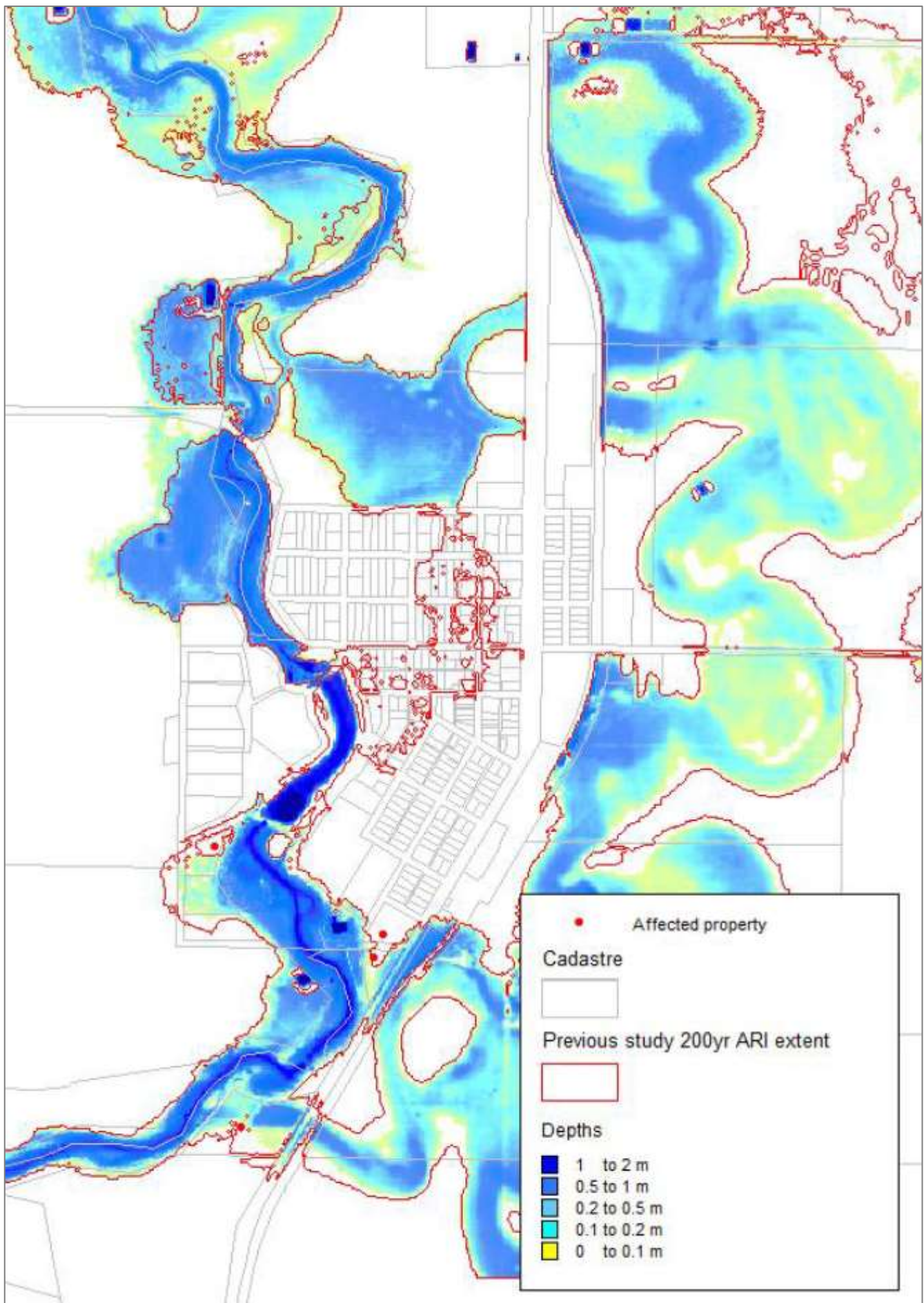
While there is some variation between the proposed flood mitigation works that have been modelled and actual works undertaken, the Yarriambiack Shire Council are confident that flood water is not likely to enter the Bell



Street area during a 100 year flood event. Given there is uncertainty regarding this, during flood events the Yarriambiack Shire Council will continue to monitor and provide support via offering sandbags etc to the landholders of the two buildings that may be subject to flooding in Bell Street, refer to maps, Flood Intelligence table and Flood Impacts table below.

Given there is uncertainty regarding the flood extents for the design flood events this Plan has used the design maps 10, 20 and 50 year ARI flood extents from the 2006 Beulah Flood Investigation (Water Technology 2006). The revised flood extent maps (Water Technology 2013) were used for the 100 and 200 year ARI flood extents.

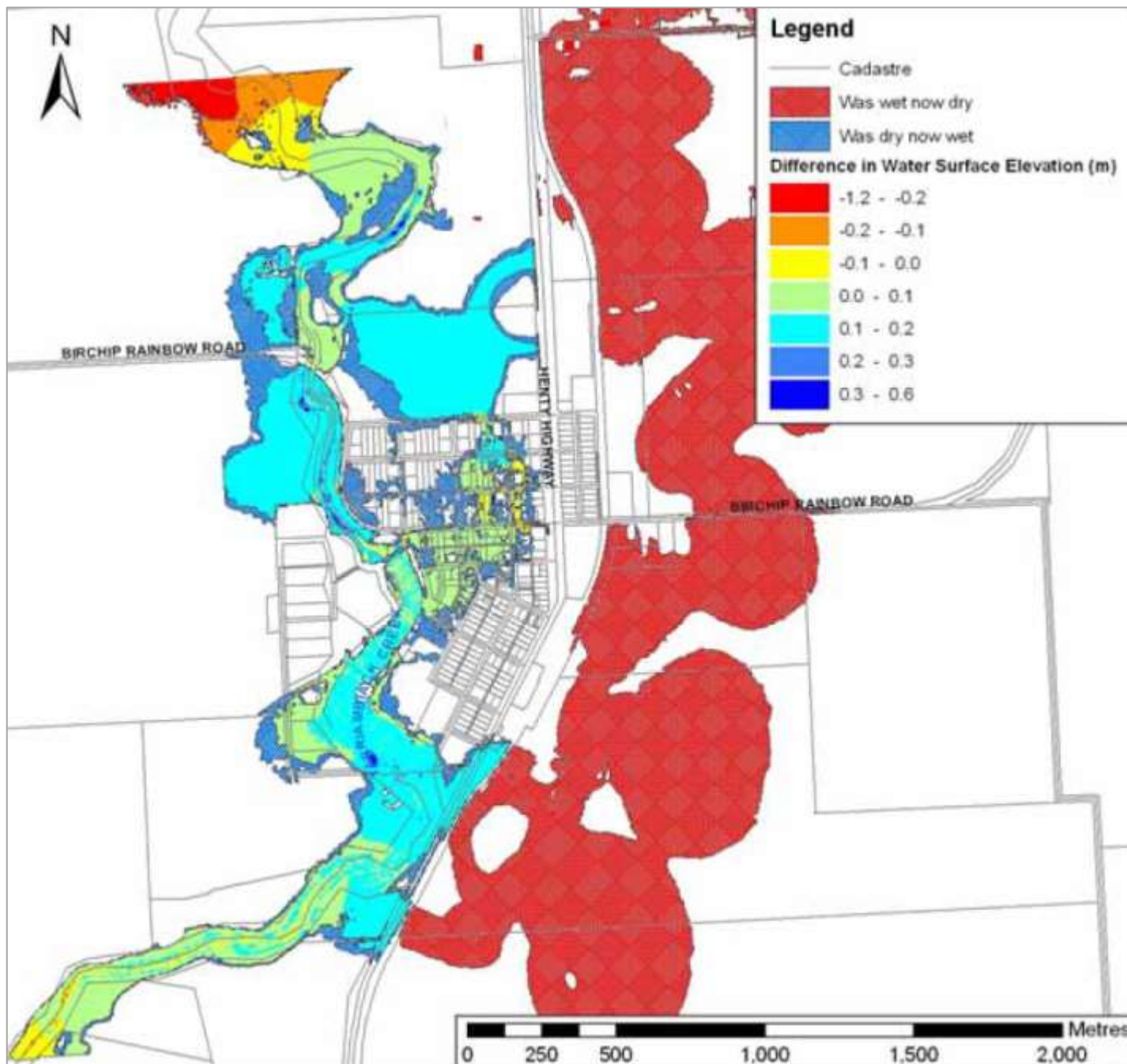
It is important to note that these maps should be used as a guide only given the uncertainty regarding the impacts of the flood mitigation works undertaken. This uncertainty can be resolved when the design flood mapping is revised to incorporate the mitigation works that have been undertaken.





## Culvert blockage impact assessment

An assessment of the potential impact of the blockage of two culverts to the south of Beulah, that enable flood flows to pass under the railway line. The impact of this blockage was assessed for a 100 year ARI flood event. Refer to the impact map below for the difference in flood level caused by the blockage. This model shows that if the culverts are blocked, this will cause significant number of properties to be impacted by flooding within Beulah, raising the flood level in some areas by over 300mm.



Blockage of culvers under the railway line south of Beulah (Water Technology 2007).

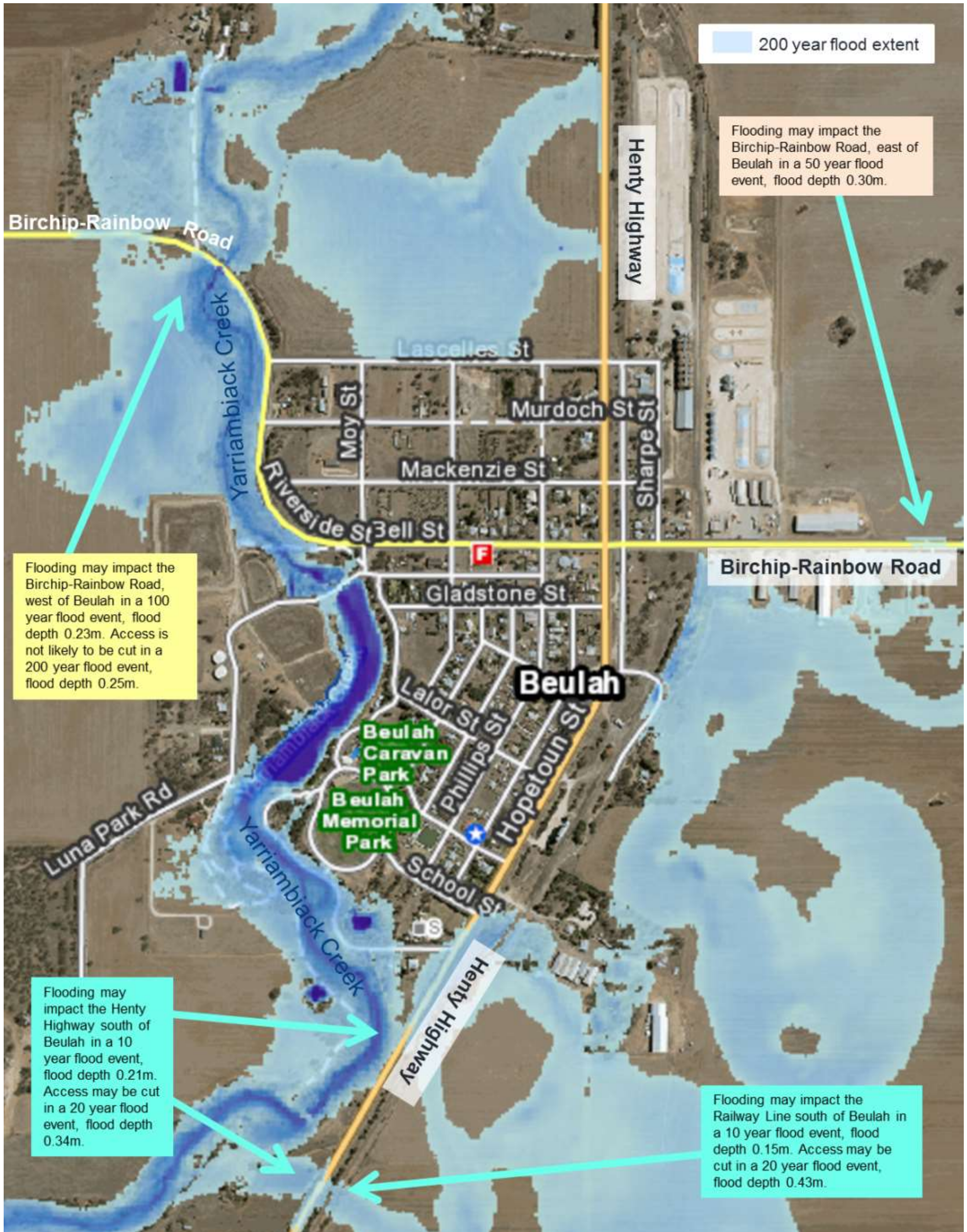
## Flood Impacts and Required Actions

Key assets in Beulah 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 to the Henty Highway, south of Beulah	10 year flood	Flooding may impact the Henty Highway in a 10 year flood, flood depth may be 0.21m. Access may be cut in a 20 year flood, flood depth greater than 0.34m.	Deploy road closure signs and undertake traffic management	Yarriambiack Shire Council Regional Roads Victoria
The Railway Line south of Beulah may be impacted by flooding.	10 year flood	Flooding may impact the Railway Line in a 10 year flood, flood depth may be 0.15m. Access may be cut in a 20 year flood, flood depth greater than 0.43m.	Suspend rail services during the flood event	VLINE
Access to a house at 3463 Henty Highway, south of Beulah, east of Yarriambiack Creek.	20 year flood	Access/egress to a house at 3463 Henty Highway may be impacted by flooding.	Notify the landholder that access may be cut by flooding	Yarriambiack Shire Council
Access to a house at 3870 Birchip-Rainbow Road north of Beulah, west of Yarriambiack Creek.	20 year flood	Access/egress to a house at 3870 Birchip-Rainbow Road may be impacted by flooding.	Notify the landholder that access may be cut by flooding	Yarriambiack Shire Council
Access to a house at 1 Molony Street, east of Yarriambiack Creek.	50 year flood	Access/egress to a house at 1 Molony Street may be impacted by flooding.	Notify the landholder that access may be cut by flooding	Yarriambiack Shire Council
Two houses at 24 Bell Street and 28 Bell Street may be impacted by flooding.	50 year flood	Two houses at 24 Bell Street and 28 Bell Street may be impacted by over floor flooding. There is uncertainty regarding if these buildings are at risk of flooding due to flood mitigation works undertaken.	Sandbag / evacuate as needed	VICSES Victoria Police
Flooding may impact the Birchip-Rainbow Road east of Beulah	50 year flood	Flooding may impact the Birchip-Rainbow Road east of Beulah in a 50 year flood, flood depth may be 0.30m.	Deploy road signs and undertake traffic management as needed	Yarriambiack Shire Council Regional Roads Victoria
Access to houses at 12, 39, 46, 56, 67 and 81 Luna Park Road, west of Yarriambiack Creek.	100 year flood	Access/egress to houses at 12, 39, 46, 56, 67 and 81 Luna Park Road may be impacted by flooding, depth 0.35m.	Notify the landholder that access may be cut by flooding	Yarriambiack Shire Council
Flooding may impact the Birchip-Rainbow Road west of Beulah	100 year flood	Flooding may impact the Birchip-Rainbow Road west of Beulah in a 100 year flood, flood depth may be 0.23m. Access is not likely to be cut.	Deploy road signs and undertake traffic management as needed	Yarriambiack Shire Council Regional Roads Victoria

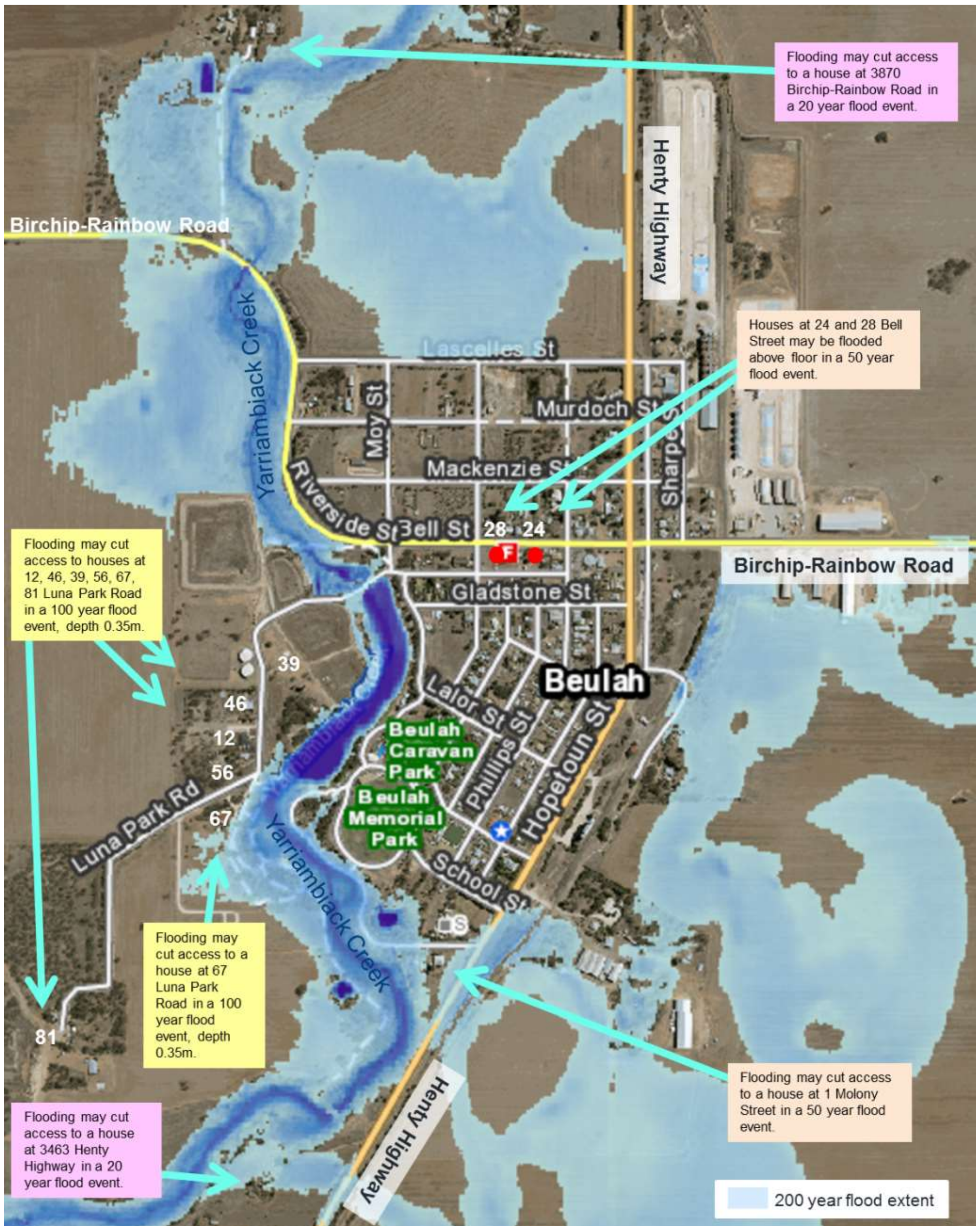
For more detailed information regarding buildings and roads impacted refer to the Beulah Flood Intelligence Card and flood asset impact maps below. Also refer to the Beulah flood depth maps in **Appendix F**, a list of flood observers in **Appendix H** and community sandbag collection points in **Appendix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





Roads impacted by flooding in Beulah (Water Technology 2006 & 2013).





Buildings impacted by flooding in Beulah (Water Technology 2006 & 2013)



# Beulah (Yarriambiack Creek) Flood Intelligence Card

Flood travel time								Stormwater flooding time from start of rain to flooding 2-3 hours		
								Time between Brim peak to steep rise in Beulah 0.5 to 4 days		
								Time between Brim and Beulah peak 1 to 5.3 days		
								Flooding duration: 2 - 3 days		
Wimmera River at Glenorchy gauge height 415201 (m) Water Tech 2016	Yarriambiack Creek at Jung gauge height 415241 (m)	Yarriambiack Creek at Warracknabeal Weir gauge board height (m)	Yarriambiack Creek at Beulah Rainbow Road gauge board height (m)	Average Recurrence Interval (ARI)	Yarriambiack Creek flow at Beulah gauge (ML/d) Water Tech 2013	Beulah damages total (above floor) Water Tech 2006	Consequences/ Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action
2.82 (3,900 ML/d)										
4.68 (14,531 ML/d)	0.84			5	794		Yarriambiack Shire Council will monitor flow rates at the Warracknabeal Weir and will open the Beulah Weir if flooding or high flows are likely to occur. Some Yarriambiack Creek road crossings may be impacted by flooding.			Council open the Beulah Weirs. Council and Regional Roads Victoria to deploy road closure signs and undertake traffic management as needed. VICSES activate ground observers as needed.
4.81	1.46			September 2010						
4.81 (19,884 ML/d)	0.95	2.41	1.07	10	872	0 (0)*	Floodwater breaks out to the south of Beulah, across the Henty Highway and under the railway. This breakout inundates agricultural land to the east of Henty Highway. Floodwater also breaks out north of Lascelles Street inundating agricultural land.		Birchip-Rainbow Road (east) depth 0m Birchip-Rainbow Road (west) depth 0m Henty Highway (south) depth 0.21m Railway line (south) depth 0.15m Luna Park Road depth 0.0m	Refer to actions listed above.
4.89 (25,020 ML/d)	1.21	2.67	1.11	20	1,183	0 (0)*	The extent of floodwater expands to the east of Henty Highway and continues flowing to the north across the Birchip-Rainbow Road.	House may be isolated (access cut): 3463 Henty Highway and 3870 Birchip-Rainbow Road.	Birchip-Rainbow Road (east) depth 0m Birchip-Rainbow Road (west) depth 0m Henty Highway (south) depth 0.34m Railway line (south) depth 0.43m Luna Park Road depth 0.0m	Yarriambiack Shire Council notify landholders that access/egress may be cut to their house by flooding.
4.89	1.35			September 2016						Refer to actions listed above.
	1.80			Minor flood level						
	2.00			Moderate flood level						Refer to actions listed above.
	2.06			1983 and 1981						Refer to actions listed above.
	2.10			Major flood level						Refer to actions listed above.
4.96 (31,667 ML/d)	2.17	2.86	1.15	50	1,892	0 (0)*	There is uncertainty regarding if the two buildings are at risk of flooding due to mitigation works undertaken. Minor breakouts may not occur at the Birchip-Rainbow Road (and along Bell Street) due to mitigation works undertaken.	Two houses that may be at risk of over floor flooding: 28 Bell Street and 24 Bell Street. Watch for floodwater breaking out adjacent to these houses. Houses may be isolated (access cut): 1 Molony Street, 18 Henty Highway.	Birchip-Rainbow Road (east) depth 0.30m Birchip-Rainbow Road (west) depth 0m Henty Highway (south) depth 0.45m Railway line (south) depth 0.45m Luna Park Road depth 0.0m	In addition to actions listed above: VICSES sandbag buildings impacted by flooding as needed. Yarriambiack Shire Council notify landholders that access/egress may be cut to their house by flooding.
5.01 (36,648 ML/d)	2.30	2.90	1.20	100	2,574	4 (0)*	Access is cut to most main and minor roads, Beulah is likely to be isolated. Flood depth	Houses may be isolated (access cut): x6 Luna Park Road (12, 46, 39, 56, 67, 81).	Birchip-Rainbow Road (east) depth 0.17m Birchip-Rainbow Road (west) depth 0.23m Henty Highway (south) depth 0.45m Railway line (south) depth 0.45m Luna Park Road depth 0.35m	In addition to actions listed above: Yarriambiack Shire Council notify landholders that access/egress may be cut to their house by flooding.
5.03 (39,527 ML/d)	2.335			January 2011						
5.05 (41,611 ML/d)	2.39	2.92	1.21	200	2,756	4 (0)*	There are small increases in the flood depth and extent surrounding Beulah.		Birchip-Rainbow Road (east) depth 0.10m Birchip-Rainbow Road (west) depth 0.25m Henty Highway (south) depth 0.45m Railway line (south) depth 0.45m Luna Park Road depth 0.38m	Refer to actions listed above.

\* Estimated property and building damages following the implementation of flood mitigation works in Beulah. There is uncertainty regarding these estimates given there were changes to the planned flood mitigation works that were modelled.

## Appendix C4: Rupanyup (Dunmunkle Creek) Flood Emergency Plan

Rupanyup is impacted by both riverine flooding from Dunmunkle Creek and stormwater flooding from local rainfall.

Flooding in Dunmunkle Creek is driven by high flows in the Wimmera River, with the Wimmera River distributing flood flows to Dunmunkle Creek. During high flows in the Wimmera River, flow is distributed to Dunmunkle Creek through a breakout to the north-west of Glenorchy. The Creek flows 38km north to Rupanyup, and continues north into the southern Mallee, into Lake Carron, refer to the map below. Dunmunkle Creek is a highly modified waterway having previously been part of the GWMWater Stock and Domestic supply system.

In small floods, less than 5 year ARI (14,531 ML/d), inundation along Dunmunkle Creek might only reach Rupanyup. Flood flows break out along Dunmunkle Creek at a Glenorchy gauge height of less than 4.68m (14,644 ML/d), and breaks out overland at less than 2.81m (3,898 ML/d).

### Historic flood events

Rupanyup and Dunmunkle Creek has experienced flooding in 1909, 1916, 1956, 1974, 1975, 1992, 1993, 2010, 2011 and 2016. The largest recent flood event on record was the January 2011 flood event, refer to the photos below. During this event Rupanyup was significantly impacted by both riverine and stormwater flooding. The Rupanyup community reported heavy rainfall on Tuesday the 11th and Thursday the 13th of January with 149mm falling over three days (Water Technology 2011).

Rupanyup was impacted by localised stormwater flooding began at night around 6:30pm on Thursday the 13th of January, and peaked at approximately 9am on Friday 14th of January. For more detail regarding stormwater risk, refer to the Stormwater Flood section below.

Riverine flooding from Dunmunkle Creek began to rise on Sunday the 16th and peaked on Monday the 17th of January. During the initial riverine inundation, water inundated the streets reaching the Rupanyup Café. Flood mitigation works undertaken included extensive sandbagging throughout Rupanyup and modification of the Dunmunkle Creek channel embankments and flow control infrastructure. The Rupanyup main street was heavily sandbagged. This work was credited with preventing inundation of a number of shops and dwellings. Local sources reported approximately 18 buildings were threatened by floodwater. Due to sandbagging only seven buildings were flooded over floor (Water Technology 2011). Modelling suggest (Water Technology 2018) that this flood event was a similar magnitude to the 100 year ARI event. Refer to the flood photos and flood map below.

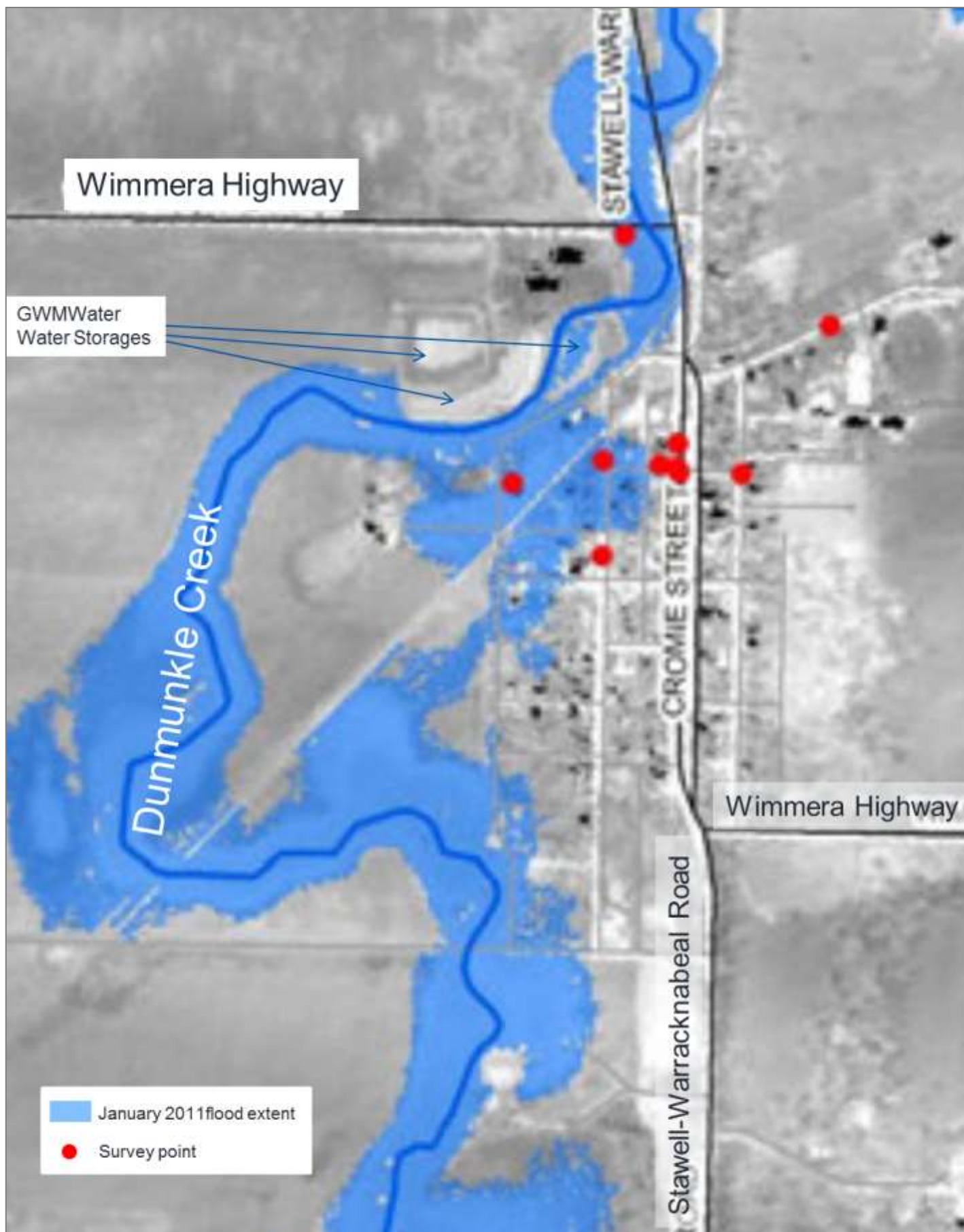
The filling of culverts underneath the railway embankment at Rupanyup was undertaken. This was done to prevent water from entering Rupanyup. This action exacerbated flood levels on the northern side of the railway line and significantly reduced flood levels on the southern side. For more detail, refer to the Railway embankment culvert section below.

Modification of the channel embankments and flow control infrastructure along Dunmunkle Creek was undertaken by landholders during the January 2011 flood event primarily in the lower Dunmunkle Creek in a effort to prevent inundation of agricultural land. There were also changes made to GWMWater regulating structures along Dunmunkle Creek. The Bryntirion Reserve was highlighted as an area which was a focus of these changes during the initial community consultation session. Some of these actions undertaken by landholders had serious risk to life, and should not be undertaken in future flood events.

The January 2011 flood event cut access to all main and minor road crossings along Dunmunkle Creek impacting numerous rural properties, refer to the photos below.







Flooding in Rupanyup along Dunmunkle Creek during the January 2011 event (Water Technology 2018).





The Rupanyup Supermarket (Cromie Street) impacted by flooding during the January 2011 flood event.



A house in Dyer Street impacted by flooding during the January 2011 event.



Wimmera Highway, north of Rupanyup during the January 2011 flood event.



Dunmunkle Creek, north of Rupanyup during the January 2011 flood event.



## Stormwater Flooding

Rupanyup is particularly susceptible to stormwater flooding. Heavy local rainfall can cause extensive stormwater flooding from local runoff. During the January 2011 flood event the Yarriambiack Shire Council received anecdotal accounts that several buildings in Dyer Street were flooded over floor. Also several buildings along Cromie Street were very close to being flooded above floor.

An assessment of stormwater flood risk (Water Technology 2018) shows that the majority of Rupanyup's streets experience nuisance flooding, refer to the map and flood photo below. Considerable ponding occurs along Dyer Street, and will affect properties in the area bounded by Dyer, Wood, Cromie and Walter streets. Refer to the map below showing stormwater modelling of the 2 hour 100 year ARI event.

Areas across Rupanyup that are at risk of stormwater flooding include;

- |                 |                  |                |
|-----------------|------------------|----------------|
| ■ Cromie Street | ■ Stewart Street | ■ Beryl Street |
| ■ Edward Street | ■ Walter Street  | ■ Wood Street  |
| ■ Gibson Street | ■ Gordon Street  | ■ Dyer Street  |

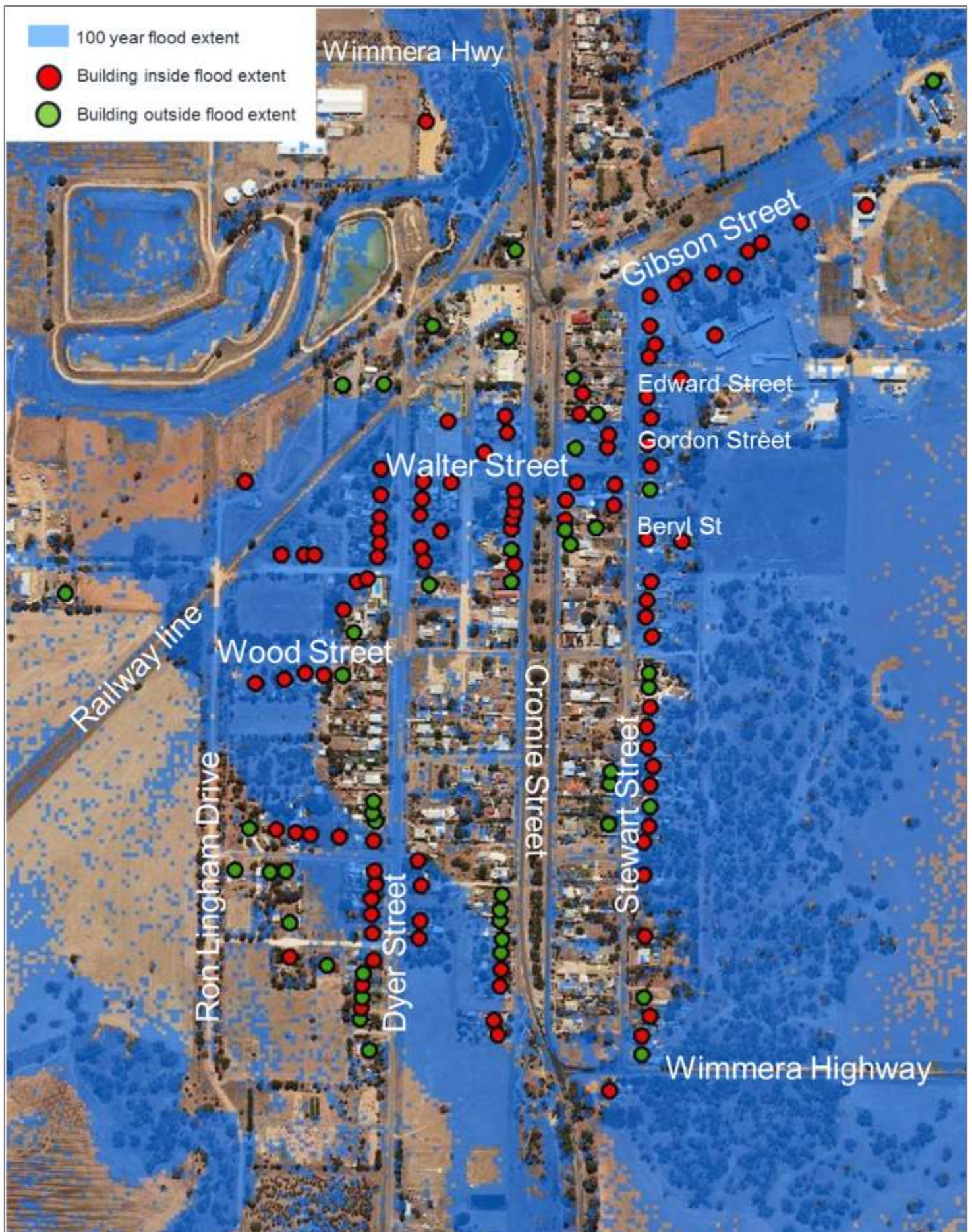


Rupanyup impacted by flooding during the January 2011 event (Wimmera CMA).

Stormwater flooding can develop quickly as a result of local heavy rainfall. Heavy rainfall events can cause rapid rise of floodwater. The warning time available from rainfall to stormwater flood impacts occurring can range between 2 to 3 hours depending on the rainfall intensity.

Since the January 2011 flood event the Yarriambiack Shire Council have undertaken significant mitigation works to reduce the stormwater flood risk in Rupanyup. For more detail regarding mitigation works undertaken, refer to the Flood Mitigation Works section below.





Rupanyup stormwater flood mapping, 100 year ARI 2 hour duration event (Water Technology 2018).



## Flood mitigation works since January 2011

During the Dunmunkle Creek flood Investigation (Water Technology 2018) it was found that three water storages to the north west of the Lubeck-Rupanyup railway line in Rupanyup were significantly constraining the Dunmunkle Creek.

A flood impact analysis (Water Technology 2018) of the benefits of removal of two of the three water storages during a 100 year ARI flood event is shown in the map below. The location of the water storages removed is shaded purple.

Modelling shows that the removal of two water storages results in the flooding no longer reaching the railway embankment and therefore no flow through the 600 mm railway culverts is observed. Overland flow is still observed on the upstream side of the railway embankment into the residential area of Rupanyup, impacting dwellings in Wood Street, Westcott Avenue and Dyer Street. There are increases in water level downstream of the reservoir removal with building in the direct vicinity of the water level increases. These mitigation works would reduce above floor damages to 1 building for a 100 year flood and 5 for a 200 year flood event.

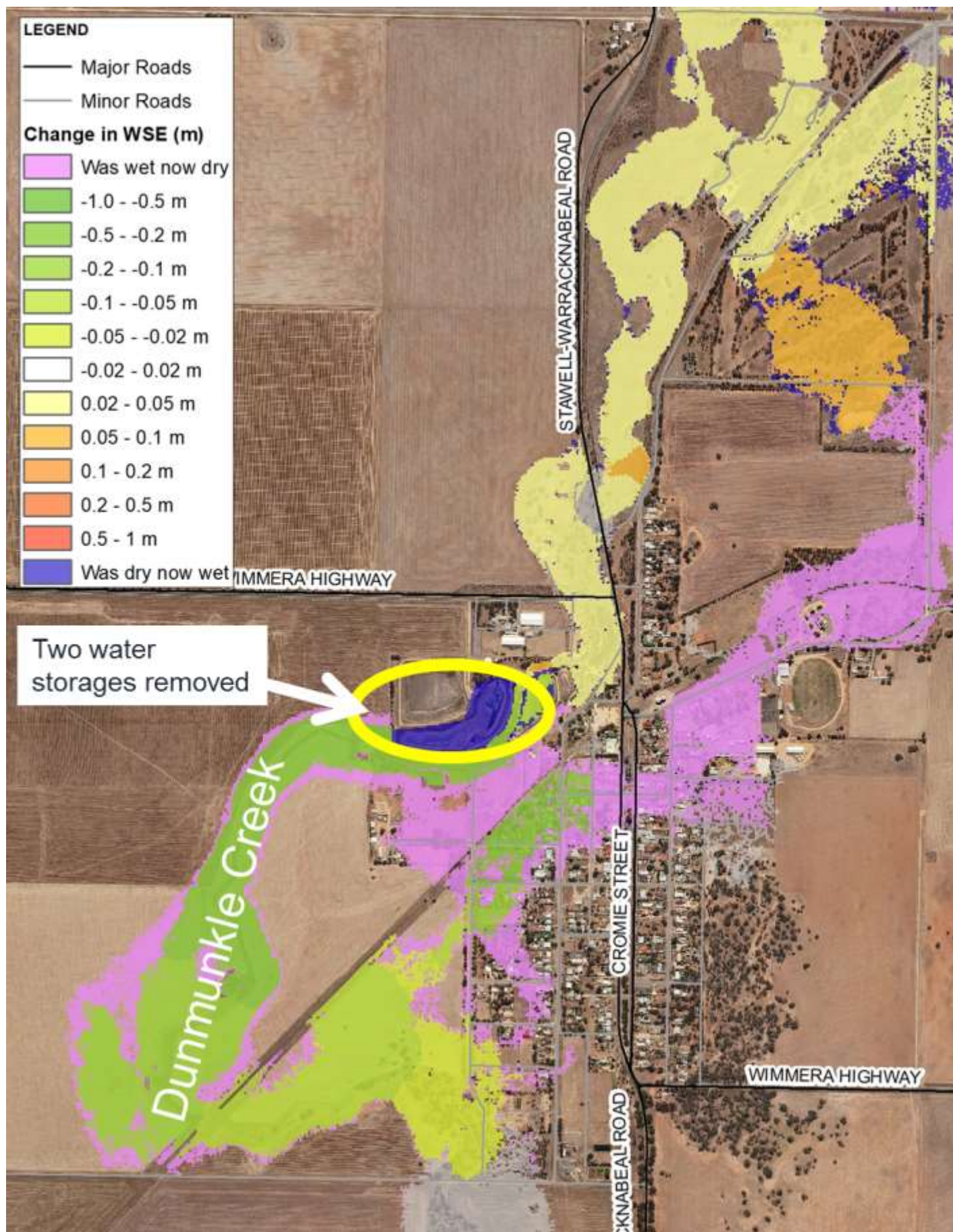
Since January 2011 the Yarriambiack Shire Council has spent significant amount of time and resources to implement flood mitigation works for Rupanyup. Prior to the September 2016 flood event, GWMWater excavated sections of Rupanyup's water storage embankments, refer to the image below. The revised modelling included the complete removal of the Rupanyup water storages.

There is some variation between the proposed flood mitigation works that have been modelled and actual works undertaken. It is important to note that the flood extent maps should be used as a guide only given the uncertainty regarding the impacts of the flood mitigation works undertaken. This uncertainty will be resolved when the design flood mapping is revised to incorporate the mitigation works undertaken.



Excavated sections of Rupanyup's water storages (Water Technology 2017).





Flood impact assessment of removal of water storages in Rupanyup during a 100 year ARI flood event (Water Technology 2018).



## Rupanyup's proposed levee

Modelling the construction of a levee along sections of the Ron Lingham Drive and McIntyres Road showed some slight reductions in flooding was achieved. Refer to the map below for the proposed road height increase needed to provide flood protection for a 100 year flood event (including 0.3m freeboard). The construction of the levee will allow additional flood protection for buildings to the south west of Rupanyup.



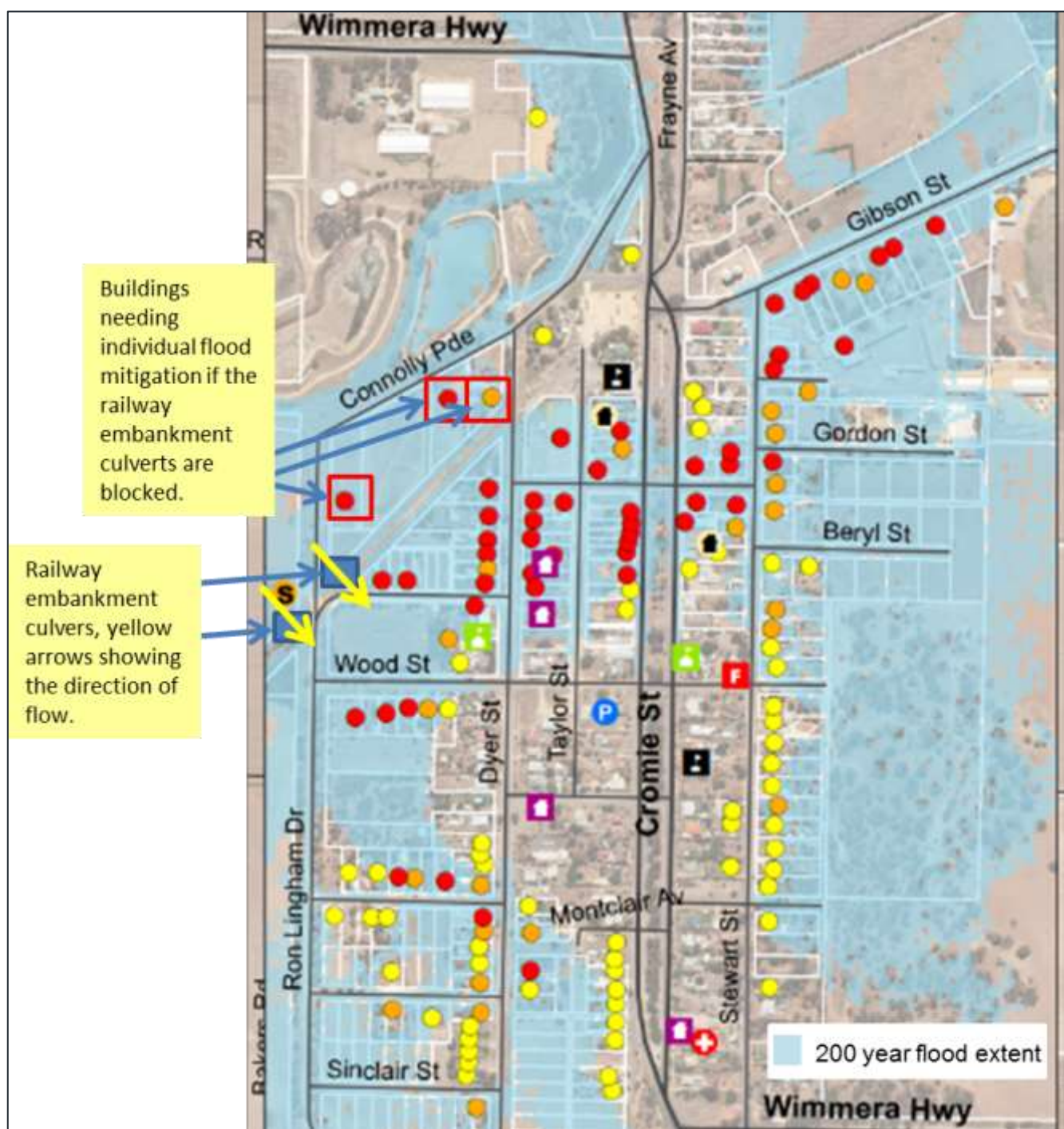
Rupanyup's proposed the Ron Lingham Drive and McIntyres Road levee event (Water Technology 2018).



## Railway embankment culverts

There are two pipe culverts underneath the railway embankment in Rupanyup. These culverts are able to allow water from Dunmunkle Creek to the southern side of the railway embankment and the most densely populated area of Rupanyup during large floods. During January 2011 these culverts were blocked preventing water from inundating dwellings; however modelling has shown this blockage caused minor increases in water levels on the northern side of the railway embankment and the properties to the north. Refer to the map below for the location of the railway embankment culverts.

Blocking of these culverts in future flood events should be carefully considered. While it does provide benefit to the majority of residents in Rupanyup it will detrimentally impact on those north of the railway line (by several centimetres). If the culverts were blocked it is recommended specific flood mitigation be undertaken at three buildings shown in the map below.



## Flood Warning

A key stream gauge that provides early warning of flooding in Rupanyup and Dunmunkle Creek is the Wimmera River gauge at Glenorchy (415201). The location of this gauge is shown in the map above. An analysis undertaken (Water Technology 2018) of flood peak travel times between Glenorchy and Rupanyup show that historic flood peak travel times vary between 28 hours and 123 hours, refer to table below. The flood peak was maintained at Rupanyup for 2 to 3 days. The speed of the flood peak slows dramatically north of Rupanyup.

Factors that influence the flood peak travel time include the size of the flood, recent flood history, soil moisture and land use conditions (i.e. crop size). Given the significant variation in flood peak travel times for flood events, it will be important to constantly track the flood peak along Dunmunkle Creek.

Historic flood events	January 2011	September 2016
Flood peak travel time from Glenorchy and Rupanyup (hours) (Water Technology 2018)	28.5	103-123



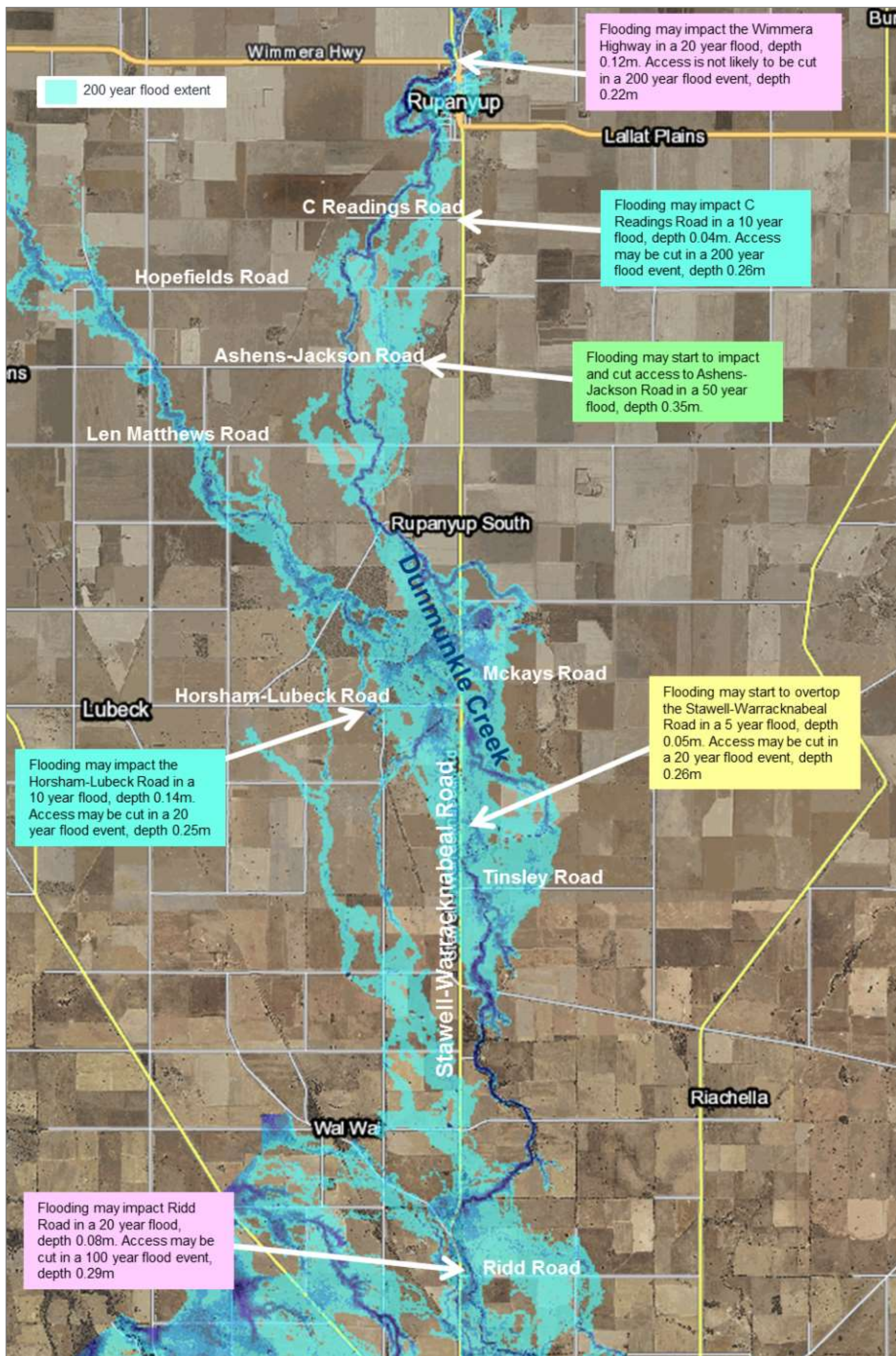
## Flood Impacts and Required Actions

Key assets at risk of flooding Dunmunkle Creek are listed in the table below. Assets at risk of flooding for Rupanyup need to be incorporated when revised flood modelling has been completed.

Asset register				
Asset Name and location	Average Recurrence Interval (ARI)	Consequence / Impact	Mitigation/ Action	Lead Agency
Stawell-Warracknabeal Road, south of Rupanyup,	5 year flood	Flooding may start to overtop the Stawell-Warracknabeal Road in a 5 year flood, depth 0.05m. Access may be cut in a 20 year flood, depth 0.26m.	Deploy road closure signs and undertake traffic management as needed.	Regional Roads Victoria
Horsham-Lubeck Road, south of Rupanyup.	10 year flood	Flooding may start to overtop the Horsham-Lubeck Road in a 10 year flood, depth 0.14m. Access may be cut in a 20 year flood, depth 0.25m.	Deploy road closure signs as needed.	Council
X13 buildings may be isolated and/or flooded below floor.	20 year flood	Buildings may be isolated or/and flooded below floor. Refer to maps and Intelligence Card below for locations.	Undertake evacuations as needed.	Victoria Police
Wimmera Highway north west of Rupanyup	20 year flood	Flooding may start to overtop the Wimmera Highway in a 20 year flood, depth 0.12m. Access is not likely to be cut in a 200 year flood, depth 0.22m.	Deploy road closure signs as needed.	Regional Roads Victoria
Ashens-Jackson Road, south of Rupanyup.	50 year flood	Flooding may start to overtop and cut access to Ashens-Jackson Road in a 50 year flood, depth 0.35m.	Deploy road closure signs as needed.	Council
x3 additional buildings may be isolated and/or flooded below floor.	50 year flood	x3 additional buildings may be isolated or/and flooded below floor. Refer to maps and Intelligence Card below for locations.	Undertake evacuations as needed.	Victoria Police
x1 additional buildings may be isolated and/or flooded below floor.	100 year flood	x3 additional buildings may be isolated or/and flooded below floor. Refer to maps and Intelligence Card below for locations.	Undertake evacuations as needed.	Victoria Police
X2 additional buildings may be isolated and/or flooded below floor.	200 year flood	x3 additional buildings may be isolated or/and flooded below floor. Refer to maps and Intelligence Card below for locations.	Undertake evacuations as needed.	Victoria Police

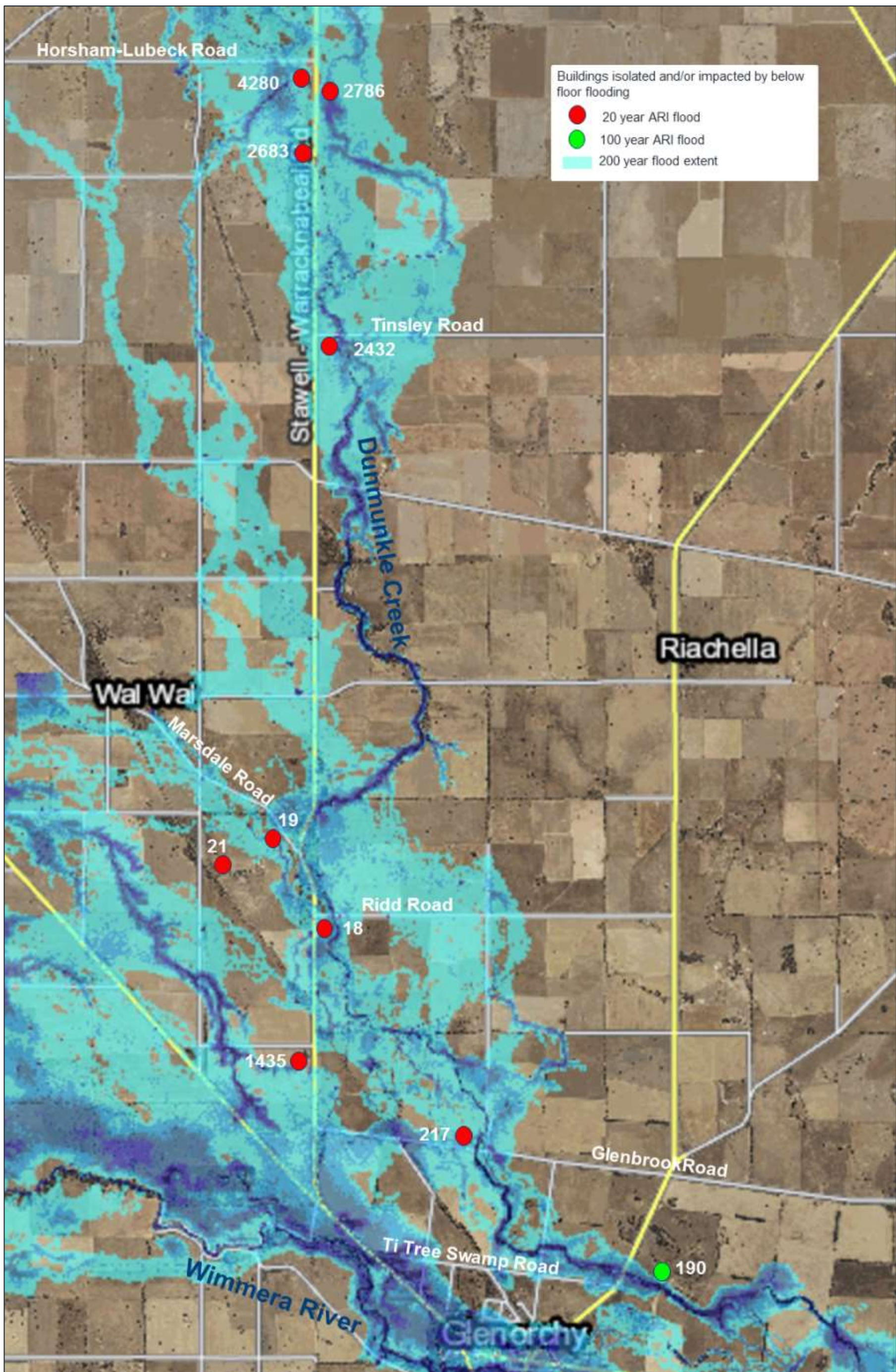
For more detailed information regarding buildings and roads impacted refer to the Rupanyup Flood Intelligence Card and flood damages/impact maps below. Also refer to the Dunmunkle Creek flood depth maps in **Appendix F**, a list of flood observers in **Appendix H** and community sandbag collection point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





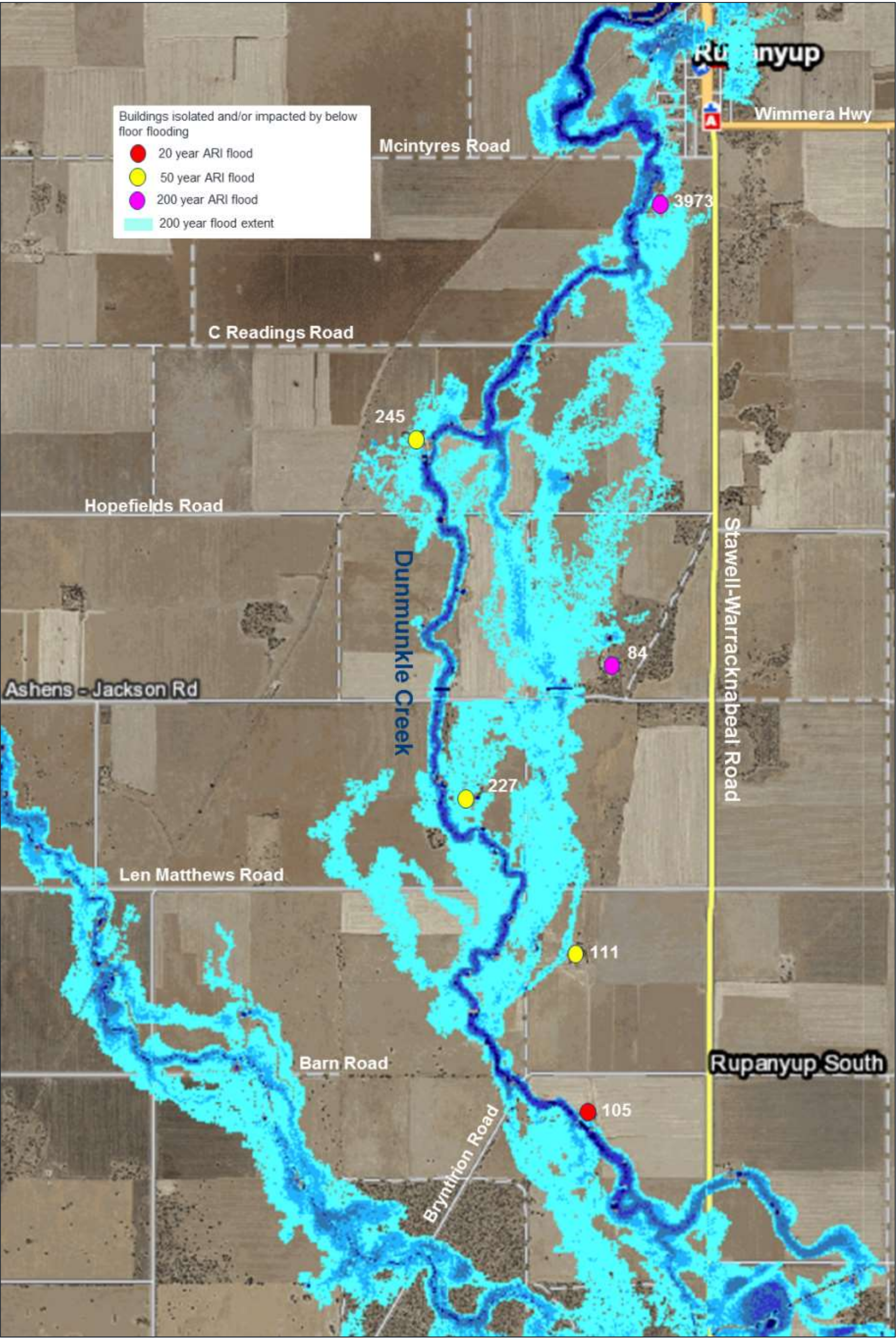
Roads impacted by flooding along Dunmunkle Creek, south of Rupanyup (Water Technology 2018).





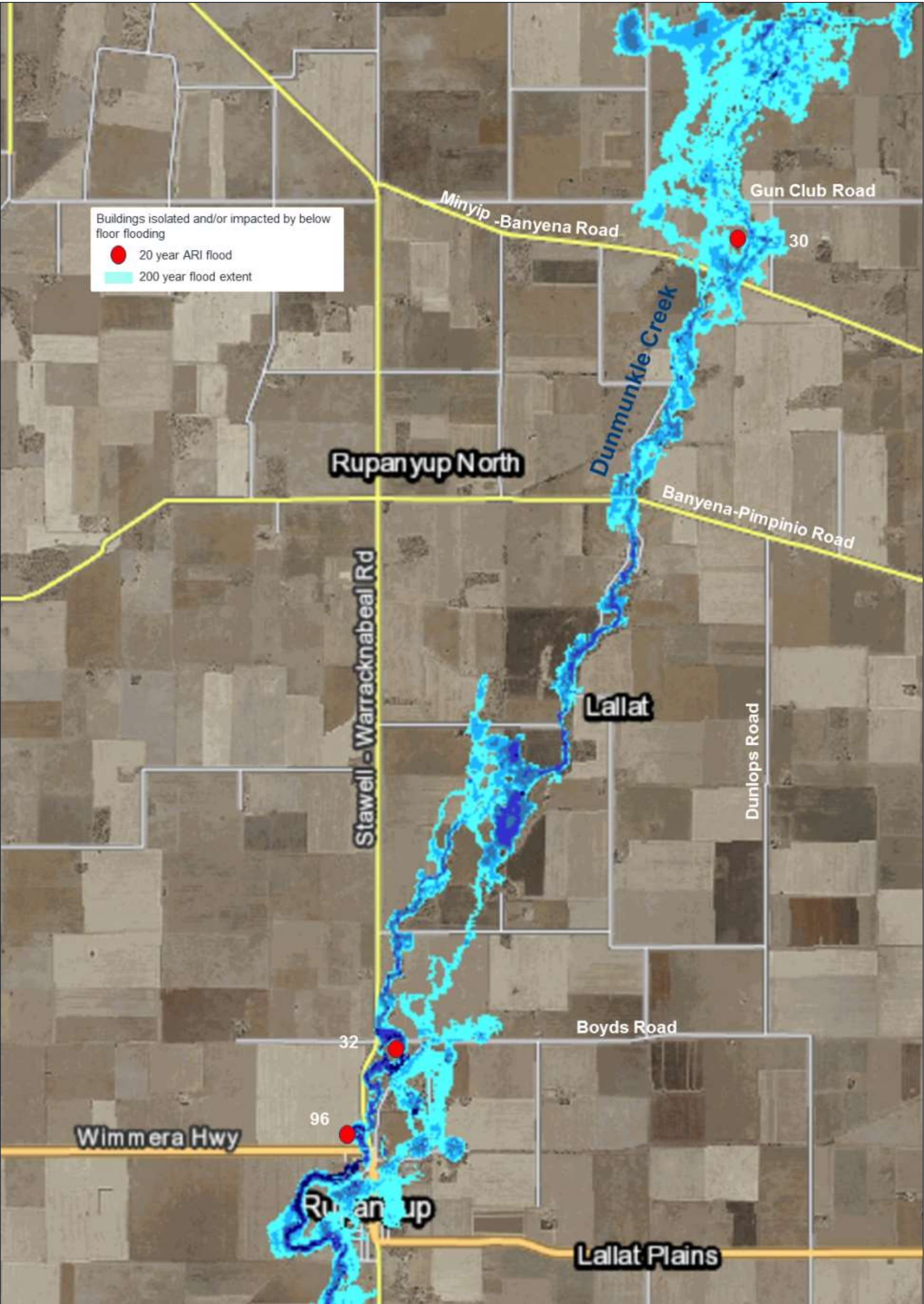
Buildings isolated and/or impacted by below floor flooding along Dunmunkle Creek, north of Glenorchy (Water Technology 2018).





Buildings isolated and/or impacted by below floor flooding along Dunmunckle Creek, south of Rupanyup (Water Technology 2018).





Buildings isolated and/or impacted by below floor flooding along Dunmunkle Creek, north of Rupanyup (Water Technology 2018).



# Rupanyup and Dunmunkle Creek Flood Intelligence Card

Flood travel time							Stormwater flooding time from start of rain to flooding 2-3 hours			
							Riverine flooding time from start of rain to steep rise in floodwater 30 - 18 hours			
							Time between Glenorchy and Rupanyup peak 22 to 40 hours			
							Flooding duration: 2 - 3 days			
Wimmera River at Eversley gauge height 415207 (m)	Wimmera River at Glynwylln gauge height 415206 (m)	Wimmera River at Glenorchy gauge height 415201 (m)	Average Recurrence Interval (ARI)	Glenorchy Design Flows Warracknabeal study 2017 (ML/d)	Dunmunkle Creek damages (excluding Rupanyup) total number (above floor)	Rupanyup damages total number properties flooded (above floor)	Consequences/ 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
		4.00	Glenorchy minor flood level 2 year flood	7,000			Flooding along Dunmunkle Creek is driven by high flows in the Wimmera River, with the Wimmera River distributing water to Dunmunkle Creek (in less than a 5 year flood) upstream of Glenorchy. Several stock and domestic channels influence drainage and floodwater.			
		4.50	Glenorchy moderate flood level	10,757						
		4.68	5	14,531	403 (0)	0 (0)	Flooding in upper Dunmunkle Creek in less than a 5 year flood (14,000 ML/d). No major assets are likely to require flood protection. Flooding of upper Dunmunkle Creek is likely to impact minor and major roads. There may be shallow overtopping of the Stawell-Warracknabeal Road. Flooding only reaches Hopefields Road, not reaching Rupanyup due to a lack of volume.		Stawell-Warracknabeal Road depth 0.05m Ridd Road depth 0m Horsham-Lubeck Road depth 0m Ashens-Jackson Road depth 0m C Readings Road depth 0m Wimmera Highway depth 0m	
		4.80	Glenorchy major flood level	18,830						
4.72 m (19,136 ML/d)	8.26 m (40,460 ML/d)	4.81	September 2010 10 year flood	19,884	541 (0)	2 (0)	In addition to break out flows from the Wimmera River at the Dunmunkle Creek offtake, floodwater overtops Campbells Bridge Road at several locations and flows into Dunmunkle Creek. Some flow is directed toward the Richardson River system. Several overland flow paths occur at Glenbrook Road, re-enter Dunmunkle Creek at Marsdale Road. Flooding reaches Rupanyup.		Stawell-Warracknabeal Road depth 0.16m Ridd Road depth 0m Horsham-Lubeck Road depth 0.14m Ashens-Jackson Road depth 0m C Readings Road depth 0.04m Wimmera Highway depth 0m	VICSES activate ground flood observers as needed. Council clear debris from waterway crossings, drains and culverts to reduce blockages.
3.91 m (10,658 ML/d)	6.56 m (17,444 ML/d)	4.89	September 2016 20 year flood	25,020	738 (0)	10 (0)	Deeper flooding may cause access/egress to dwellings to be cut. Consider closing Dunmunkle Creek crossings. Floodwater may reach north of Habels Road. Provide warning to residents along Dunmunkle Creek impacted by flooding. Extensive flooding occurs where Dunmunkle Creek intersects Stawell-Warracknabeal Road may cut access.	x13 buildings isolated and/or flooded below floor; 217 Glenbrook Road, x5 Stawell-Warracknabeal Road (1435, 2432, 2683, 2786, 4280), 18 Ridd Road, x2 Marsdale Road (19, 21), 105 Bryntirion Road, 96 Wimmera Highway, 32 Boyds Road, 30 Jess Road.	Stawell-Warracknabeal Road depth 0.26m Ridd Road depth 0.08m Horsham-Lubeck Road depth 0.25m access cut Ashens-Jackson Road depth 0m C Readings Road depth 0m Wimmera Highway depth 0.12m	In addition to actions listed above; Council and Regional Roads Victoria deploy road closure signs and undertake traffic management as needed.
		4.96	50	31,667	905 (0)	13 (1)*	One building may be flooded over floor. To prevent flood water from entering Rupanyup from the south a levee should be placed along Ron Lingham Drive. Floodwater breaks out from Dunmunkle Creek through the Rupanyup Golf Course. Flooding impacts all rural Dunmunkle Creek crossings, including the Wimmera Highway at Rupanyup. The Donald Murtoa Road is inundated in several locations, flow continues north to the Borung Highway, terminating in a wetland west of Carrion-Lawler Road.	X1 building may be flooded above floor. x3 additional buildings isolated and/or flooded below floor; 111 Len Matthews Road, 227 Ashens-Jackson Road, 245 C Readings Road.	Stawell-Warracknabeal Road depth 0.35m Ridd Road depth 0.20m Horsham-Lubeck Road depth 0.27m Ashens-Jackson Road depth 0.35m C Readings Road depth 0.15m Wimmera Highway depth 0.20m	In addition to actions listed above; VICSES sandbag buildings as needed (uncertainty regarding buildings impacted) Victoria Police evacuate buildings as needed.
		5.01	100	36,648	937 (0)	23 (1)*	This event is similar to January 2011. Inundation depth and extent has increased in Rupanyup and north of Rupanyup.	An additional building isolated and/or flooded below floor; 190 Ti Tree Swamp Road.	Stawell-Warracknabeal Road depth 0.38m Ridd Road depth 0.29m Horsham-Lubeck Road depth 0.30m Ashens-Jackson Road depth 0.37m C Readings Road depth 0.20m Wimmera Highway depth 0.21m	Refer to actions listed above.



5.79 m (34,154 ML/d)	8.72 m (54,498 ML/d)	5.03	January 2011	39,527			Rupanyup was flooded twice, initially by local runoff from the south on the 13th of January, then flood Dunmunkle Creek 3 days later. Significant damage to buildings was caused from stormwater flooding reaching the Rupanyup Cafe, 149.2 mm over 3 days. Specifically in Cromie, Stewart, Edward, Gibson, Walter, Gordon and Beryl Streets. Local sources reported 18 buildings were threatened by riverine flooding, due to extensive sandbagging 7 buildings were flooded above floor.			
		5.05	200	41,611	982 (0)	61 (5)*	Flooding in Rupanyup has increased considerably with water pushing into the rear of properties on Stewart Street. All properties along Dunmunkle Creek are likely to require some flood mitigation or assistance with access/egress. Greater inundation is observed through the Bryntirion Forrest. North of Rupanyup the inundation extent and depths have generally increased with no changes to flow paths of large breakout flows.	X4 additional buildings may be flooded above floor  X2 additional buildings isolated and/or flooded below floor; 84 Ashens-Jackson Road, 3973 Stawell-Warracknabeal Road.	Stawell-Warracknabeal Road depth 0.42m Ridd Road depth 0.39m Horsham-Lubeck Road depth 0.35m Ashens-Jackson Road depth 0.42m C Readings Road depth 0.26m Wimmera Highway depth 0.22m	Refer to actions listed above.
Forecast gauge: Wimmera River at Glenorchy gauge 415201										

\* There is uncertainty regarding Rupanyup's building damage estimated given there have been changes between the proposed (modelled) and actual mitigation works undertaken to the water storages. Further modelling needs to be undertaken to improve the accuracy of these building damage estimates.

# 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:

- Warracknabeal Aerodrome, along the Henty Highway, 8km south of Warracknabeal.
- Hopetoun Aerodrome, 78 Hopetoun-Aerodrome Road, north of Hopetoun.

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 Yarriambiack 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.</p> <p>Access to main and minor roads may be cut.</p> <p>Advise to shelter in place if it is safe to do so.</p> <p>The flood peak is likely to last between 2 to 3 days.</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 Yarriambiack 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 Flooding ???. Falls are expected to be between ???mm and ???mm. Locally heavier falls are possible due to embedded thunderstorms that could cause severe flooding.

Locations which may be affected could include: Jung, Kellalac, Warracknabeal, Lah, Brim, Beulah, Hopetoun and Rupanyup.

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 motorists.  
Flooding may cause extensive inundation of properties.  
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 last between 2 to 3 days.  
Floodwater may cut access to main and minor roads; avoid driving until floodwater has subsided.

Waterways likely to be affected include:

- Yarriambiack Creek
- Dunmunkle 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/>

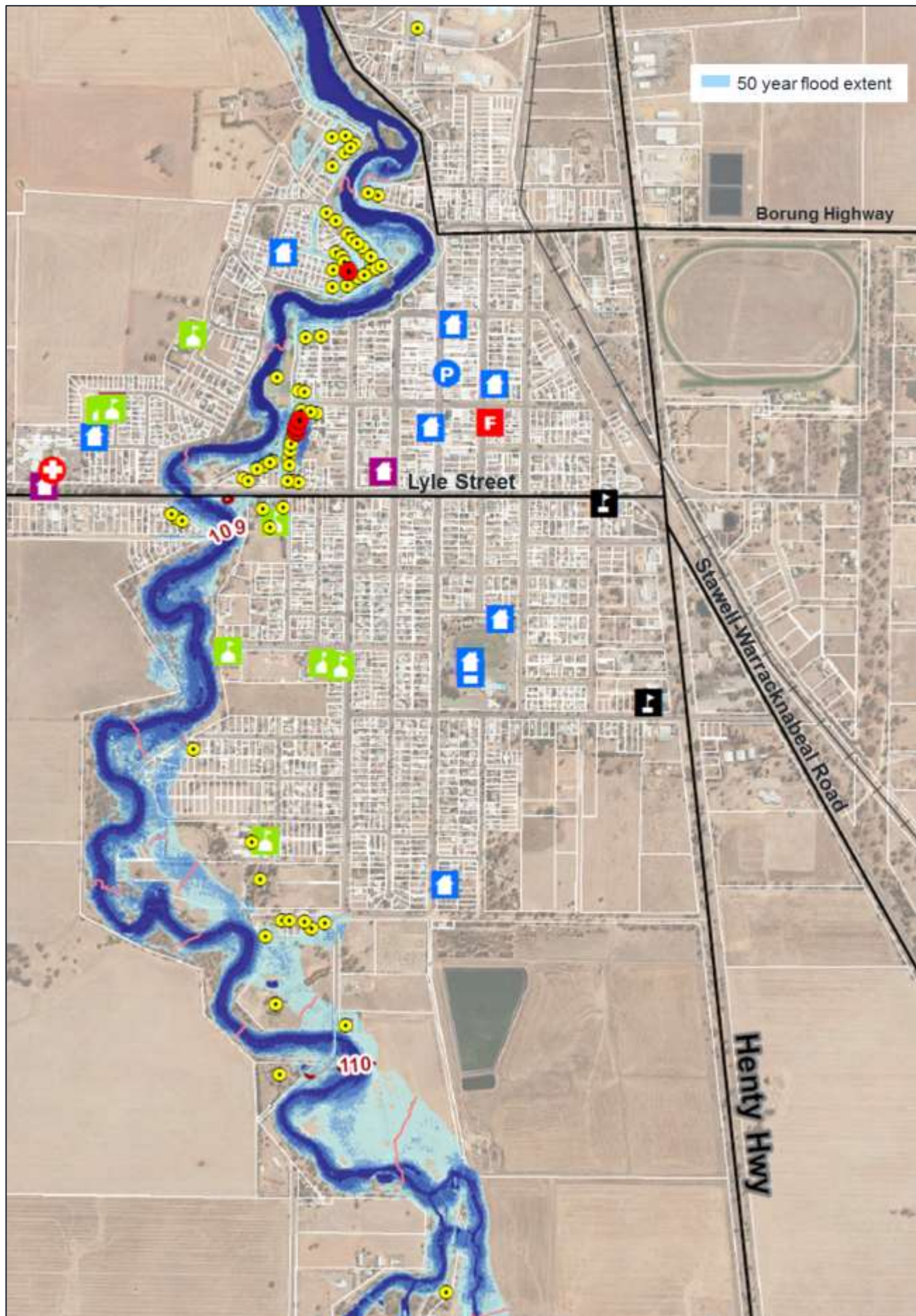


## Appendix F: Flood Maps

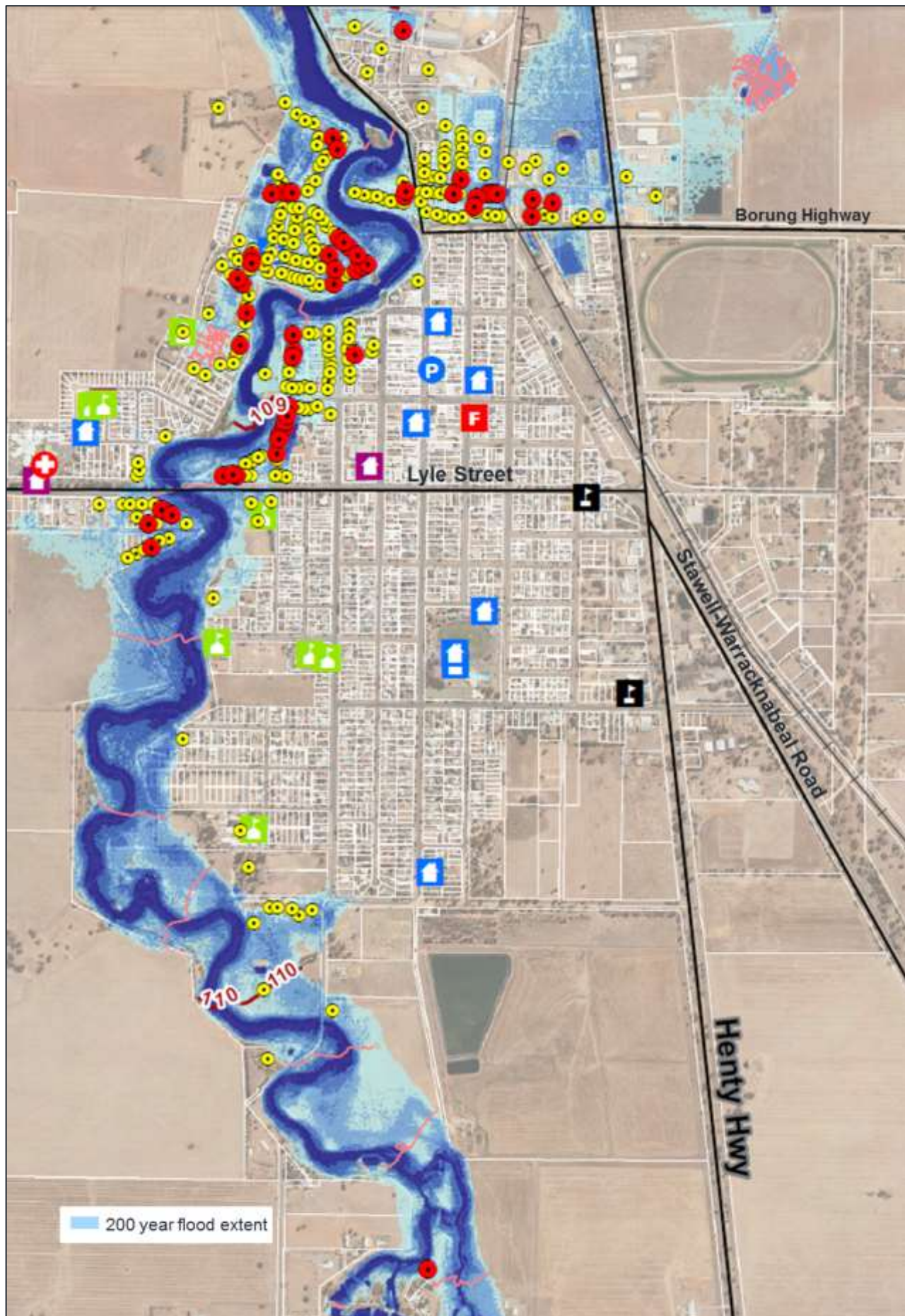
1.1. **Warracknabeal Flood Extent Maps.** Warracknabeal (Yarriambiack Creek) 10 year ARI flood extent map (Water Technology 2016).





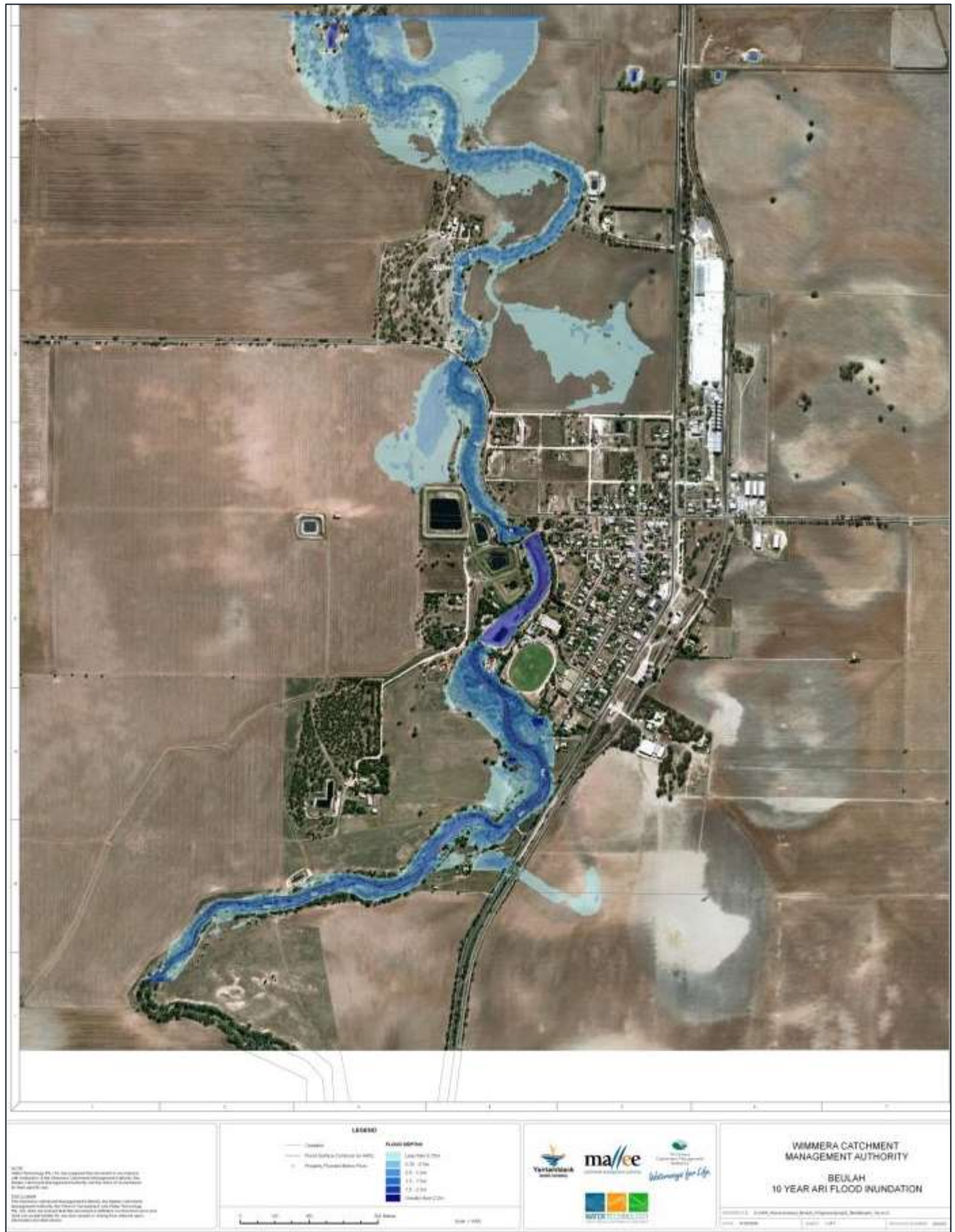




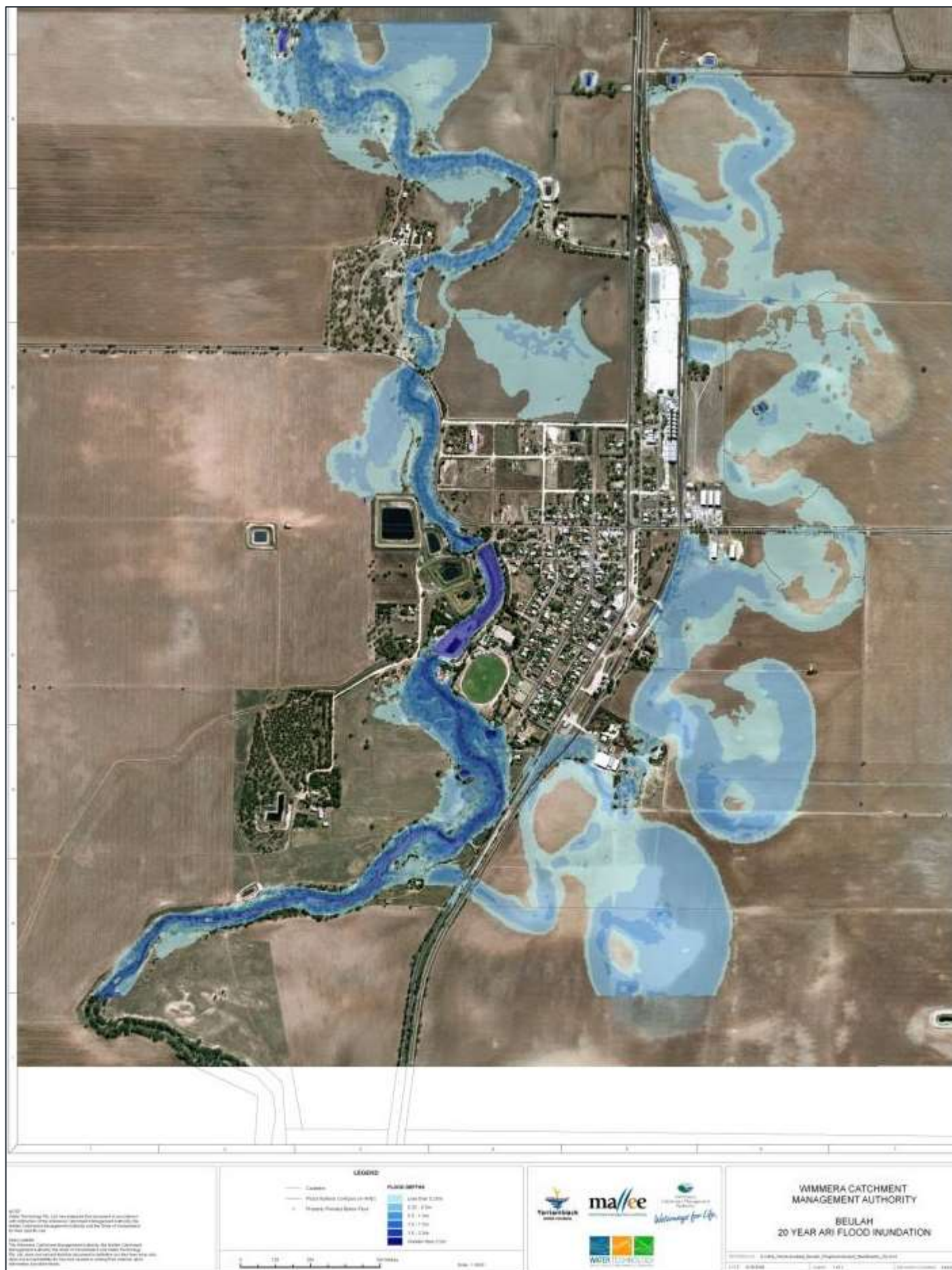




**1.2. Beulah Flood Extent Maps.** Beulah 10 year ARI flood extent map (Water Technology 2013).



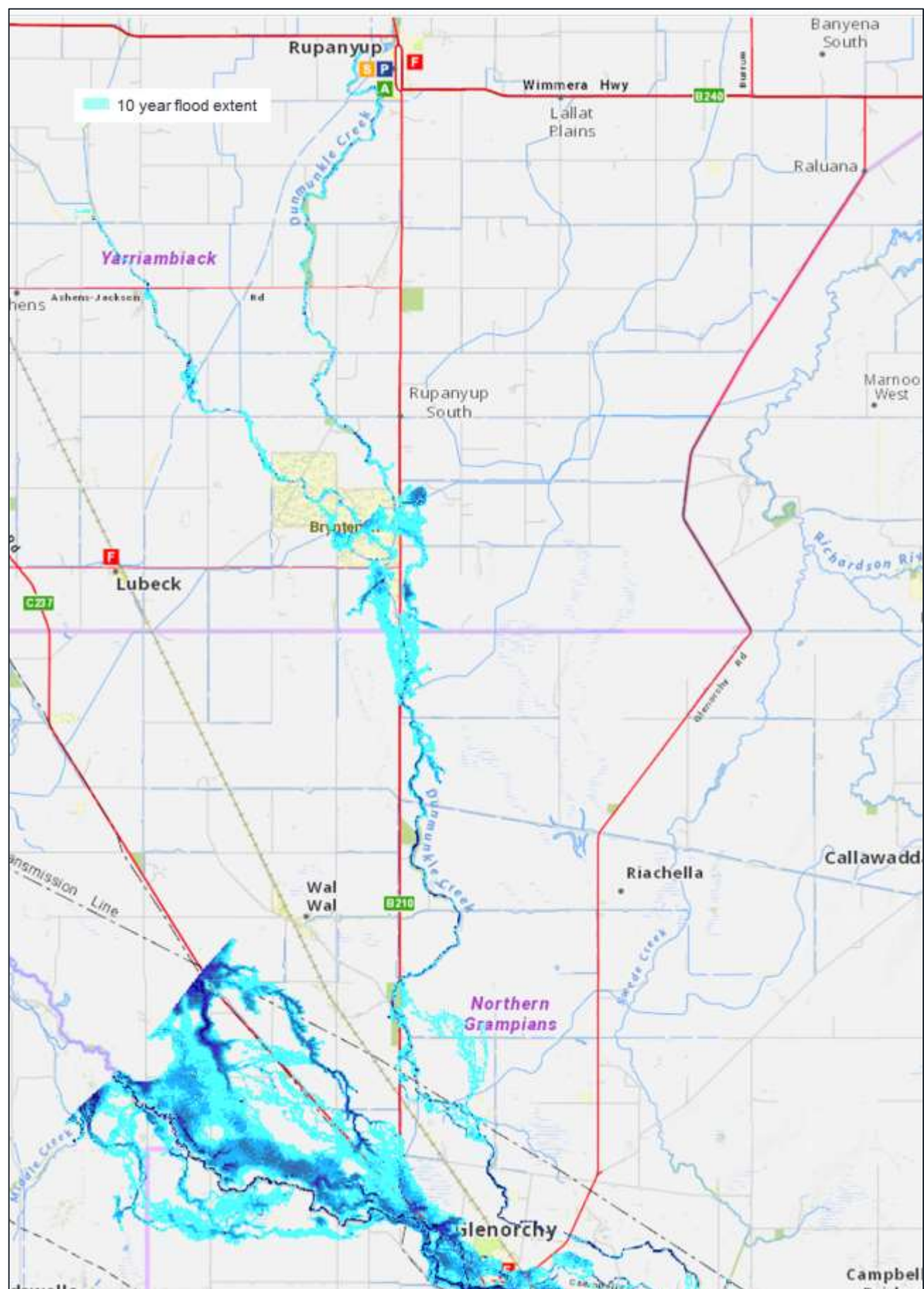




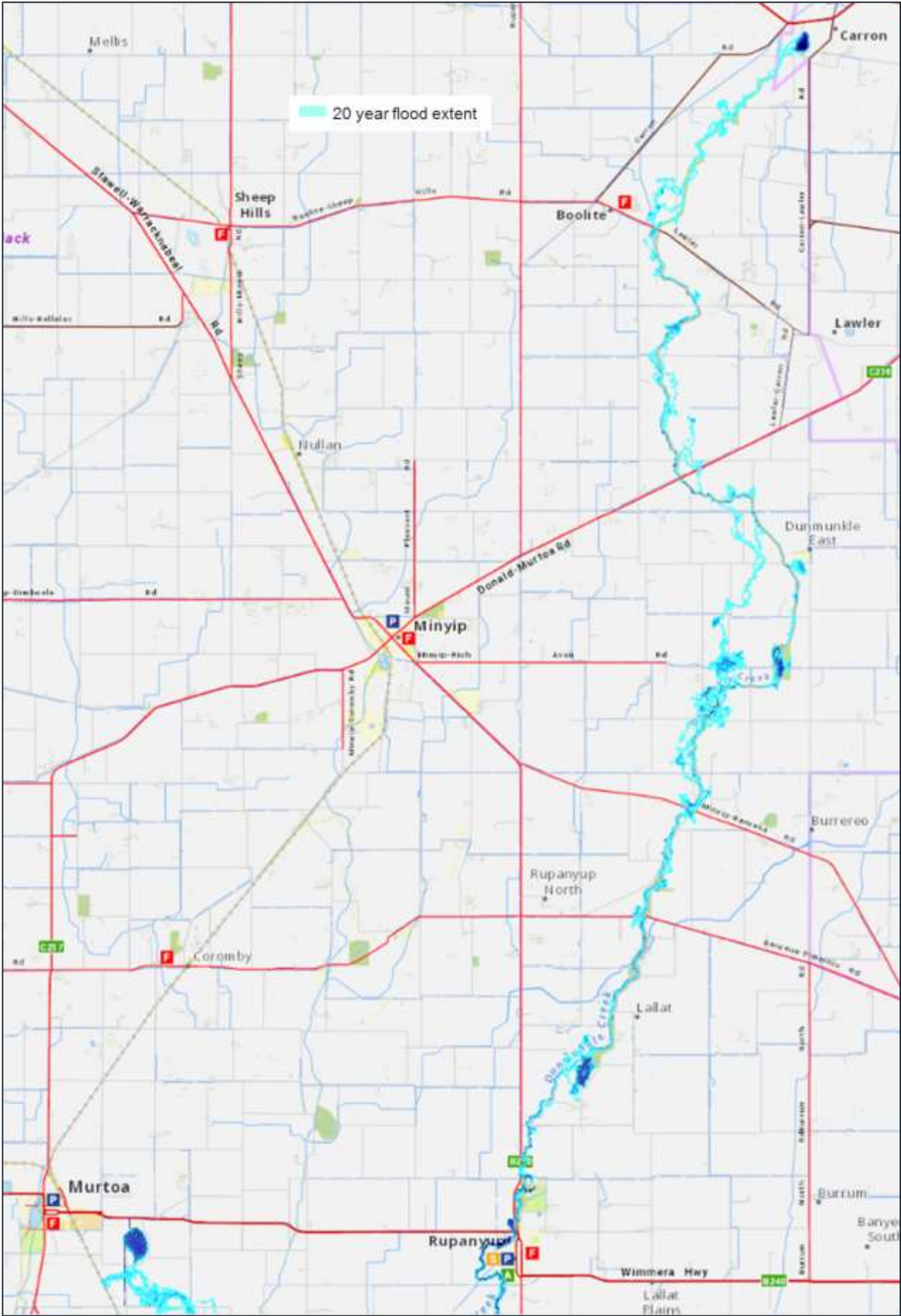




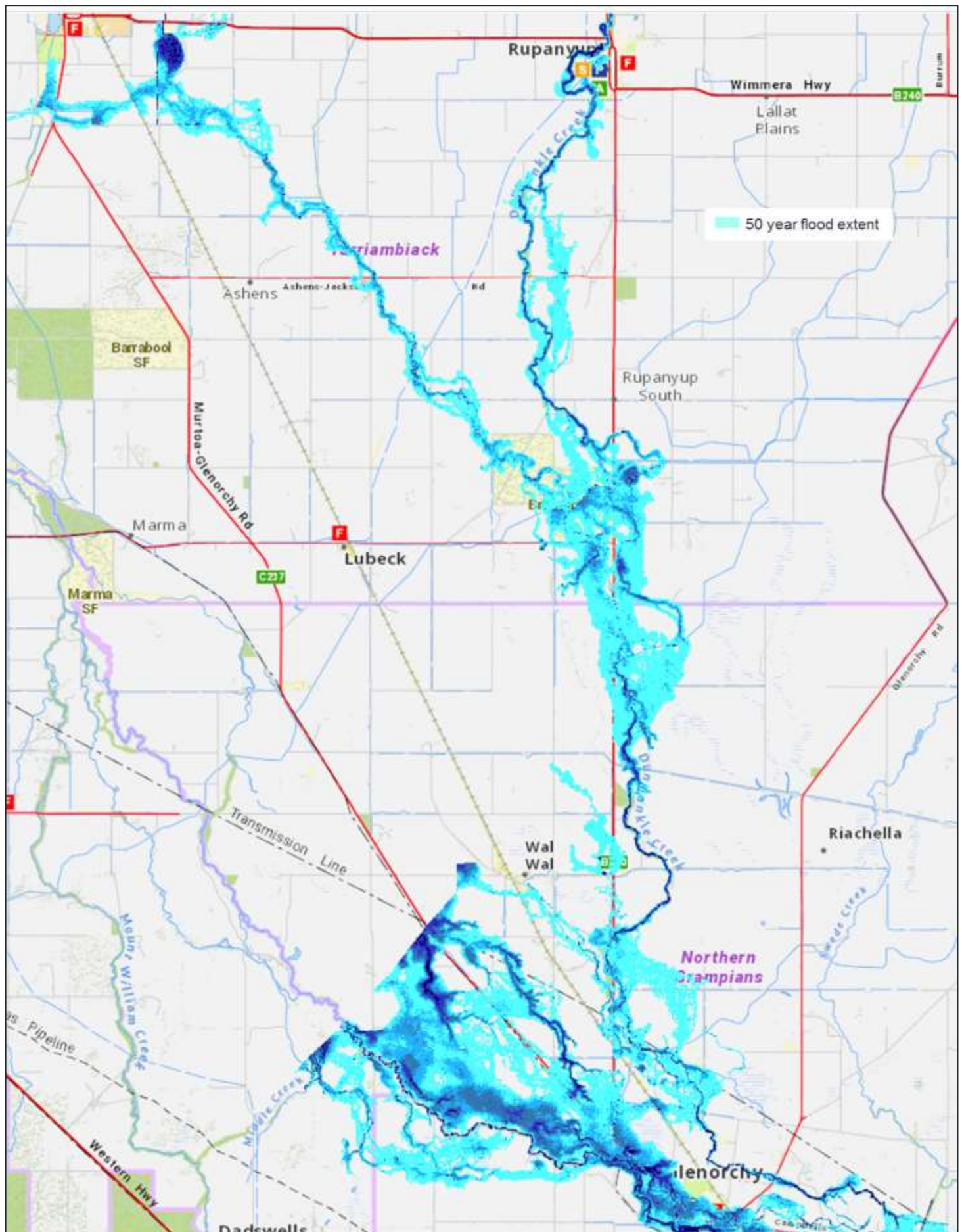
**1.3. Dunmunkle Creek Flood Extent Maps.** Dunmunkle Creek (south of Rupanyup) 10 year ARI flood extent map (Water Technology 2018).



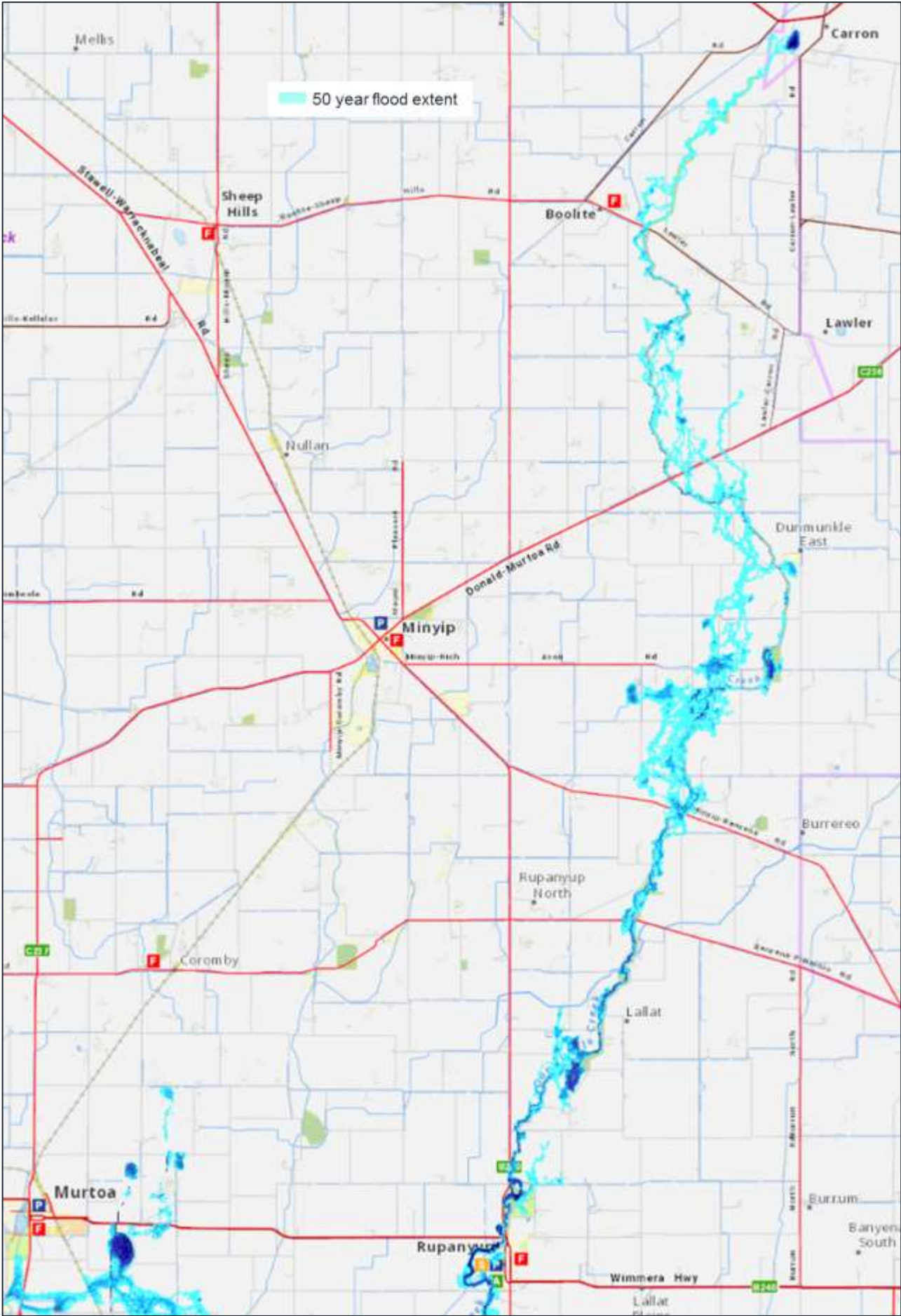
Dunmunkle Creek (north of Rupanyup) 20 year ARI flood extent map (Water Technology 2018).







Dunmunkle Creek (north of Rupanyup) 50 year ARI flood extent map (Water Technology 2018).





# Appendix G: Local flood information

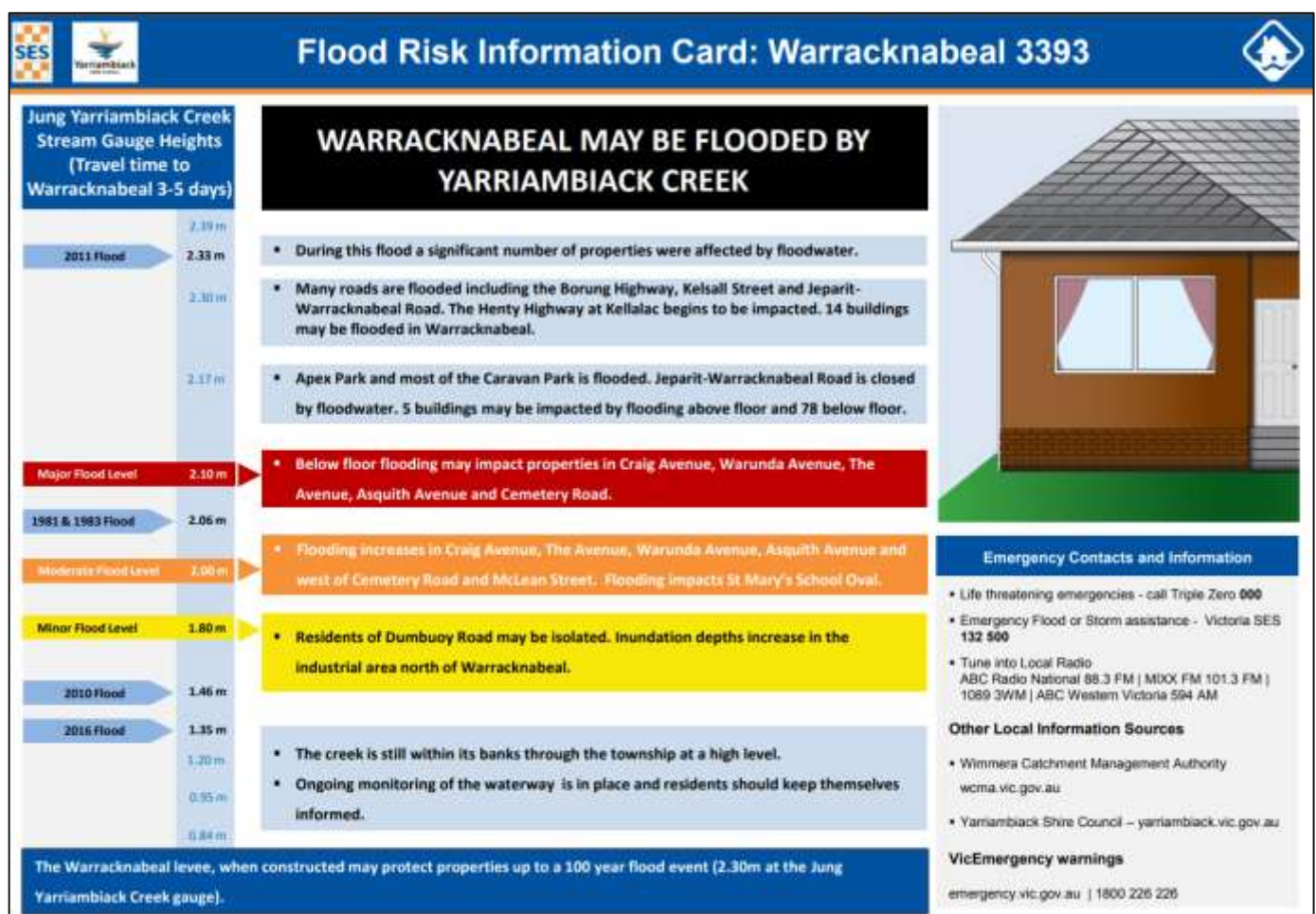
There have been three Local Flood Guides developed for the Yarriambiack Shire Council Region;

- Refer to the link below for the Yarriambiack Shire Council flood risk information on the VICSES website;

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

- Also on this website is the Warracknabeal Flood Risk Information Card which provides a instructions on how the community can access live stream gauge information and how the Jung gauge relates to flood risk for Warracknabeal. Refer to the link below;

<https://www.ses.vic.gov.au/documents/112015/2715338/YSC+Warracknabeal+Flood+Risk+Information+Card+Generic.pdf/8cc8c726-4747-ab91-3d48-ed48f5c0cca4>



# Stay Informed

You can ensure you are always up to date by following these three easy steps:

## Step 1

Prepare for Flood

[ses.vic.gov.au/get-ready](https://ses.vic.gov.au/get-ready)

### What should I do?

Leaving early is always the safest option in Warracknabeal. Leave well before roads are closed by floodwater. Never drive, ride or walk through floodwater.

View Warracknabeal flood extent maps at [wcm.vic.gov.au/permitsplanningfloodadvice/FloodInvestigations](https://wcm.vic.gov.au/permitsplanningfloodadvice/FloodInvestigations)

## Step 2

Monitor Yarriambiack Creek water levels

[bom.gov.au/vic/flood](https://bom.gov.au/vic/flood)

- Select 'River Conditions' (above the map)
- Click on Wimmera Mallee on the right.
- Find the Yarriambiack Creek gauge and hover over it.
- Compare flood class levels & river height to the stream gauge heights on the other side of this card to determine if flooding is likely on your property (see below).

## Step 3

Check emergency information and warnings

[emergency.vic.gov.au](https://emergency.vic.gov.au)

### Bureau of Meteorology (BoM)

[bom.gov.au/vic/warnings](https://bom.gov.au/vic/warnings)

#### Look out for:

- A Flood Watch for Wimmera, Victoria.

### VicEmergency

[emergency.vic.gov.au](https://emergency.vic.gov.au)

Download the App.

1800 226 226

#### Monitor warnings in your area:

##### Warnings



##### Evacuation

An evacuation is recommended if preparations are in place to evacuate.



##### Emergency Warning

You are in imminent danger and need to take action now. You will be impacted.



##### Warning (Watch and Act)

An emergency is developing nearby. You need to take action now to protect yourself and others.



##### Advice

An incident is occurring or has occurred in the area. Assess information and monitor conditions.

Can also be used as a notification that activity in the area has subsided and is no longer a danger to you.

Version 1.0 – March 2018

MURTOA (YARRIAMBIACK CK)	
Station No	579018
River Height (m)	0.155
Time of Obs	22-01-2018 07:46:22
Flood Class	Below Flood Level
Tendency	Steady

Click mouse to display plot.



**Disclaimer:** This information is provided to assist you in planning for flooding on your property. While best efforts have been made to ensure the accuracy of the information provided on this notice, the Yarriambiack Shire Council, Wimmera Catchment Management Authority and VICSES accept no liability for the use of or reliance on this information.



## 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 Yarriambiack Shire Council region community observers identified are:

Town	Observer Details	Community Observer Name	Contact Details
Warracknabeal	Council Officer Staff	Council office number	5398 0100
Warracknabeal	Warracknabeal VICSES Unit	John Bish	0427 869 930
Warracknabeal	Warracknabeal VICSES Unit	Amanda Larcombe	0438 885 343
Beulah	Council Officer Staff	Council office number	5398 0100
Rupanyup	Council Officer Staff	Council office number	5398 0100
Rupanyup	Dunmunkle VICSES Unit	Marty Reither	0448 050 971

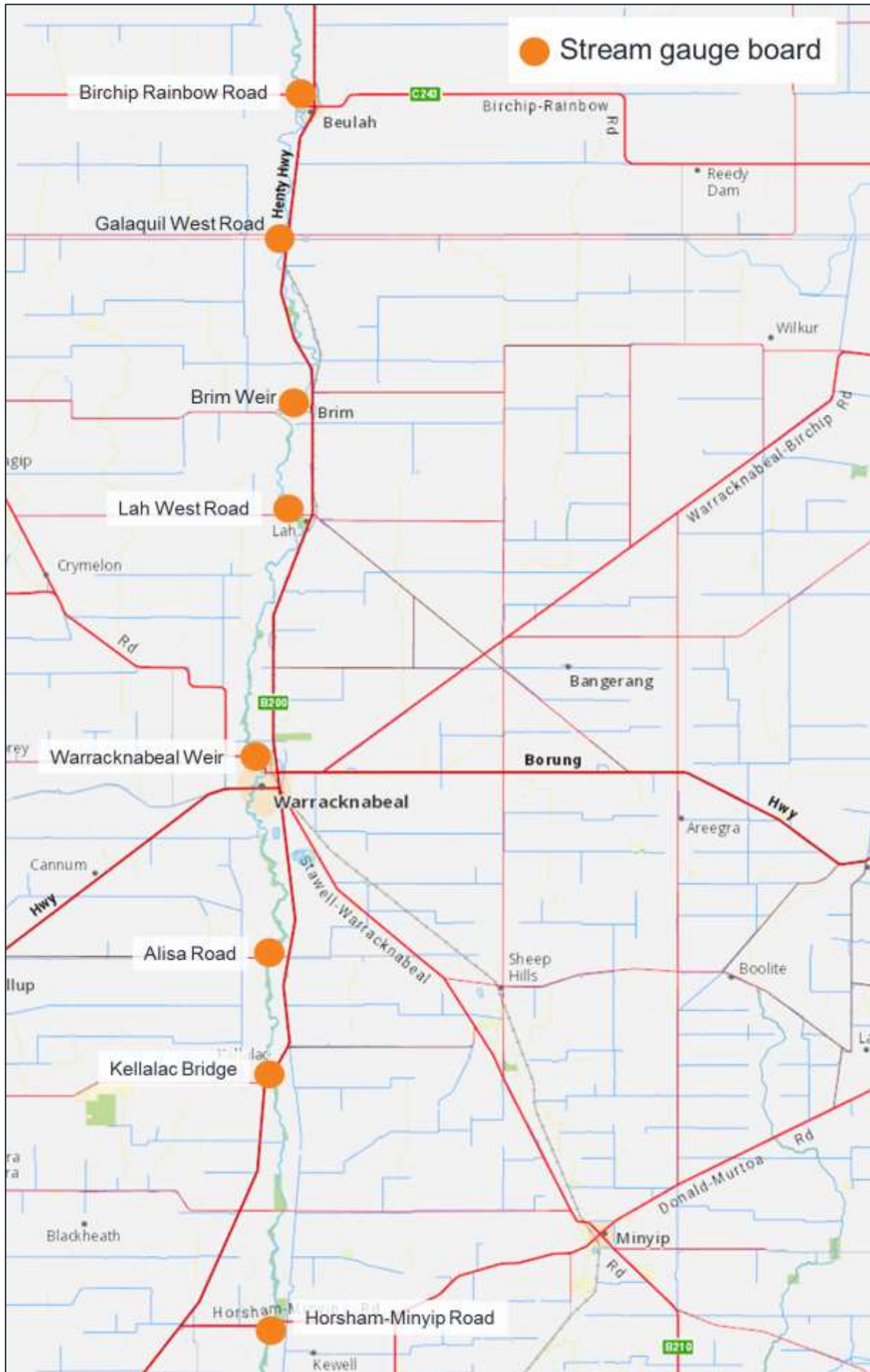
## Gauge board locations along Yarriambiack Creek

There are 8 gauge board locations along Yarriambiack Creek, used to undertake flood observations during flood events. Refer to the map below showing the stream gauge board locations.

The table below can be used to record stream gauge board height observations.

No	Yarriambiack Creek Gauge Board Location	Date	Time	Height (m)
1	Horsham Minyip Road			
2	Kellalac Bridge at the Henty Highway			
3	Alisa Road			
4	Warracknabeal Weir			
5	Lah West Road Bridge			
6	Brim Weir			
7	Galaquil West Road			
8	Birchip Rainbow Road -Beulah			





# Appendix I: Yarriambiack 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 immanent

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

- Yarriambiack Shire Council Depot in Warracknabeal: 1 Pyers Street, Warracknabeal.
- Yarriambiack Shire Council Depot in Rupanyup: 95 Dyers Street, Rupanyup.
- Yarriambiack Shire Council Depot in Beulah: Murdoch Street, Beulah.

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

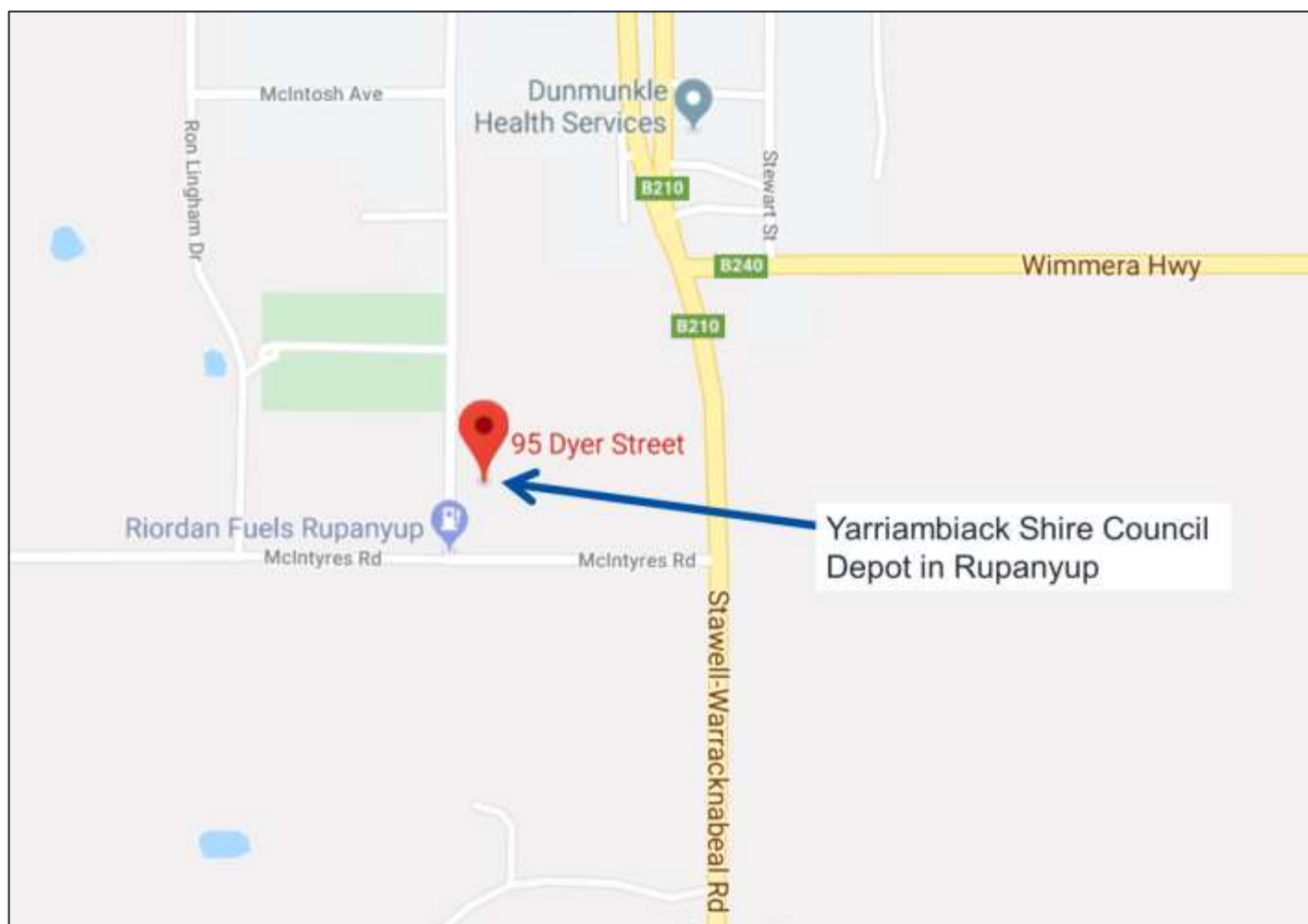
Agency	Task Description
VICSES	Deliver sandbags to the council depot or other nominated sandbag filling point to prefill the sandbags.
Yarriambiack Shire Council	Deliver sand to sandbag filling points documented below.
Yarriambiack Shire Council / VICSES / CFA	Deliver prefilled sandbags either directly 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.
Yarriambiack Shire Council / VICSES	Notify the community of the location of the community sandbag collection point via local radio and social media channels.



**Warracknabeal sandbag filling and community collection point:** the Yarriambiack Shire Council Depot in Warracknabeal, 1 Pyers Street (refer to map below).



**Rupanyup sandbag filling and community collection point:** the Yarriambiack Shire Council Depot in Rupanyup, 95 Dyer Street (refer to map below).





**Beulah sandbag filling and community collection point:** the Yarriambiack Shire Council Depot in Beulah, Murdoch Street (refer to map below).



## References

Alluvium (2014): Management of environmental flows in and through the Wimmera Weir Pools.

Water Technology (2007): Warracknabeal and Beulah Flood Study.

Water Technology (2011): January 2011 Wimmera Regional Flood Report.

Water Technology (2013): Beulah Flood Investigation.

Water Technology (2016): Warracknabeal and Brim Flood Investigation.

Water Technology (2018): Warracknabeal and Brim Flood Investigation.