

# Golden Plains Shire

## FLOOD EMERGENCY PLAN

A Sub-Plan of the Municipal Emergency Management Plan

For Golden Plains Shire Council  
and  
VICSES Bannockburn and Ballarat 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	Tony Grimme	Draft Version
1	November 2019	Clare Mintern	Rewrite the report.
2	February 2020	Clare Mintern	Incorporate MEMPC feedback.

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 Golden Plains Shire website <https://www.goldenplains.vic.gov.au/page/HomePage.aspx>

# List of Abbreviations & Acronyms

The following abbreviations and acronyms are used in the Plan

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

# Part 1. Introduction

## 1.1 Approval and Endorsement

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

VICSES staff has undertaken consultation with the Golden Plains staff, Corangamite CMA staff and Bannockburn and Ballarat VICSES Unit members regarding the arrangements contained within this plan.

This MFEP is a sub plan to the Golden Plains 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 Golden Plains MEMPC as a sub-plan to the MEMP.

### Approval

Stephen Warren

Date 14 February 2020

Grampians Mid West Region VICSES Regional Manager



### Endorsement

Phil Josipovic

Date 17 February 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 the Golden Plains Shire.

As such, the scope of the Plan is to:

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

## 1.3 Municipal Flood Planning Committee (MFPC)

Membership of the Golden Plains 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),
- Corangamite Catchment Management Authority (CMA),
- 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

## 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 the Golden Plains Shire and Corangamite CMA 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

Levees have been constructed in Inverleigh and Shelford. The Inverleigh levee is located on the southern side of the Leigh River adjacent to the Inverleigh Tennis Courts in High Street. Two levees in Shelford are located on the eastern side of the Leigh River. Refer to **Appendix C** for more details regarding the location and protection level of these levees.

### 2.3 Non-structural Flood Mitigation Measures

#### 2.3.1 Exercising the Plan

Arrangements for exercising this Plan will be at the discretion of the MEMPC. It is recommended that the MFEP is exercised on annual basis and reviewed in line with Section 1.4.

#### 2.3.2 Flood Warning

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

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

#### 2.3.3 Local Knowledge

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

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



# Part 3. DURING: Response arrangements

## 3.1 Introduction

### 3.1.1 Activation of Response

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

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

### 3.1.2 Responsibilities

There are a number of agencies with specific roles that will act in support of VICSES and provide support to the community in the event of a serious flood within the Golden Plains Shire. 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 Golden Plains Shire including those arising from a dam failure or retarding basin / levee bank failure incident will therefore be under the control of the appointed IC, or delegated representative.

### 3.2.2 Incident Controller (IC)

An Incident Controller (IC) will be appointed by the VICSES (as the Control Agency) to command and control available resources in response to a flood event on the advice of the Bureau of Meteorology (or other reliable source) that a flood event will occur or is occurring. The IC responsibilities are as defined in Part 3 of the EMMV.

### 3.2.3 Incident Control Centre (ICC)

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

Pre-determined ICC locations are 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:

Table 1. Divisions and sectors for the Golden Plains Shire.

Incident Level	ICC / ICP	Division	Division Control Point	Sector	Sector Control Point
Level 2-3	Ballarat ICC	Ballarat	Inverleigh CFA	Inverleigh	TBD as needed
Level 2-3	Ballarat ICC	Ballarat	Bannockburn VICESSES Unit	Shelford	TBD as needed

### 3.2.5 Incident Management Team (IMT)

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

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

### 3.2.6 Incident Emergency Management Team (IEMT)

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

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

Refer to 3 of the EMMV for guidance on IEMTs.

### 3.2.7 On Receipt of a Flood Watch / Severe Weather Warning

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

- Review flood intelligence to assess likely flood consequences
- Monitor weather and flood information – [www.bom.gov.au](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 Golden Plains Shire MERC and MERO at the earliest opportunity to allow for relief preparation to commence.

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

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 Golden Plains Shire to assist with rescue operations:

- Flood Rescue boats are located at Ballarat, Bacchus Marsh and Geelong Units.
- Geelong and South Barwon Units have a land based Swift Rescue Team.
- HEMS 4 Rescue helicopter is located at the Essendon Airport.

### 3.8 Aircraft Management

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

Air support operations will be conducted under the control of the IC

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

Suitable airbase facilities are located at:

- Ballarat Aerodrome, off Learmonth Road, Mitchell Park.
- Lethbridge Aerodrome, 3429 Midland Highway, Lethbridge.

### 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 Golden Plains Shire Council maintains a small stock of sandbags that will be made available at community collection points at Inverleigh CFA, Shelford Council Depot and Bannockburn VICSES Unit, refer to **Appendix I** for further details. These details will be advertised by both VICSES and Golden Plains Shire 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 the Golden Plains Shire.

### 3.12 Road Closures

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

Regional Roads Victoria and the Golden Plains Shire will communicate community information regarding road closures. Information will be updated on the VIC Traffic website: <https://traffic.vicroads.vic.gov.au/>



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

### **3.13 Dam Spilling/ Failure**

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

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

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

### **3.14 Waste Water related Public Health Issues and Critical Sewerage Assets**

Inundation of critical sewerage assets including septic tanks and sewerage pump stations may result in water quality problems within the Municipality. Where this is likely to occur or has occurred the responsibility agency for the critical sewerage asset should undertake the following:

Advise VICSES of the security of critical sewerage assets to assist preparedness and response activities in the event of flood;

Maintain or improve the security of critical sewerage assets;

Check and correct where possible the operation of critical sewerage assets in times of flood;

Advise the ICC in the event of inundation of critical sewerage assets.

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

### **3.15 Access to Technical Specialists**

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 Golden Plains Shire is detailed in the Golden Plains Shire MEMP.

### 4.2 Emergency Relief

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

The range and type of emergency relief services to be provided in response to a flood event will be dependent upon the size, impact, and scale of the flood. Refer to Part 4 of the EMMV for details of the range of emergency relief services that may be provided.

Suitable relief facilities identified for use during floods are detailed in **Appendix D** and the MEMP.

Details of the relief arrangements are available in the MEMP.

### 4.3 Animal Welfare

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

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

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

### 4.4 Transition from Response to Recovery

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

# Appendix A: Flood threats for the Golden Plains

This Appendix provides a broad overview of flood risk within the Municipality. Detailed flood risk information for individual communities is detailed in **Appendix C**.

## 5.1 Stormwater and Riverine Flooding

Golden Plains Shire Council has towns that are subject to stormwater and riverine flooding. Shelford is subject to stormwater flooding.

Golden Plains Shire has a long history of riverine flood events. Towns impacted by riverine flooding include Inverleigh and Shelford.

Flood events within Golden Plains Shire have been frequent over the last decade. The most recent flood event was recorded in 2016, refer to table 2 of significant flood events below.

Table 2. Historic flood events.

Year	Description
September 2016	Minor flood impacts to Inverleigh and Shelford causing access to be cut to minor and major roads.
2012	Minor flooding in the Leigh River impacting rural land and minor roads in Inverleigh and Shelford.
January 2011	This flood event caused significant damage to buildings and infrastructure in Shelford and Inverleigh. Some outbuildings were flooded over 0.5m deep in Cambridge Street, Inverleigh. The Barwon River was not in flood.
2010	Minor flooding in the Leigh River impacting rural land and minor roads in Inverleigh and Shelford.
1995	Minor flood impacts to Shelford and Inverleigh causing access to be cut to minor and major roads.
1978	Minor flood impacts to Shelford causing access to be cut to minor and major roads. The third largest flood in Inverleigh, causing significant damage to buildings and infrastructure. Flooding also occurred along the Barwon River.
1976	Very significant flood event in the Barwon River, only minor flooding in Inverleigh.
1974	Minor flooding in the Leigh River impacting rural land and minor roads in Inverleigh and Shelford.
1973	This was the largest flood event on record on the Leigh River, 185mm fell in less than 48 hours. This flood caused significant damage to buildings and infrastructure in Shelford and Inverleigh.
1965	Flooding in the Leigh River cause minor impacts, flooding the Hamilton Highway west of Inverleigh. No buildings were impacted.
1952	This was the largest flood event on record on the Barwon River and the second largest flood event in living memory in the Leigh River causing significant damage to buildings and infrastructure in Shelford and Inverleigh.

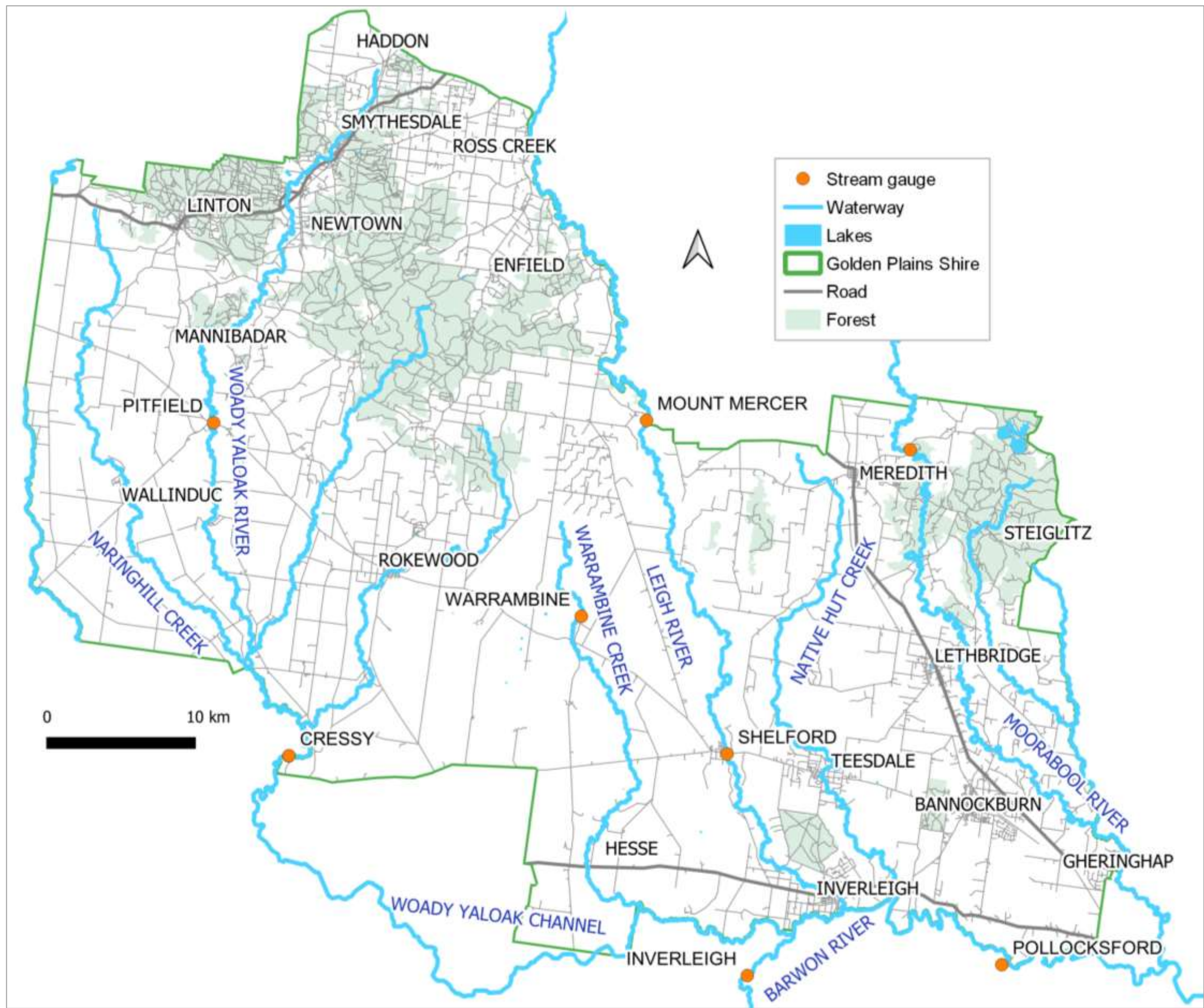


Figure 1. Golden Plains waterways.



## 5.2 Major Waterways

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

Waterway	Description
<b>Leigh River</b>	<p>The upper reaches of the Leigh River is located to the north east of Ballarat, begins as the Yarrowee River and flows south through Shelford and Inverleigh before it joins the Barwon River east of Inverleigh. The catchment area of the Leigh River upstream of Inverleigh is approximately 883 km<sup>2</sup>.</p> <p>The Leigh River frequently causes flooding in Shelford and Inverleigh. There are two stream gauges along the Leigh River at Mount Mercer and Shelford that provide flood warning to Shelford and Inverleigh. Flooding can occur in Shelford 18 to 28 hours after rainfall in the upper catchment, and in Inverleigh 4 to 8 hours after the flood peak in Shelford.</p>
<b>Barwon River</b>	<p>The upper reaches of the Barwon River drains the eastern Otway Ranges surrounding Forrest, with an approximate catchment area of 1,608 km<sup>2</sup>. Barwon River then flows through Birregurra and Winchelsea before intersecting the Leigh River east of Inverleigh.</p> <p>Flooding from the Barwon River is usually a result of prolonged heavy rainfall in the upper catchment in the Otway Ranges. The Barwon River frequently causes flooding in Inverleigh. There are four stream gauges along the Barwon River at Ricketts Marsh, Kildean, Winchelsea and upstream of Inverleigh that provide flood warning to Inverleigh. Flooding can occur in Inverleigh 2.5 to 3 days after rainfall in the upper Barwon River Catchment. The flood peak travel time between the Ricketts Marsh and Inverleigh gauges can range between 18 to 20 hours.</p> <p>In addition to receiving flows from the Leigh River, the Barwon River also receives flows from Woody Yaloak Creek and Warrambine Creek. Warrambine Creek flows into the Barwon River 13km upstream of Inverleigh.</p>
<b>Warrambine Creek</b>	<p>Warrambine Creek drains the southern slopes of Mount Mercer and flows south 56 km where it joins Barwon River. Warrambine Creek flows into the Barwon River 13 km upstream of Inverleigh. Warrambine Creek is a much smaller waterway compared to the Barwon and the Leigh Rivers. Warrambine Creek also receives diversion flows from the Woody Yaloak Diversion Channel, 19 km upstream of the Barwon River confluence.</p> <p>A stream gauge located along the upper Warrambine Creek, north of the Rokewood-Shelford Road provides an indication of flows, however it's not useful for flood warning.</p>
<b>Woody Yaloak Diversion Channel</b>	<p>The upper reach of Woody Yaloak Creek begins in Alfredton, the southern fringe of Ballarat. Woody Yaloak Creek then flows south through Smythesdale, Pitfield and Cressy. Woody Yaloak Creek is then diverted into Warrambine Creek via the Woody Yaloak Diversion Channel north of the Cundare Pool (north of Lake Corangamite).</p> <p>Flows harvested from Woody Yaloak Creek via the Woody Yaloak Diversion Channel contribute to flooding in Inverleigh. This drainage scheme was built following the 1950's floods to protect agricultural land from flooding around Lake Corangamite. The Woody Yaloak Diversion Channel has a capacity of around 490 ML/d. These flows are minor compared to the flows from the Barwon River at Inverleigh during major flood events (100 year ARI peak flow 69,900 ML/d).</p>

## 5.3 Building Damages

Refer to the table below for property and building damages for flood events within the Golden Plains 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.

Table 3. Golden Plains Shire Council building damages.

Average Recurrence Interval (ARI)	Total number of properties flooded (buildings flooded above floor)			Total damages for the Golden Plains Shire Council (Inverleigh Barwon River dominant was not included)
	Inverleigh (Leigh River dominant) (Appendix C1)	Inverleigh (Barwon River dominant) (Appendix C1)	Shelford * (Appendix C2)	
2	83 (0)	89 (0)	6 (0)	89 (0)
5	90 (0)	94 (0)	8 (0)	98 (0)
10	97 (0)	95 (0)	10 (0)	105 (0)
20	110 (0)	100 (0)	12 (2)	122 (0)
50	158 (0)	144 (1)	25 (10)	183 (11)
100	247 (5)	167 (2)	38 (12)	283 (17)
200	273 (33)	231 (9)	41 (15)	314 (48)
500	321 (82)	324 (133)	58 (18)	379 (100)
1000	356 (117)	371 (174)	62 (20)	418 (137)

\* Estimated using flood extent mapping (DNRE 2000), Corangamite CMA Flood Response Guide and anecdotal information.

- Level 2 ICC
- Level 3 ICC

## 5.4 Dams Spill / Failure

Significant dams or lakes that influence flooding within Golden Plains Shire Council area are listed below.

**Table 4. Dams and lakes that influence flooding.**

Dam	Owner	Full Supply Volume	Comments
<b>West Barwon Reservoir</b>	Barwon Water	21,504 ML	West Barwon Reservoir is located in the Otway Ranges National Park. The catchment which feeds this Reservoir is very small, 51 km <sup>2</sup> compared with the entire catchment area upstream of Inverleigh is 2,700 km <sup>2</sup> (Water Technology 2018). Therefore, although the West Barwon Reservoir may contribute spills, it's unlikely to significantly impact flooding in the Barwon River.
<b>Wurdee Boluc Reservoir</b>	Barwon Water	38,100 ML	Given the Wurdiboluc Reservoir is an off stream storage located south of Winchelsea it is unlikely to significantly impact flooding in the Barwon River.
<b>White Swan Reservoir</b>	Central Highlands Water	14,107 ML	During flood events on the Yarrowee River (Leigh River) the White Swan Reservoir will have very little influence on flooding downstream.
<b>Gong Gong Reservoir</b>	Central Highlands Water	1,909 ML	During flood events on the Yarrowee River (Leigh River) the Gong Gong Reservoir will have very little influence on flooding downstream.

## West Barwon and Wurdee Boluc Reservoirs

The most significant regulated storages within the Barwon River Catchment include the West Barwon and Wurdee Boluc Reservoirs. The West Barwon Reservoir is located in the upper Barwon River Catchment within the Otways, south of Forrest, refer to the map below. The reservoir has a catchment area of 51 km<sup>2</sup> and has a capacity of 21,504 ML. When capacity of the West Barwon Reservoir is reached excess water spills via a concrete spillway to the West Barwon River, refer to photo below.

Water from West Barwon Reservoir is also diverted to Wurdee Boluc Reservoir via a concrete lined diversion channel. Water is stored at Wurdee Boluc for potable water usage for to the greater Geelong area. Given the Wurdee Boluc Reservoir is an off stream storage, it is unlikely to significantly impact flooding in the Barwon River (Water Technology 2018).

The catchment which feeds the West Barwon Reservoir is very small, 51 km<sup>2</sup> compared with the entire catchment area upstream of Inverleigh is 2,700 km<sup>2</sup> (Water Technology 2018). Therefore, although the West Barwon Reservoir may contribute spills, it's unlikely to significantly impact flooding in the Barwon River.



Figure 2. Location of West Barwon and Wurdee Boluc Reservoirs (source Water Technology 2018)





Figure 3. West Barwon Reservoir spillway.

## 5.5 Levees

Levees have been constructed in Inverleigh and Shelford. The Inverleigh levee is located on the southern side of the Leigh River adjacent to the Inverleigh Tennis Courts in High Street. Two levees in Shelford are located on the eastern side of the Leigh River. Refer to Appendix C for more details regarding the location and protection level of these levees.

## Appendix B: Typical flood peak travel times

Table 5. Flood peak travel times.

Location From	Location To	Typical Travel Time	Comments	Duration
<b>Shelford (Leigh River)</b>				
Start of rainfall (upper catchment)	Mount Mercer	4 - 6 hours	begin to rise from normal levels	2 days
Start of rainfall (upper catchment)	Mount Mercer	12 - 18 hours	to peak	
Mount Mercer	Shelford	6 - 10 hours	to peak	
<b>Inverleigh (Leigh River)</b>				
Start of rainfall (upper catchment)	Mount Mercer	4 - 6 hours	begin to rise from normal levels	2 days
Start of rainfall (upper catchment)	Mount Mercer	12 - 18 hours	to peak	
Mount Mercer	Inverleigh (town)	10 - 18 hours	to peak	
<b>Inverleigh (Barwon River)</b>				
Start of rainfall (upper catchment)	Ricketts Marsh	18 - 30 hours	begin to rise from normal levels	2 days
Start of rainfall (upper catchment)	Inverleigh (town)	2.5 - 3 days	begin to rise from normal levels	
Ricketts Marsh	Inverleigh (town)	16 - 20 hours	to peak	
Kildean gauge	Inverleigh (town)	12 - 16 hours	to peak	
Winchelsea gauge	Inverleigh (town)	8 - 12 hours	to peak	
Inverleigh (gauge)	Inverleigh (town)	3 - 5 hours	to peak	

## Appendix C1: Inverleigh Flood Emergency Plan

Inverleigh is located on junction of the Barwon River and the Leigh River, and has experienced extensive and frequent riverine flooding from the Barwon and Leigh Rivers. Flooding from the Barwon and Leigh Rivers can occur at different times due to the large 2,700km<sup>2</sup> combined catchment areas upstream of Inverleigh. Warrambine Creek is tributary of the Barwon River that contributes flows to the Barwon River 13km upstream of Inverleigh. The Barwon River catchment area comprises 46% of the total catchment area, Leigh River 32% and Warrambine Creek 22%. The catchment stretches over 130 km from the Otway Ranges in the south to Ballarat in the north, refer to the map below. Storms can impact different parts of the catchment in isolation.

The majority of Inverleigh is affected by flooding from the Leigh River. Flooding from the Leigh River usually occurs during prolonged heavy rainfall in the upper catchment around Mount Mercer and Ballarat. Overbank flows from the Leigh River are likely to inundate parts of Inverleigh from the north. Initially flows will enter the Inverleigh via the Leigh River near the Inverleigh Tennis Courts in High Street and over Hamilton Highway. The Inverleigh Primary School is impacted by flooding during a 50 year flood, when the adjacent levee is overtopped. Large sections of Inverleigh should be evacuated during a 100 year flood event (Shelford stream gauge height of 8.44m) given flooding cuts access to a significant number of roads and 5 buildings are flooded over floor. There are two stream gauges along the Leigh River upstream of Inverleigh that provide early flood warning, these include Mount Mercer and Shelford gauges. Refer to the map below. The flood peak can occur in Inverleigh between 22 to 36 hours after rainfall in the upper catchment.

The Barwon River floods Inverleigh during larger flood events, a significant number of properties are flooded and houses start to be flooded over floor during a 200 year event (Inverleigh gauge height greater than 6.04m). Access to major and minor roads may start to be impacted by flooding during a 20 year flood event. There are four stream gauges along the Barwon River upstream of Inverleigh that provide early flood warning, these include Ricketts Marsh, Kildean, Winchelsea and Inverleigh gauges. Refer to Barwon River Warning Time section below for a stream gauge location map. Rises in streamflow at Inverleigh can occur between 2.5 to 3 days after rainfall in the upper catchment.

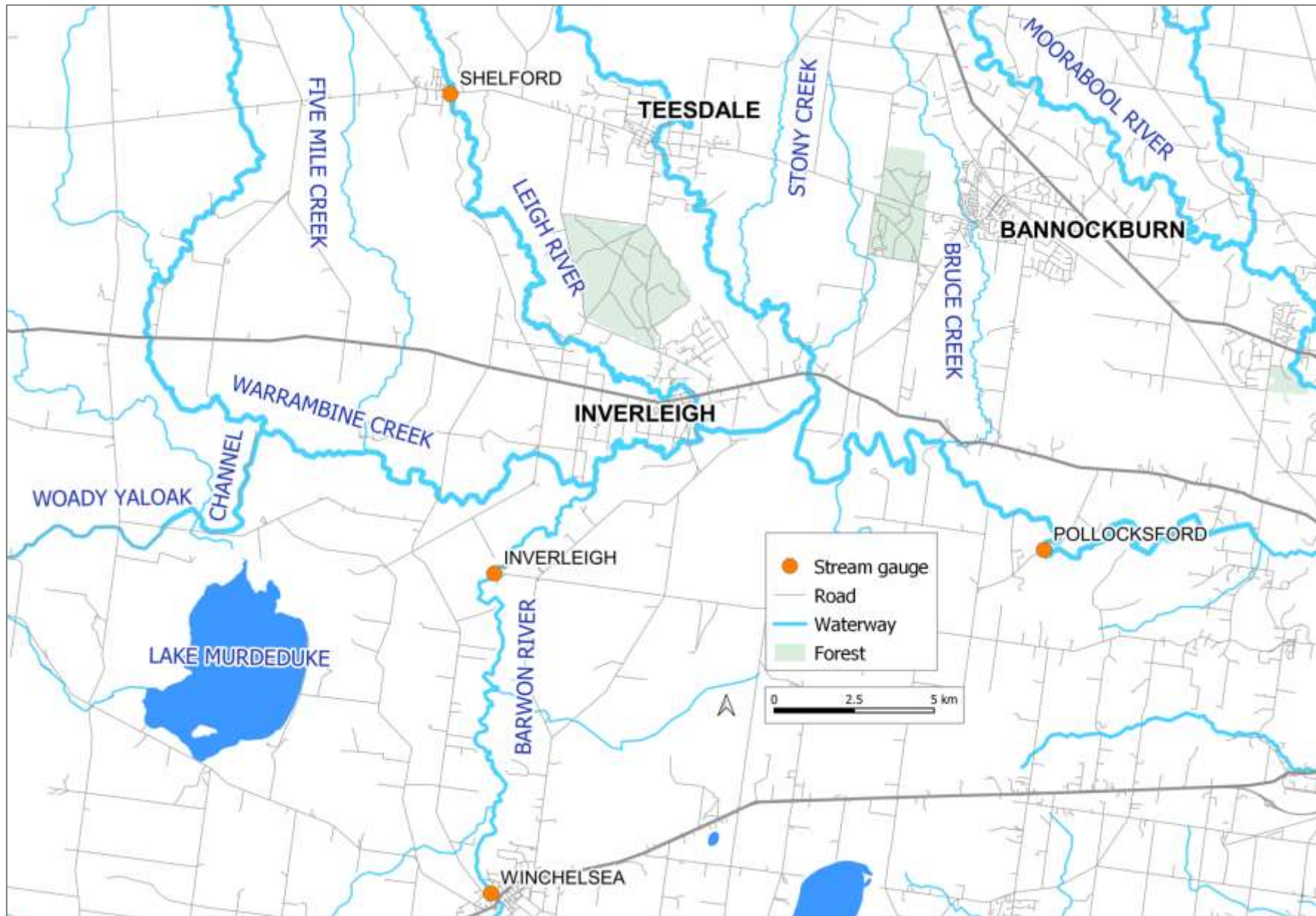


Figure 4. Waterways surrounding Inverleigh.

## Historic Flood Events

Inverleigh has experienced frequent and extensive flood events, refer to the graph below. Significant flood events have occurred in 1956, 1973, 1974, 1976, 1978, 1981, 1983, 1984, 1988, 1990, 1992, 1995, 1996, 2001, 2007, 2010, 2011, 2012 and 2016. The Leigh River stream gauge at Mount Mercer was used to indicate historic flood events that have occurred in Inverleigh given there are large gaps in the Shelford stream gauge record.

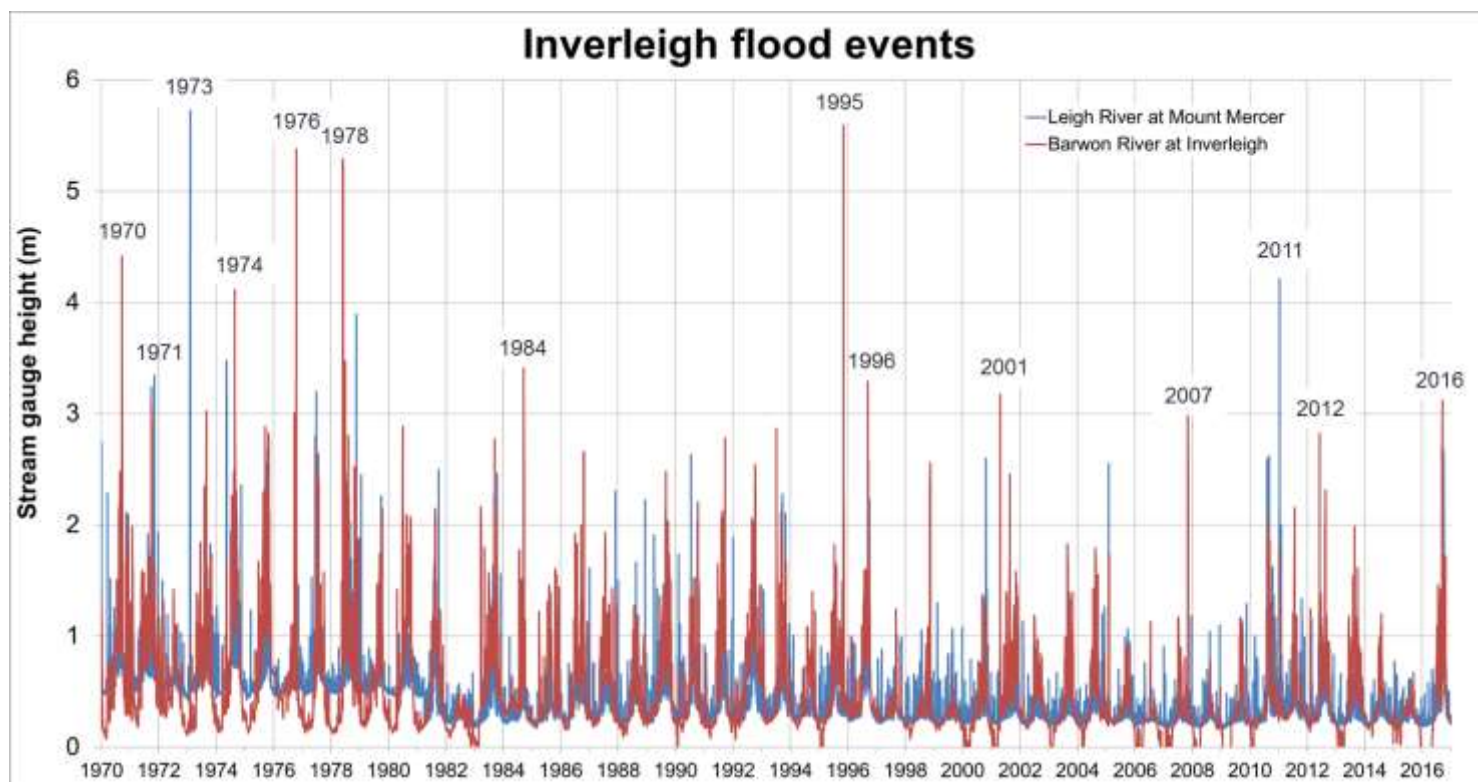


Figure 5. Inverleigh historic flood events.

The 1973 flood is Inverleigh's largest flood event on record, estimated to be between a 100 and 200 year ARI event. Significant rainfall over two days in the upper Leigh River catchment exceeded 200mm. The Mount



Mercer gauge recorded 206mm and Ballarat Botanical Gardens 205.5mm. Rainfall totals for the Barwon River catchment were around half of the totals recorded in the Leigh River, with 121mm recorded at Winchelsea.

Peak flow rates recorded of four main waterways that contributed to flooding in Inverleigh include; Leigh River at Shelford 44,000 ML/d, Warrambine River at Warrambine 5,200 ML/d, Barwon River at Inverleigh 600 ML/d and Woody Yaloak Channel at 7 mile Weir 360 ML/d. Flow rates for the Leigh River and Warrambine Creek were the highest on record with only minor flows in the Barwon River, refer to the graph below.

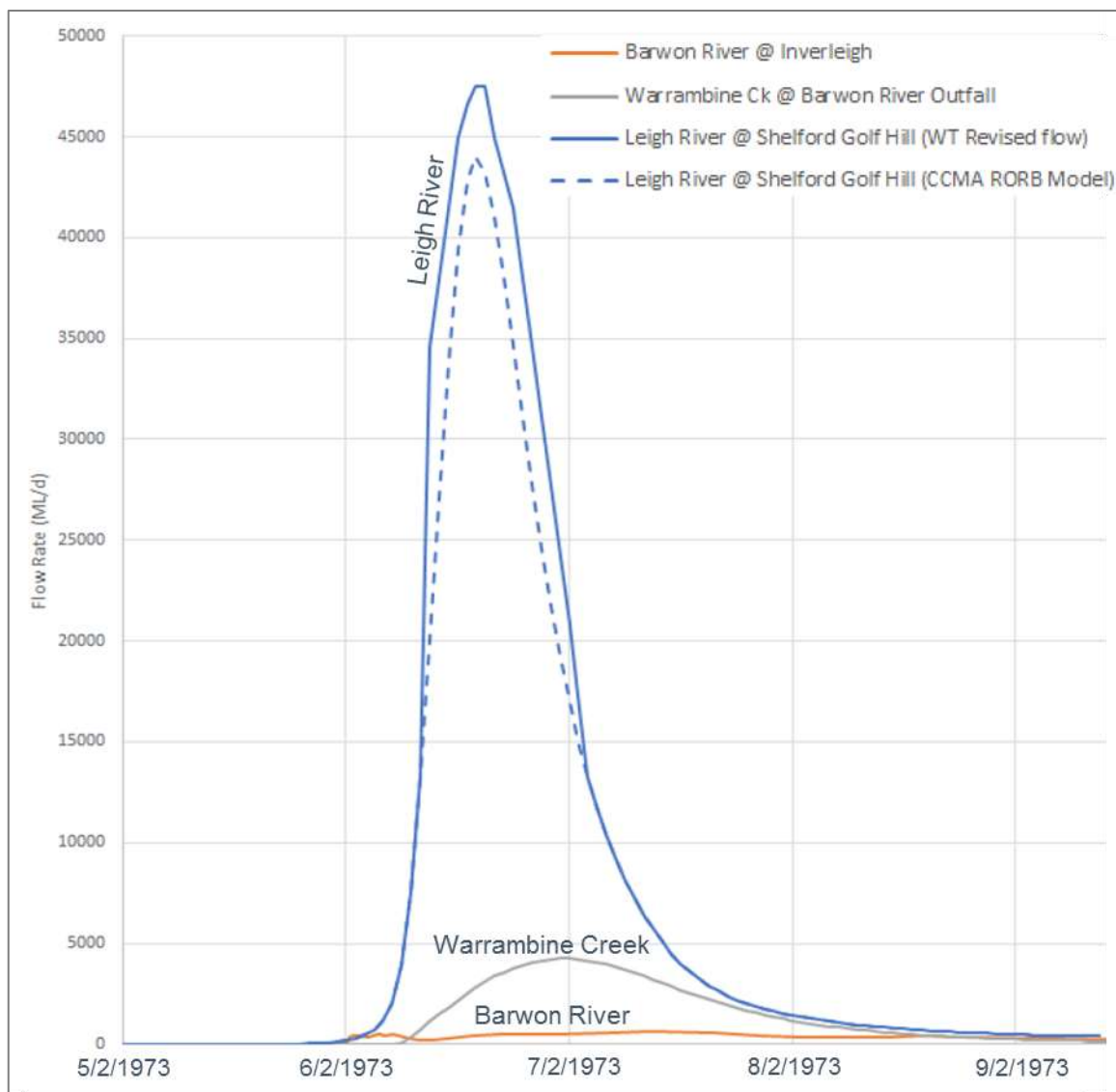


Figure 6. Waterways peak streamflow contributing to flooding in Inverleigh during the 1973 flood event.

This flood event caused considerable damage to buildings, roads and bridges. 60 buildings were impacted by flooding, including the Inverleigh School, Inverleigh Hotel and the Inverleigh Petrol Station. Deep flooding impacted a significant number of properties in Inverleigh's main shopping area. 'The Sun' newspaper described flooding at the General Store with 0.6m of flooding running through it. Access was cut to the Hamilton Highway in addition to streets surrounding High Street, Mercer Street and Dundas Street. Refer to the flood photos below.

For more details refer to the Inverleigh Flood Intelligence Cards below pages 51-52.

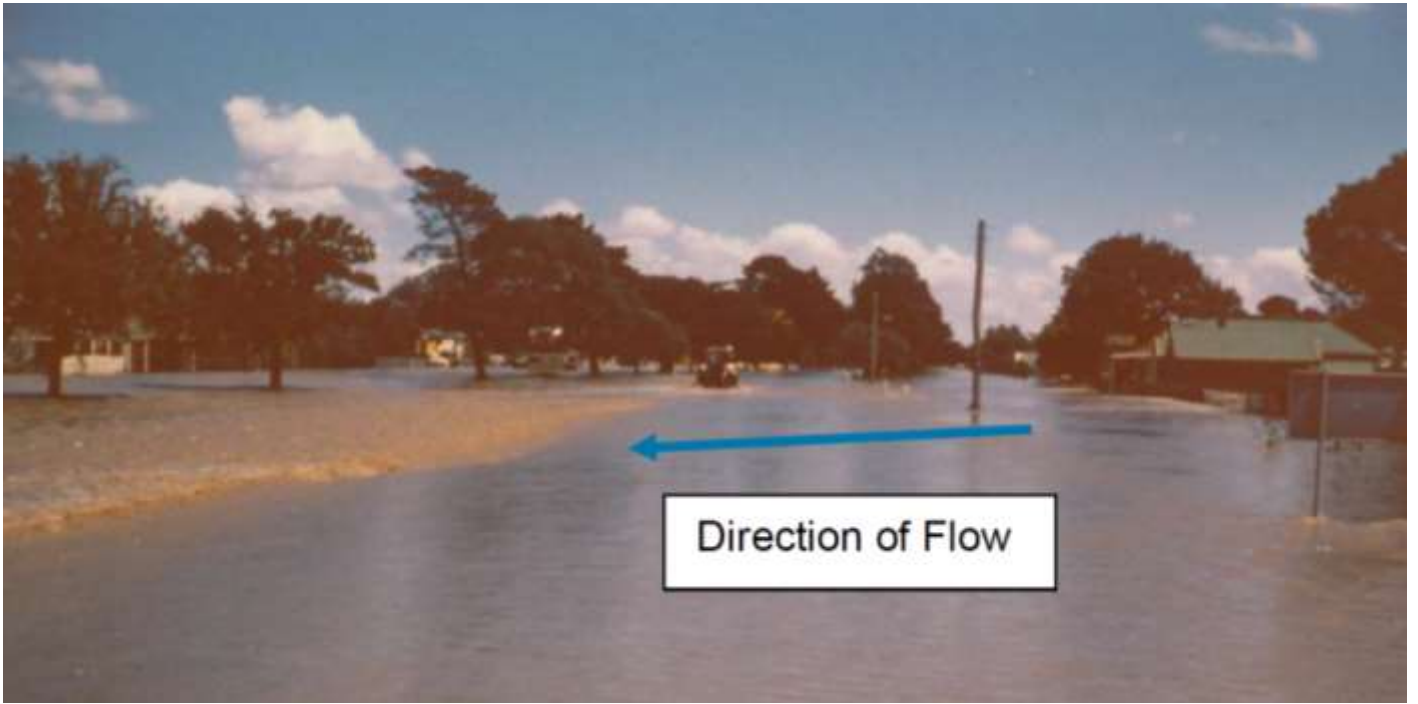


Figure 7. Flooding in High Street (Hamilton Highway) during the 1973 flood event (Water Technology 2018).



Figure 8. Flooding surrounding a house in Dundas Street, Inverleigh during the 1973 flood event.



Figure 9. Flooding impacting the Inverleigh Service Station, 19 High Street during the 1973 flood event.



Figure 10. Flooding impacting a house in Napier Street, Inverleigh during the 1952 flood event.





Figure 11. Flooding impacting the Inverleigh Hotel, 1 High Street during the 1952 flood event.



Figure 12. Flooding south east of Inverleigh during the 1995 flood event.



Figure 13. Flooding impacting the Hamilton Highway, looking east towards Inverleigh during the 2011 flood event.

## Flood Behaviour

The likelihood of the Barwon River and Leigh River flood event peaking in Inverleigh at the same time is extremely unlikely. An analysis of the timing of flood peaks for the Barwon and Leigh Rivers showed that there was little correlation between these waterways, historically flooding of these waterways have not occurred at the same time (Water Technology 2018).

For the final design flood mapping, two events were simulated for each of the ARI design events. A Leigh River dominant flood event and Barwon River dominant flood event. A summary of the design flow rates for the three waterways and the adopted combination of flows for each design event is shown in the tables below.

Inverleigh Flood Intelligence Cards, building damages maps and asset impact maps have been developed for both a Leigh River dominant flood event and a Barwon River dominant flood event. Refer to tables and maps below.

Table 6. Adopted peak flows for design events (Water Technology 2018).

Design Event (ARI)	Barwon River at Inverleigh (ML/d)	Leigh River at Shelford (ML/d)	Warrambine Ck (US of Barwon River) (ML/d)
2	6,700	2,300	2,000
5	13,900	6,200	4,100
10	21,400	10,600	6,100
20	31,500	16,600	9,100
50	50,200	27,800	13,600
100	69,900	39,000	18,200
200	95,900	54,250	23,000
500	143,200	80,400	30,100
1000	192,100	106,300	39,700
Probable Maximum Flood	915,000	740,000	686,000

Table 7. Concurrent flow combinations used for the design event maps (Water Technology 2018).

Design Event on Dominant River	Leigh River Dominant Flood		Barwon River Dominant Flood	
	Probability of concurrent flow for minor tributaries		Probability of concurrent flow for minor tributaries	
	Barwon River	Warrambine Ck	Leigh River	Warrambine Ck
1000	2%	0.2%	1%	1%
500	5%	0.5%	2%	2%
200	10%	0.77%	3.28%	3.28%
100	20%	1.31%	5%	5%
50	28.35%	2.15%	6.89%	6.89%
20	50%	5%	13.31%	13.31%
10	50%	10%	22.12%	22.12%
5	50%	20%	22.12%	22.12%
2	50%	50%	50%	50%



## Influence of the Woody Yaloak Diversion Channel

Warrambine Creek is tributary of the Barwon River that contributes flows to the Barwon River upstream of Inverleigh. Warrambine Creek also receives additional flows from the Woody Yaloak Diversion Channel, 13-14km upstream of where the Warrambine Creek flows into the Barwon River. This drainage scheme was built following the 1950's floods to protect agricultural land from flooding around Lake Corangamite. Flows are diverted into the Woody Yaloak Diversion Channel near Cressy before flows enter Lake Corangamite.

The Woody Yaloak Diversion Channel has a capacity of around 490 ML/d. These flows are minor compared to the flows from the Barwon River at Winchelsea during major flood events. An assessment was undertaken of the impact of additional 500 ML/d to the Warrambine Creek inflow for the 10 year and 100 year ARI shows a minimal increase in flood levels.

## Inverleigh Levee

An existing earthen levee has been constructed along the Leigh River floodplain adjacent to the Inverleigh Tennis Courts in High Street to protect the Inverleigh Primary School. Refer to the location map below. The protection level of this levee is only up to a 20 year flood event, the levee is overtopped during a 50 year flood event.



Figure 14. Inverleigh levee.

Two structural mitigation options were assessed to reduce flood impacts in Inverleigh as part of the 2018 Inverleigh Flood Investigation (Water Technology 2018). Flood mitigation option 1 involved increasing the height of the existing levee to above the 100 year ARI (with 300mm freeboard). Refer to the map below for the proposed location of the levee.



Figure 15. Location of the proposed levee for flood mitigation option 1 (Water Technology 2018).

This mitigation option reduces above floor flooding to 25 buildings and removes 19 parcels of land from the 100 year flood extent. Refer to the map below showing the changes to flood levels as a result of raising the existing levee. This results in a reduction of flood levels (pink and green) with minimal increase in flood levels (yellow-orange).



Figure 16. Changes to flood levels for flood mitigation option 1, raising the existing levee (Water Technology 2018).



Flood mitigation option 2 involved increasing the existing levee to above the 100 year ARI level (with 300mm freeboard) and extending the levee east following Cambridge Street to the Hamilton Highway Bridge. Refer to the map below for the proposed location of the levee.



Figure 17. Location of the proposed levee for flood mitigation option 1 (Water Technology 2018).

This mitigation option reduces above floor flooding to 25 buildings and removes 45 parcels of land from the 100 year flood extent. Refer to the map below showing the changes to flood levels as a result of raising the existing levee. This results in a reduction of flood levels (pink and green) with small increase in flood levels (yellow-orange). There is an increase in flood levels to 11 parcels showing an increase in flood levels between 0.10-0.20 m, 23 parcels showing an increase of between 0.05- 01.0 m and 32 parcels showing an increase of between 0.02 -0.05 m. These properties are nearly all located north of Cambridge Street. This does not result in the inundation of any properties that were not already inundated, nor does it result in any floor levels being exceeded. There are 6 cases whereby properties that were already inundated above floor level will feature greater magnitude of inundation (1 building at 10cm, 3 at 2cm increase and 2 with a 1 cm increase).

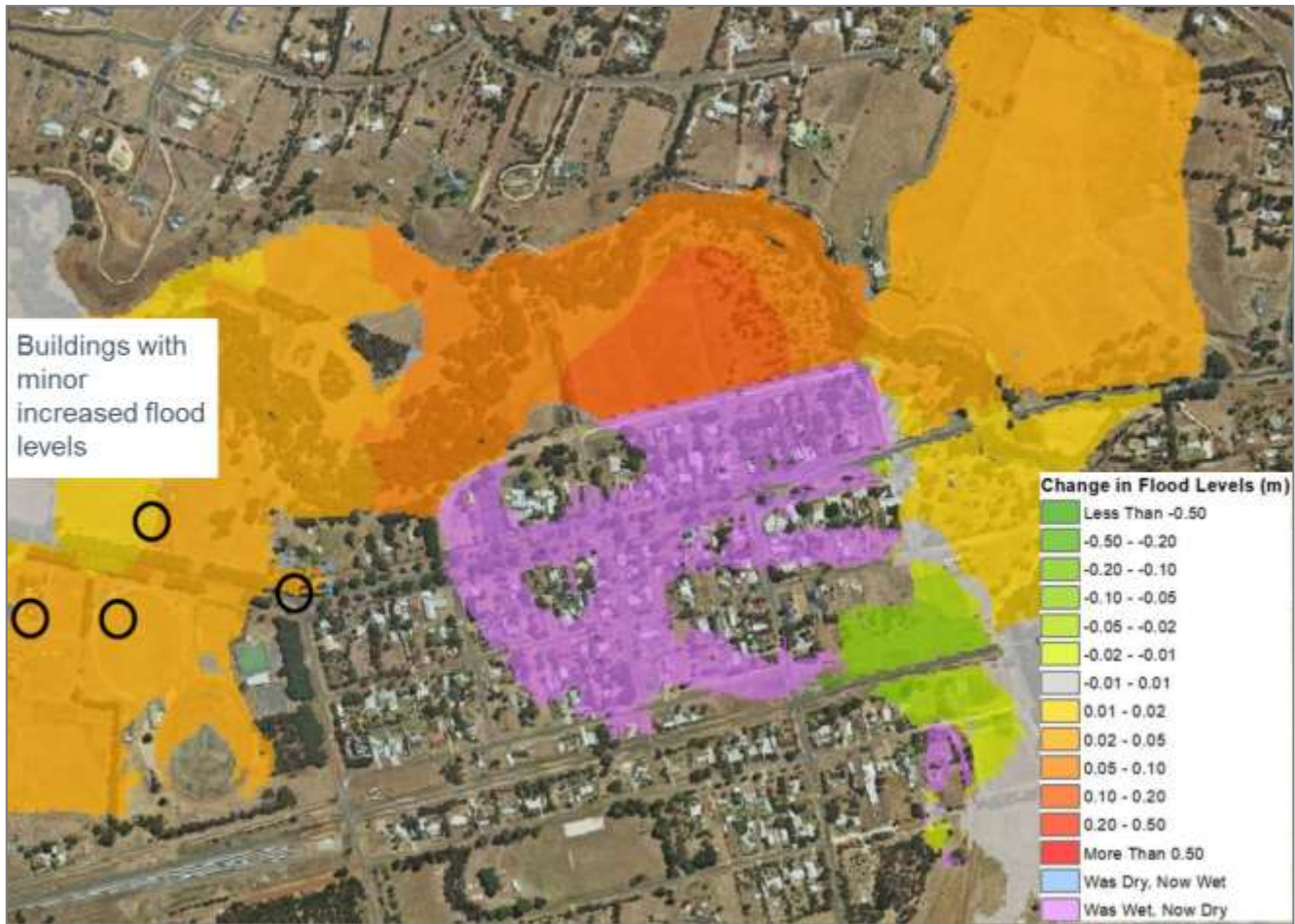


Figure 18. Changes to flood levels for flood mitigation option 2, raising and extending the existing levee (Water Technology 2018).

## Leigh River Warning Time

There are two stream gauges along the Leigh River upstream of Inverleigh that provide early flood warning, these include Mount Mercer and Shelford gauges. The time between heavy rainfall in the upper catchment around Ballarat and rise in streamflow at the Mount Mercer gauge is between 4 to 6 hours. The Mount Mercer gauge is expected to peak between 12 to 18 hours after the start of heavy rainfall. The peak travel time between Mount Mercer and the Shelford gauges is approximately between 6 to 10 hours.

The tables and graphs below show there is only a few hours difference in travel time for a small flood event, during 2016 flood (13,685 ML/d) and a large flood event, 100 year ARI (39,000 ML/d). Refer to tables and graphs below for historic and design flood peak travel times.

Table 8. Leigh River flood peak travel times.

Flood event	Mount Mercer gauge peak	Shelford gauge peak	Travel Time (hours)	Inverleigh (modelled) peak	Travel Time (hours)
100 year ARI	5:00	11.30	6.5	16:30	5
September 2016	14/9/2016 11:30	14/9/2016 18:45	7.25	15/9/2016 2:00	7.25

Table 9. Summary of Leigh River flood peak travel times.

Streamflow Gauge	Distance to Inverleigh (km)	Travel time (hours)
Leigh River at Mt Mercer	40	10-18
Leigh River at Shelford	14	4-8

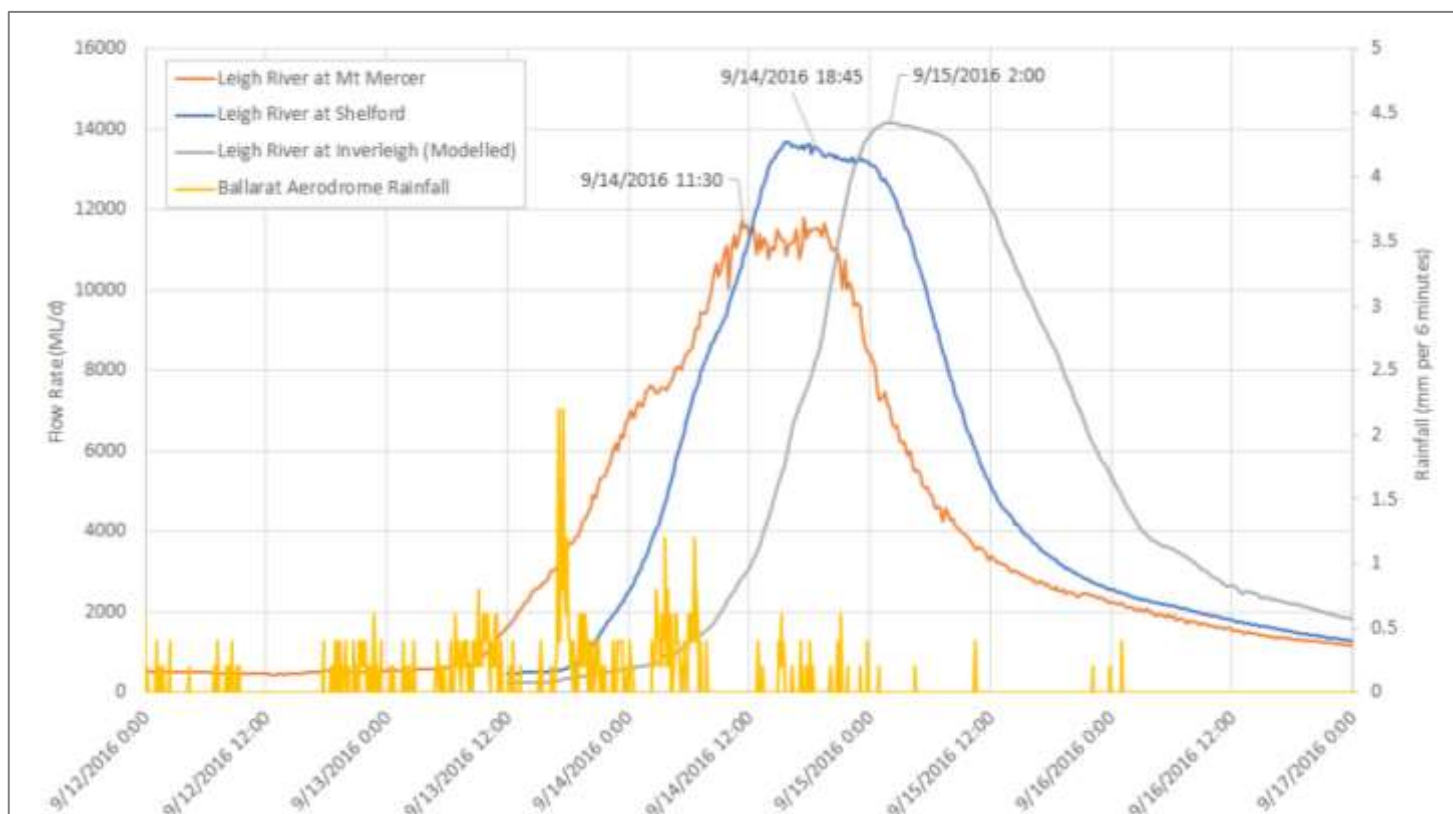


Figure 19. Peak flows in the Leigh River during the September 2016 flood event (Water Technology 2018).



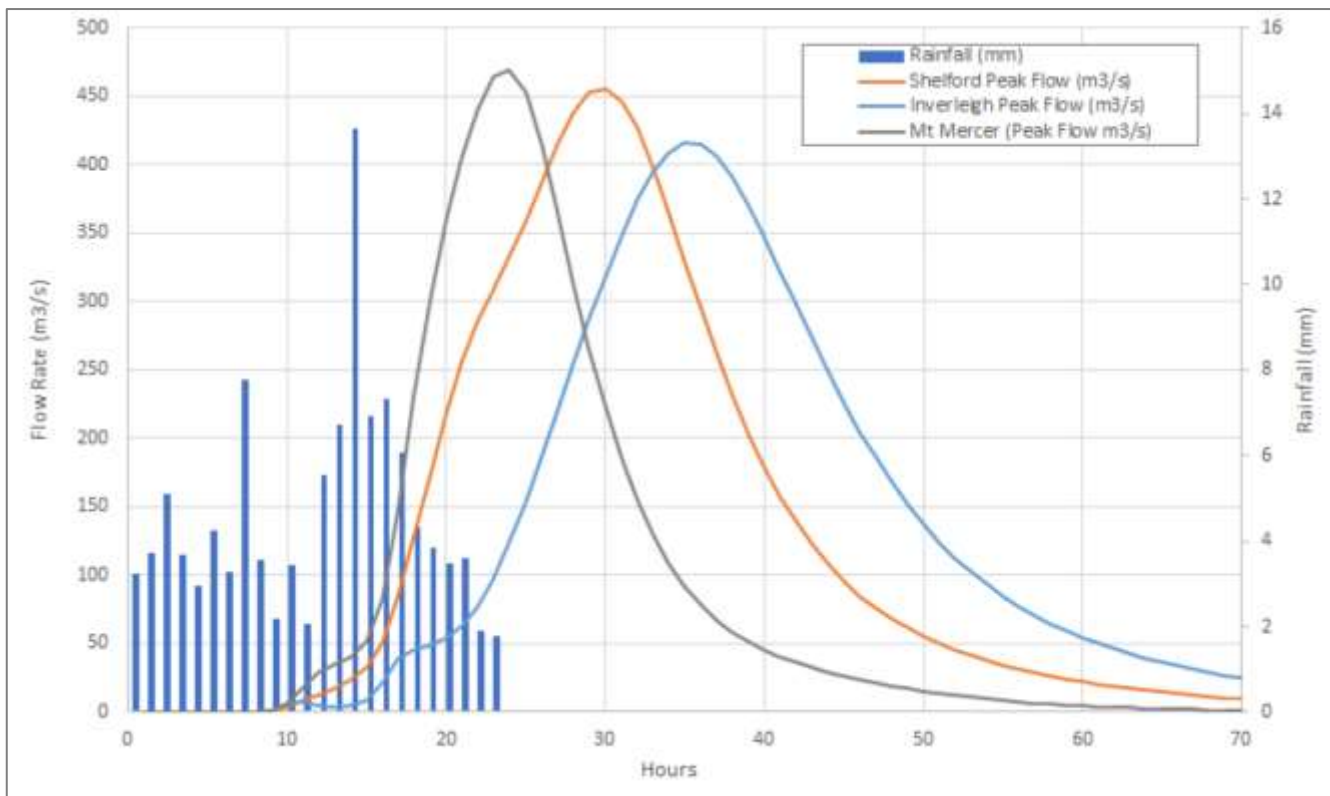


Figure 20. Peak flows in the Leigh River during a 100 year design flood event (Water Technology 2018).

A gauge board has been installed along the Leigh River at Inverleigh, on the upstream (northern) side of the Hamilton Highway. Refer to the map below. This gauge board can be used to undertake flood observations during flood events. Regularly measuring the flood level at this gauge board can be used to track the flood peak along the Leigh River and determine the flood magnitude in Inverleigh. Refer to the Inverleigh Flood Intelligence Card (Leigh River) for the relationship between the gauge board height and flood magnitude.

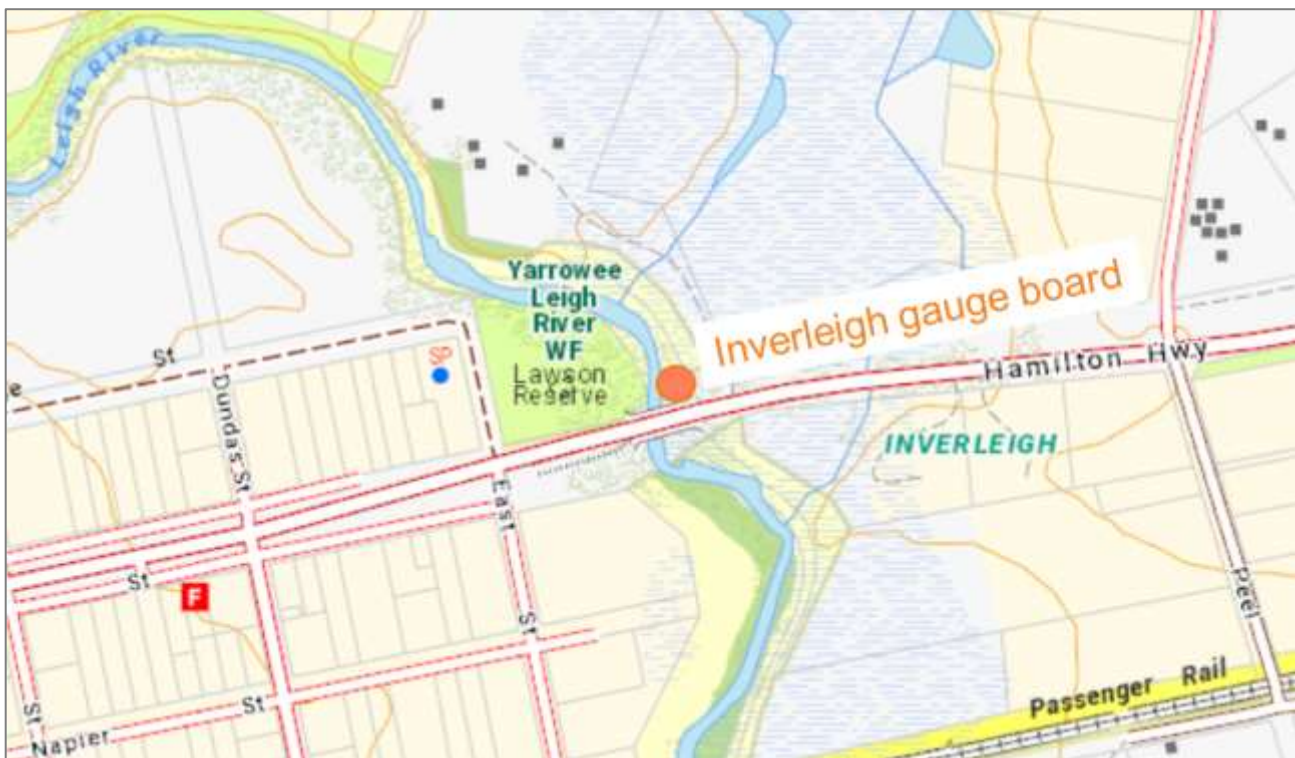


Figure 21. Inverleigh gauge board location.

## Barwon River Warning Time

There are four gauges along the Barwon River upstream of Inverleigh that provide early flood warning, these include Ricketts Marsh, Kildean, Winchelsea and Inverleigh gauges. Refer to the map below.

The travel time of historic flood events can be used to provide an indication of expected travel time, refer to the table and graph below.



Figure 22. Barwon River stream gauges upstream of Inverleigh.

The Ricketts Marsh stream gauge provides early warning of flooding on the Barwon River. Streamflow rises at Ricketts Marsh can occur between 18-30 hours after the start of heavy rainfall. Rises in streamflow can occur in Inverleigh between 2.5 to 3 days after rainfall. This is largely dependent on the duration of the storm and antecedent conditions of the catchment (saturation). Refer to the table below for flood peak travel times between upstream gauges and Inverleigh. It is important to note that larger floods travel time will be shorter. During the large flood event in 1995, the travel time between Ricketts Marsh and Inverleigh was 18 hours, refer to the graph below.

Table 10. Summary of Barwon River flood peak travel times.

Flood event	Distance to Inverleigh (km)	Travel time (hours)
Barwon River at Ricketts Marsh	45	16-20
Barwon River at Kildean	35	12-16
Barwon River at Winchelsea	25	8-12
Barwon River at Inverleigh	10	3-5

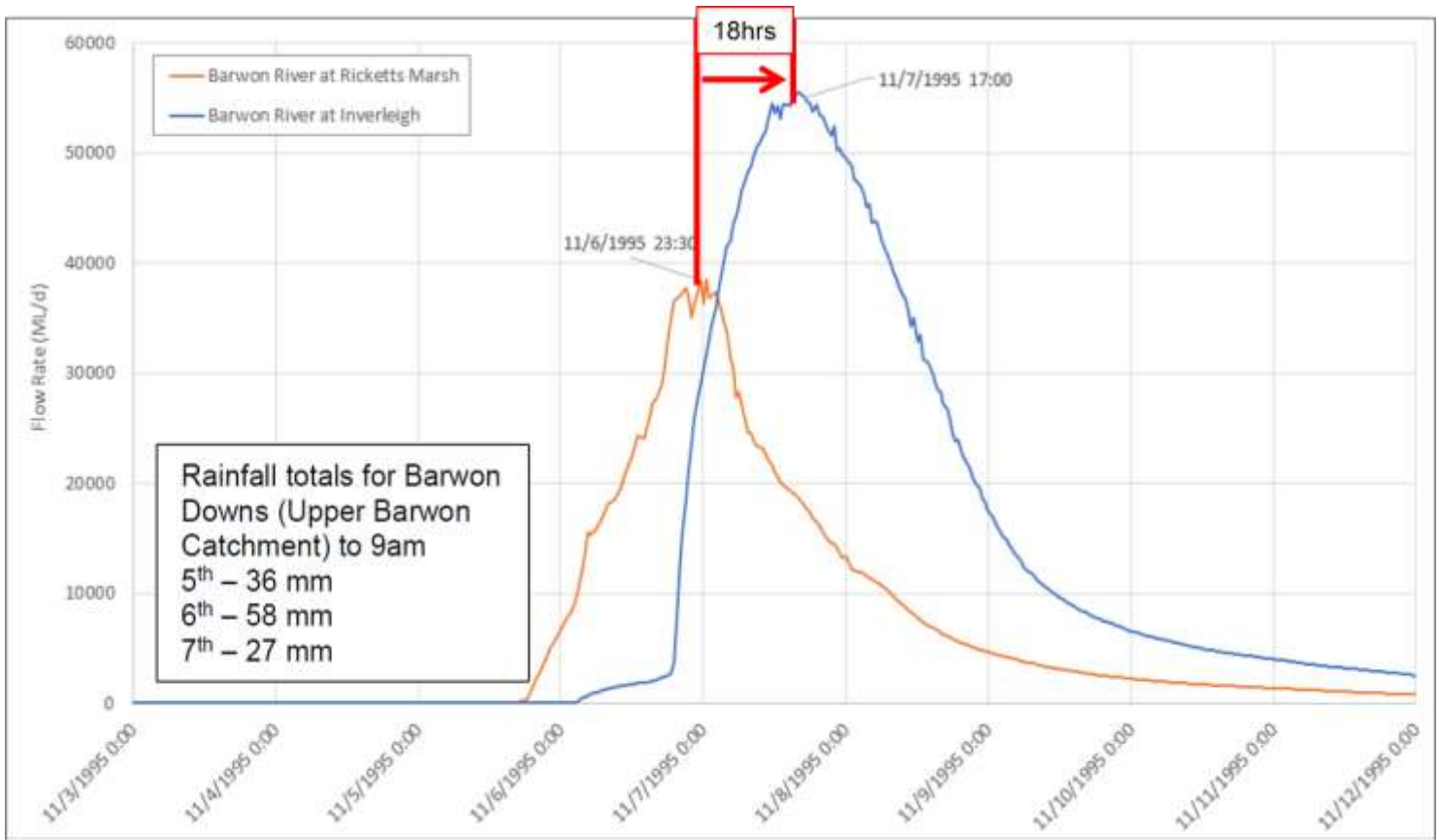


Figure 23. Barwon River flows during the 1995 flood event (Water Technology 2018).

## Flood Impacts and Actions Required

Key assets at risk of flooding in Inverleigh from a Leigh River dominant flood are listed in the table below.

Table 11. Key assets at risk of flooding (Leigh River dominant).

Asset register				
Asset Name and location	Average Recurrence Interval (ARI)	Consequence / Impact	Mitigation/ Action	Lead Agency
Dawber Road, west of Inverleigh.	20 year flood	Flooding may cut access to Dawber Road during a 20 year flood event, depth 0.29m.	Deploy road closure signs as needed.	Council
Hamilton Highway, west of Inverleigh adjacent to Dawber Road.	50 year flood	Flooding may cut access to the Hamilton Highway during a 50 year flood event, depth 0.50m.	Deploy road closure signs and undertake traffic management as needed.	Regional Roads Victoria
Cambridge Street, Inverleigh.	50 year flood	Flooding may cut access to the Cambridge Street during a 50 year flood event, depth 0.43m.	Evacuate all Cambridge Street buildings that have access cut.	Victoria Police
High Street, Inverleigh.	50 year flood	Flooding may impact High Street in a 50 year flood, depth 0.12m. Access may be cut in a 100 year flood event, flood depth 0.37m.	Evacuate all buildings within Inverleigh along High Street, Napier Street, Dundas Street, and others where access may be cut to buildings during a 100 year flood event.	Victoria Police
Inverleigh Railway Line	100 year flood	The Inverleigh Railway Line starts to be impacted during a 100 year flood event, depth 0.16m. Flooding is very deep in a 200 year flood, depth 0.54m	Request VLINE to close the Inverleigh Railway Line during a 100 year flood event.	VLINE
Inverleigh-Winchelsea Road, south of Inverleigh.	100 year flood	Flooding overtops the Inverleigh-Winchelsea Road in a 100 year flood, depth 0.16m. Access is cut in a 200 year flood, depth 0.88m.	Close the Inverleigh-Winchelsea Road during a 100 year flood event due to potential risk to life when flood levels rise.	Regional Roads Victoria
x5 buildings are flooded over floor in High Street and Cambridge Street, Inverleigh.	100 year flood	X5 buildings are flooded over floor in High Street and Cambridge Street. Refer to building damages map below for the locations.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
Inverleigh Primary School, 54 High Street, Inverleigh.	100 year flood	Flooding starts to impact the Inverleigh Primary School grounds during a 100 year flood event. Buildings start to be flooded over floor during a 200 year flood.	Notify the School of flooding impacting their school grounds.	VICSES
Inverleigh Presbyterian Church (48 High Street) and St Pauls Church (38 High Street), Inverleigh.	100 year flood	Flooding starts to impact the Inverleigh Presbyterian Church and St Pauls Church during a 100 year flood event. Buildings are flooded over floor during a 500 year flood.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
Inverleigh General Store and Post Office, 12 High Street, Inverleigh.	100 year flood	Flooding starts to impact the Inverleigh General Store and Post Office during a 100 year flood event. Building is flooded over floor during a 500 year flood.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Inverleigh Hotel, 1 High Street, Inverleigh.	100 year flood	Flooding starts to impact the Inverleigh Hotel during a 100 year flood event. Building is flooded over floor during a 200 year flood.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Inverleigh Petrol Station 19 High Street, Inverleigh.	100 year flood	Flooding starts to impact the Inverleigh Petrol Station during a 100 year flood event. Building is flooded over floor during a 200 year flood.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police



Inverleigh Kindergarten, 23 Mercer Street, Inverleigh.	100 year flood	Flooding starts to impact the Inverleigh Kindergarten grounds during a 100 year flood event. Buildings start to be flooded over floor during a 500 year flood.	Notify the Inverleigh Kindergarten of flooding impacting their grounds.	VICSES
Inverleigh Police Station, 90 High Street, Inverleigh.	100 year flood	Flooding starts to impact the Inverleigh Police Station during a 100 year flood event. Building is flooded over floor during a 1000 year flood.	Notify the Police of flooding impacting their Station.	VICSES
Inverleigh CFA Station, 27 High Street, Inverleigh.	100 year flood	Flooding starts to impact the Inverleigh CFA Station during a 100 year flood event. Building is flooded over floor during a 500 year flood.	Notify the Inverleigh CFA Station of flooding impact.	VICSES
Inverleigh RSL, 63 High Street, Inverleigh.	100 year flood	Flooding starts to impact the Inverleigh RSL during a 100 year flood event. Building is flooded over floor during a 200 year flood.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Inverleigh Recreation Reserve, Inverleigh.	100 year flood	Flooding starts to impact the Inverleigh Recreation Reserve ovals during a 100 year flood event. Building is flooded over floor during a 500 year flood.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Inverleigh Hall, 71 High Street, Inverleigh.	500 year flood	Flooding starts to impact the Inverleigh Hall during a 500 year flood event. There is no flooding over floor.	None needed	VICSES Victoria Police

Flooding from the Barwon River impacts roads and over floor building damages during larger flood magnitudes compared to flooding from the Leigh River. For example access is cut to the Hamilton Highway by Leigh River flooding during a 50 year event, and by the Barwon River during a 200 year event. Key assets at risk of flooding in Inverleigh from a Barwon River dominant flood are listed in the table below.

Table 12. Key assets at risk of flooding (Barwon River dominant).

<b>Asset register</b>				
<b>Asset Name and location</b>	<b>Average Recurrence Interval (ARI)</b>	<b>Consequence / Impact</b>	<b>Mitigation/ Action</b>	<b>Lead Agency</b>
Inverleigh-Winchelsea Road, south of Inverleigh.	20 year flood	Flooding may overtop the Inverleigh-Winchelsea Road in a 20 year flood, depth 0.15m. Access may be cut in a 50 year flood, depth 0.94m.	Close the Inverleigh-Winchelsea Road during a 20 year flood event due to potential risk to life when flood levels rise.	Regional Roads Victoria
Dawber Road, west of Inverleigh.	50 year flood	Flooding may impact Dawber Road in a 50 year flood, depth 0.10m. Access may be cut in a 100 year flood event, flood depth 0.26m.	Deploy road closure signs as needed.	Council
Hamilton Highway, east and west of the Leigh River, Inverleigh	100 year flood	Flooding may overtop the Hamilton Highway in a 100 year flood, depth 0.10m. Access may be cut in a 200 year flood event, flood depth 0.40m.	Deploy road closure signs and undertake traffic management as needed.	Regional Roads Victoria
Cambridge Street, Inverleigh.	100 year flood	Flooding may overtop Cambridge Street during a 100 year flood, depth 0.15m. Access may be cut in a 200 year flood event, flood depth 0.97m.	Evacuate all Cambridge Street buildings that have access cut.	Victoria Police
A house at 23 Weatherboard Road, on corner of River Road, Inverleigh.	100 year flood	A house at may be flooded over floor at 23 Weatherboard Road during a 100 year flood.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
High Street, Inverleigh.	200 year flood	Flooding may cut access to High Street in a 200 year flood, depth 0.40m.	Evacuate all buildings within Inverleigh along High Street, Napier Street, Dundas Street, and others where access may be cut to buildings during a 200 year flood event.	Victoria Police
X7 buildings are flooded over floor in High Street, Napier Street and Cambridge Street, Inverleigh.	200 year flood	X7 buildings are flooded over floor in High Street, Napier Street and Cambridge Street. Refer to building damages map below for the locations.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police

Inverleigh General Store and Post Office, 12 High Street, Inverleigh.	200 year flood	Flooding starts to impact the Inverleigh General Store and Post Office during a 200 year flood event. Building may be flooded over floor during a 500 year flood.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Inverleigh Hotel, 1 High Street, Inverleigh.	200 year flood	The Inverleigh Hotel may be flooded over floor during a 200 year flood event.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Inverleigh Petrol Station 19 High Street, Inverleigh.	200 year flood	Flooding starts to impact the Inverleigh Petrol Station during a 200 year flood event. Building may be flooded over floor during a 500 year flood.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Inverleigh Kindergarten, 23 Mercer Street, Inverleigh.	200 year flood	Flooding starts to impact the Inverleigh Kindergarten grounds during a 200 year flood event. Buildings start to be flooded over floor during a 500 year flood.	Notify the Inverleigh Kindergarten of flooding impacting their grounds.	VICSES
Inverleigh RSL, 63 High Street, Inverleigh.	200 year flood	Flooding starts to impact the Inverleigh RSL during a 200 year flood event. Building may be flooded over floor during a 500 year flood.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Inverleigh CFA Station, 27 High Street, Inverleigh.	500 year flood	The Inverleigh CFA Station may be flooded over floor during a 500 year flood event.	Notify the Inverleigh CFA Station of flooding impact.	VICSES
Inverleigh Railway Line	500 year flood	Flooding may significantly impact the Inverleigh Railway Line in a 500 year flood, depth 0.85m	Request VLINE to close the Inverleigh Railway Line during a 100 year flood event.	VLINE
Inverleigh Recreation Reserve, Inverleigh.	500 year flood	The Recreation Reserve Clubroom may be flooded over floor during a 1000 year flood event.	Sandbag building and undertake evacuations as needed.	VICSES Victoria Police
Inverleigh Primary School, 54 High Street, Inverleigh.	500 year flood	Buildings at the Inverleigh Primary School are flooded over floor during a 500 year flood event.	Notify the School of flooding impacting their school grounds.	VICSES
Inverleigh Presbyterian Church (48 High Street) and St Pauls Church (38 High Street), Inverleigh.	500 year flood	Buildings at the Inverleigh Presbyterian Church and St Pauls Church may be flooded over floor during a 500 year flood.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
Inverleigh Police Station, 90 High Street, Inverleigh.	1000 year flood	The Inverleigh Police Station may be flooded over floor during a 1000 year flood event.	Notify the Police of flooding impacting their Station.	VICSES
Inverleigh Hall, 71 High Street, Inverleigh.	1000 year flood	The Inverleigh Hall may be flooded over floor during a 1000 year flood event.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police

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





Figure 24. Inverleigh assets impacted by flooding over the 500 year flood extent (Leigh River dominant flood).



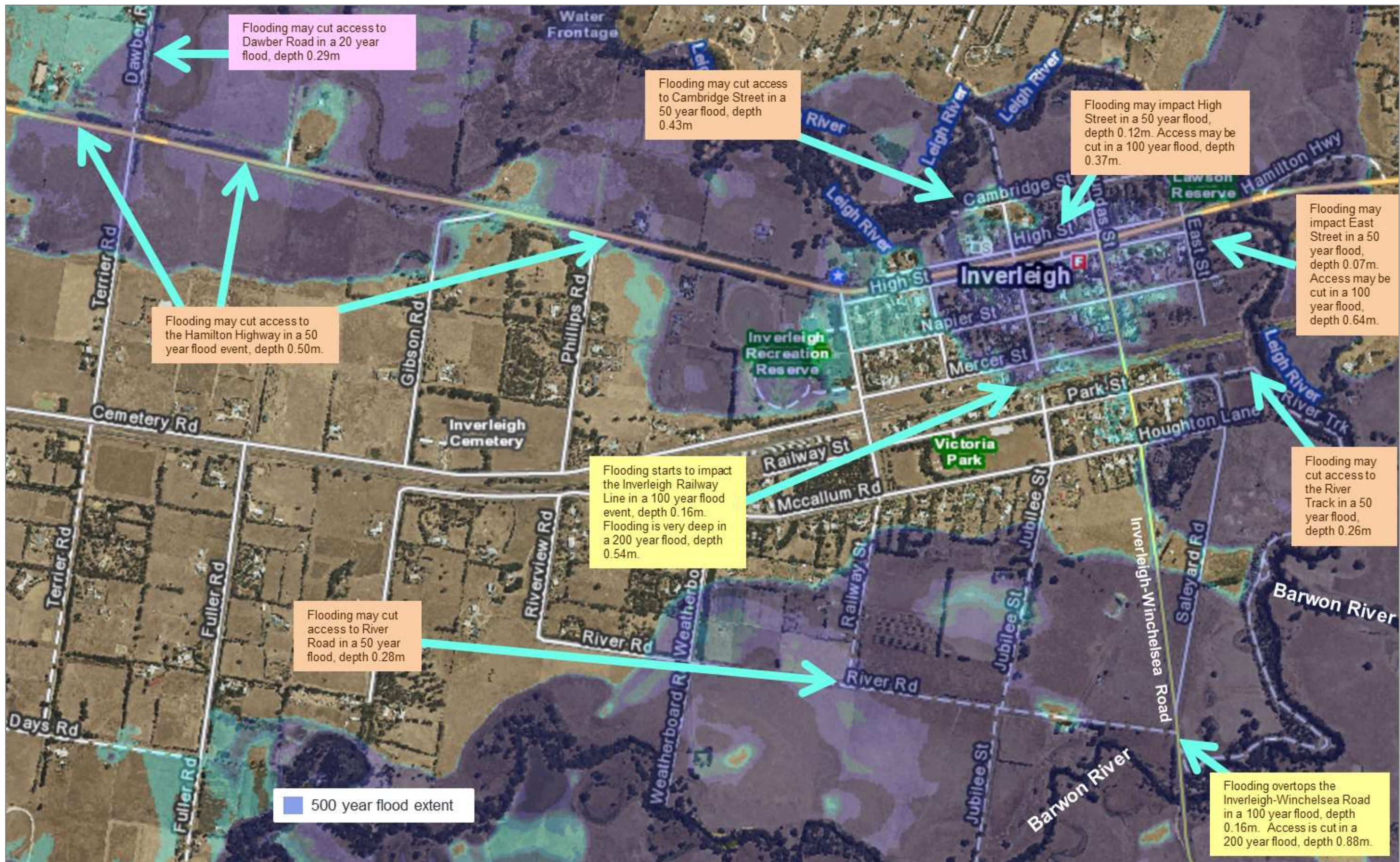


Figure 25. Inverleigh roads impacted by flooding with the 500 year flood extent (Leigh River dominant flood).



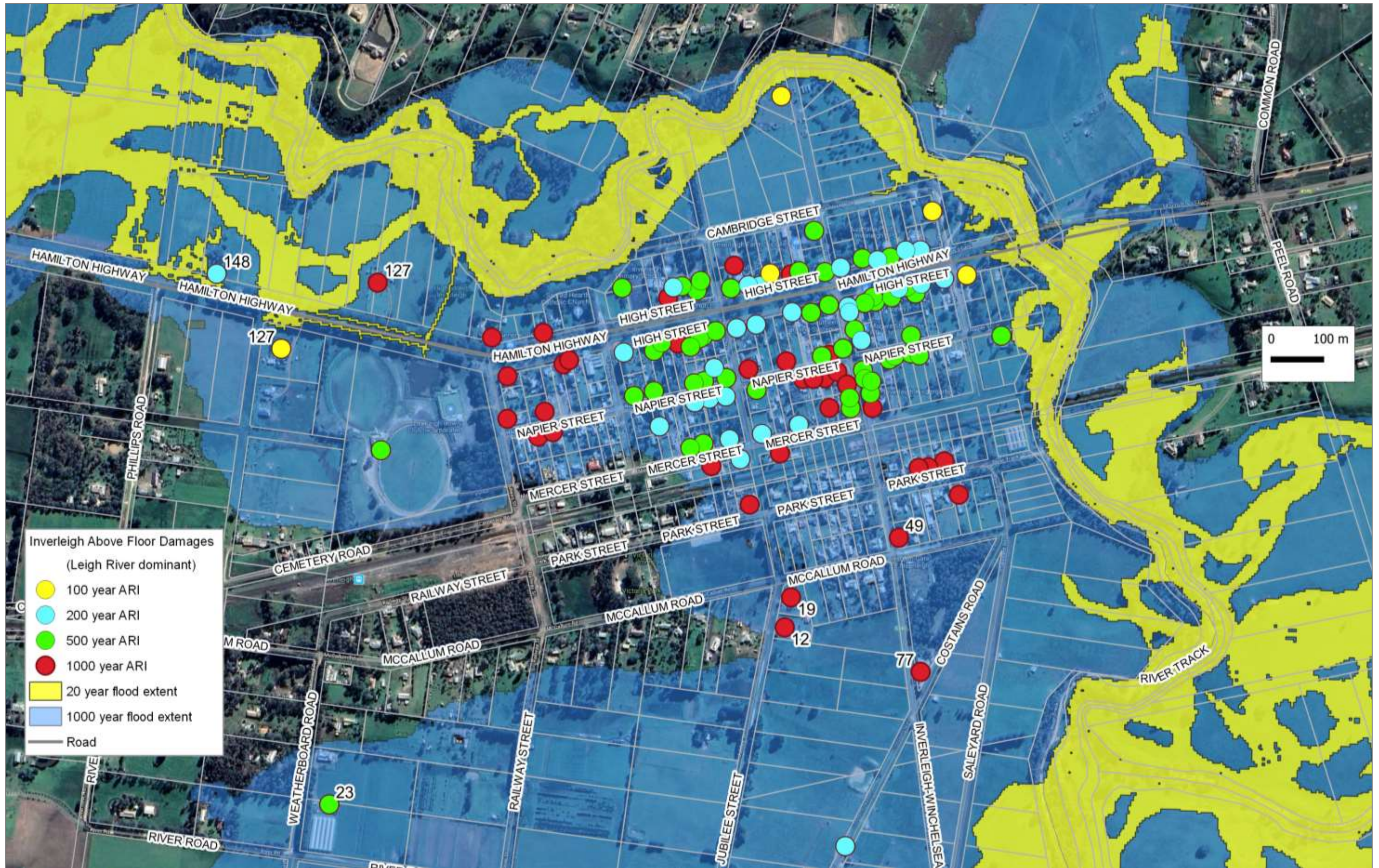


Figure 26. Inverleigh above floor damages over a range of design flood events for a Leigh River dominant flood (Water Technology 2018).





Figure 27. Inverleigh above floor damages over a range of design flood events for a Leigh River dominant flood (Water Technology 2018).



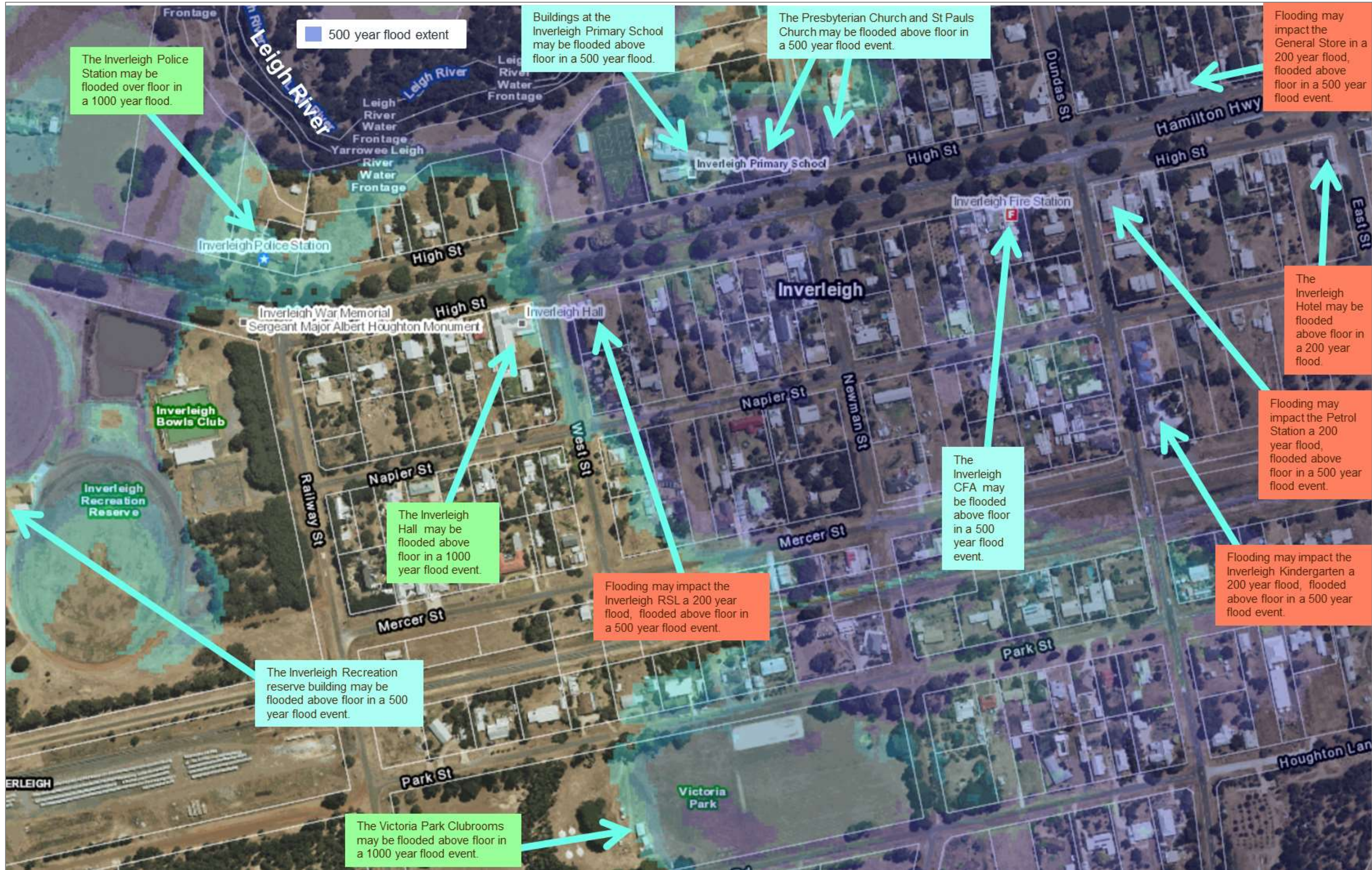


Figure 28. Inverleigh assets impacted by flooding over the 500 year flood extent (Barwon River dominant flood).



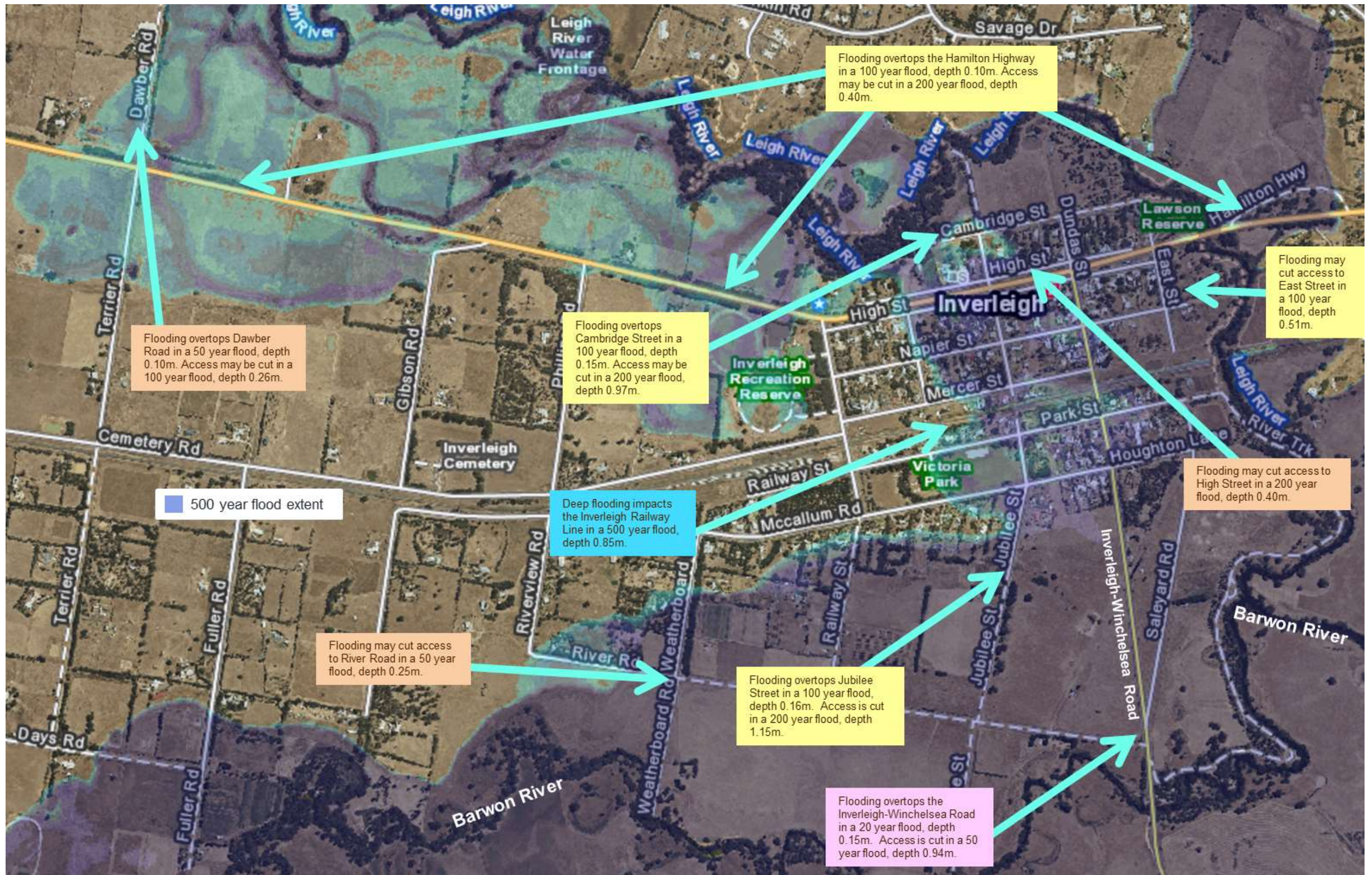


Figure 29. Inverleigh roads impacted by flooding with the 500 year flood extent (Barwon River dominant flood).









Figure 31. Inverleigh above floor damages over a range of design flood events for a Barwon River dominant flood (Water Technology 2018).



**Table 13. Inverleigh Flood Intelligence Card (Leigh River)**

Flood travel time						Time between rainfall and steep rise in flood levels at Mount Mercer 4 - 6 hours			
						Time between rainfall and flood peak at Mount Mercer 12 - 18 hours			
						Time between Mount Mercer and Shelford peak 6 - 10 hours			
						Time between Mount Mercer and Inverleigh peak 10 - 18 hours			
						Riverine flooding duration: 2 days			
Leigh River at Mount Mercer gauge height 233215 (m)	Leigh River at Shelford gauge height 233213 (m)	Leigh River at Inverleigh gauge board height (m)	Average Recurrence Interval (ARI)	Leigh River at Shelford Design Flows (ML/d)	Inverleigh damages total number properties flooded (above floor)	Consequence / Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action
	2.00	1.60	2	~2,600	83 (0)	Most floodwater is in channel, only minor flooding breaking out.		Dawber Road depth 0m Cambridge Street depth 0m Hamilton Hwy depth 0m High Street depth 0m East Street depth 0m River Track depth 0m River Road depth 0m Railway Line depth 0m	VICSES activate ground observers to take photos and record flood levels at key crossings.
	5.53	3.00	5	~6,000	90 (0)	Most floodwater is in channel, only minor flooding breaking out. Teesdale – Inverleigh Road overtopped (depth below 0.3 m)		Dawber Road depth 0m Cambridge Street depth 0m Hamilton Hwy depth 0m High Street depth 0m East Street depth 0m River Track depth 0m River Road depth 0m Railway Line depth 0m	Refer to actions listed above.
	5.70		April 2001						
2.00	6.00	3.30	Minor flood level	7,800					
	6.64	3.92	10	~11,000	97 (0)	Most floodwater is in channel, only minor flooding breaking out. Hamilton Hwy culverts west of town begin to flow (potential erosion at old Hwy alignment). Teesdale – Inverleigh Road inundated (depth above 0.3 m). Park and River reserve between township and confluence begin to inundate.		Dawber Road depth 0m Cambridge Street depth 0m Hamilton Hwy depth 0m High Street depth 0m East Street depth 0m River Track depth 0m River Road depth 0m Railway Line depth 0m	Council clear debris from waterway crossings, drains and culverts as needed.
3.00	7.00	4.30	Moderate flood level	12,500					
	7.35		November 1995			This was a major flood in in the Barwon River, Warrambine Creek was also high. Given the Leigh River was low, Inverleigh wasn't significantly impacted.			
	7.63	4.62	20	~17,000	110 (0)	Federation Bridge inaccessible. Dawber Road overtopped (depth below 0.3 m). Burkes Road overtopped (depth below 0.3 m). Shallow flooding inundates the Hamilton Highway to the east and west of Inverleigh.		Dawber Road depth 0.29m Cambridge Street depth 0m Hamilton Hwy depth 0m High Street depth 0m East Street depth 0m River Track depth 0m River Road depth 0m Railway Line depth 0m	Council and Regional Roads Victoria to deploy road closure signs and undertake traffic management as needed.
4.00	8.00	4.76	Major flood level	18,500					
	8.31	5.53	50	~28,000	158 (0)	Access is cut to the Hamilton Highway, west of Inverleigh (adjacent to Dawber Road). Levee located beside the tennis courts and Inverleigh Primary School overtopped. There are significant flooding along Cambridge Street and High Street. The Inverleigh		Dawber Road depth 0.53m Cambridge Street depth 0.43m Hamilton Hwy depth 0.50m High Street depth 0.12m East Street depth 0.07m	Regional Roads Victoria to deploy road closure signs and undertake traffic management for the Hamilton Highway.

						Recreation Reserve northern football oval is inundated. Railway culverts at East Street begin to flow.		River Track depth 0.26m River Road depth 0.28m Railway Line depth 0m	
4.21	8.44	6.00	100	~39,000	247 (5)	5 buildings flooded above floor. Flooding overtops the Inverleigh-Winchelsea Road. Although access is not cut, this road should be closed due to risk to life if flood levels rise. Flooding breaks out of the Leigh River floods over 247 properties. The grounds at the Inverleigh Primary School, Inverleigh Kindergarten, Police Station, CFA Station, Inverleigh Hotel, Petrol Station, General Store, Presbyterian Church, St Pauls Church is impacted by flooding. The Inverleigh Railway Line is impacted by flooding and trains should be stopped.	X5 additional buildings may be flooded above floor: X2 HIGH STREET (34, 127), x2 CAMBRIDGE STREET (1), toilet block (High Street).	Inverleigh-Winchelsea Road overtopped (depth below 0.3 m). Dawber Road depth 0.69m Cambridge Street depth 0.96m Hamilton Hwy depth 1.05m High Street depth 0.37m East Street depth 0.64m River Track depth 0.72m River Road depth 0.58m Railway Line depth 0.16m	VICSES sandbag buildings as needed. Access is cut to a significant number of buildings, Victoria Police evacuate buildings as needed.  Regional Roads Victoria to deploy road closure signs and undertake traffic management for the Inverleigh-Winchelsea Road.
	8.47	6.20	1973	~48,000		The highest recorded level in the Leigh River at Inverleigh. Approximately 50 buildings were flooded above floor along the Hamilton Highway, Napier Street, West Street, Newman Street, Mercer Street, Dundas Street, Cambridge Street and East Street.			Refer to actions listed above.
	8.50	6.40	200	~54,000	273 (33)	Additional 28 buildings flooded above floor including; Inverleigh Primary School (54 High Street), Inverleigh RSL (63 High Street), Inverleigh Hotel (1 High Street) and Inverleigh Petrol Station (19 High Street).	X28 additional buildings may be flooded above floor: X16 HIGH STREET (1, 5, 6, 8, 9A, 14, 19, 20, 33, 36, 38A, 39, 41, 54, 63, 148), x5 NAPIER STREET (30, 38, 40, 47A, 48), X4 MERCER STREET (37, 40, 41, 57), X2 DUNDAS STREET (sheds beside Service Station), COSTAINS ROAD (shed unknown number).	Dawber Road depth 0.85m Cambridge Street depth 1.30m Hamilton Hwy depth 1.43m High Street depth 0.56m East Street depth 1.12m River Track depth 1.16m River Road depth 1.27m Railway Line depth 0.54m	Refer to actions listed above.
	Above rating curve	6.97	500	~80,000	321 (82)	Additional 49 buildings flooded above floor including; Inverleigh Kindergarten (23 Mercer Street), Recreation Reserve building, Inverleigh CFA Station (27 High Street), General Store (12 High Street), Presbyterian Church (48 High Street) and St Pauls Church (38 High Street).	X49 additional buildings may be flooded above floor: x22 HIGH STREET (7, 9, 12, 13, 15A, 15B, 16, 17, 23, 24, 27, 28, 36A, 38B, 45, 47, 48, 49, 51, 54, 55), x18 NAPIER STREET (27, 29, 35, 37, 39, 47, 54, 57, 61, 1/70, 2/70, 2/70, 74, 76, 78, 80, 83, 94), x5 DUNDAS STREET (9, 12, 22, 23, 24), 29 MERCER STREET, 8 CAMPBELL ROAD, 25 CAMBRIDGE STREET, 23 WEATHERBOARD ROAD	Dawber Road depth 1.14m Cambridge Street depth 1.76m Hamilton Hwy depth 1.88m High Street depth 0.95m East Street depth 1.83m River Track depth 1.93m River Road depth 2.11m Railway Line depth 0.96m	Refer to actions listed above.
			1000		356 (117)	Additional 35 buildings flooded above floor including; Inverleigh Police Station is flooded over floor.	X35 additional buildings may be flooded above floor: x10 HIGH STREET (30, 38, 53, 54, 75, 77, 80, 89, 90, 118), x9 NAPIER STREET (6, 7, 8, 49, 55, 58, 60, 62, 63), x5 DUNDAS STREET (16, 20, 23, 49, 77), x5 PARK STREET (43, 77, 79, 81, 82), x3 MERCER STREET (34, 44, 59), 9 JUBILEE STREET, 19 MCCALLUM ROAD, 9 RAILWAY STREET	Dawber Road depth 1.41m Cambridge Street depth 2.11m Hamilton Hwy depth 2.27m High Street depth 1.42m East Street depth 2.75m River Track depth 2.84m River Road depth 3.00m Railway Line depth 1.35m	Refer to actions listed above.



**Table 14. Inverleigh Flood Intelligence Card (Barwon River)**

Flood travel time						Time between rainfall and steep rise in flooding at Inverleigh (town) 2.5 -3 days			
						Time between Ricketts Marsh and Inverleigh (town) peak 16 - 20 hours			
						Time between Winchelsea and Inverleigh (town) peak 8 - 12 hours			
						Riverine flooding duration: 2 days			
Barwon River at Ricketts Marsh gauge height 233224 (m)	Barwon River at Winchelsea gauge height 233201 (m)	Barwon River U/S Inverleigh gauge height 233218 (m)	Average Recurrence Interval (ARI)	Barwon River at Inverleigh Design Flows (ML/d)	Inverleigh damages total number properties flooded (above floor)	Consequence / Impact	Houses/ buildings flooded / isolated	Roads Impacted	Action
	3.80	1.80	January 2011						
		2.55	2	~6,700	89 (0)	Park and River reserve between Winchelsea-Inverleigh Road and confluence begin to inundate.		Dawber Road depth 0m Cambridge Street depth 0m Hamilton Hwy depth 0m High Street depth 0m East Street depth 0m River Track depth 0 m River Road depth 0m Jubilee Street depth 0m Railway Line depth 0m Inverleigh-Winchelsea Road depth 0m	VICSES activate ground observers to take photos and record flood levels at key crossings.
	4.92	3.20	September 2016						
		3.42	5	~13,900	94 (0)	Anabranches along Barwon floodplain (upstream of confluence) begin to flow.		Dawber Road depth 0m Cambridge Street depth 0m Hamilton Hwy depth 0m High Street depth 0m East Street depth 0m River Track depth 0 m River Road depth 0m Jubilee Street depth 0m Railway Line depth 0m Inverleigh-Winchelsea Road depth 0m	
		3.99	10	~21,400	95 (0)	Floodwater backs up against the Inverleigh – Winchelsea Road and River Road Inundated (depth below 0.5 m).		Dawber Road depth 0m Cambridge Street depth 0m Hamilton Hwy depth 0m High Street depth 0m East Street depth 0m River Track depth 0 m River Road depth 0m Jubilee Street depth 0m Railway Line depth 0m Inverleigh-Winchelsea Road depth 0m	
3.00	6.00	4.00	Minor flood level						
		4.21	1970						
6.00	7.20	4.5	Moderate flood level						
		4.57	20	~31,500	100 (0)	Significant flooding on rural properties south of Inverleigh.		Dawber Road depth 0m Cambridge Street depth 0m Hamilton Hwy depth 0m High Street depth 0m East Street depth 0m River Track depth 0 m River Road depth 0m Jubilee Street depth 0m Railway Line depth 0m Inverleigh-Winchelsea Road depth 0m	Council and Regional Roads Victoria to deploy road closure signs and undertake traffic management as needed.
	7.23	5.06	1978						

6.70	7.80	5.10	Major flood level						Council clear debris from waterway crossings, drains and culvers as needed.
6.99		5.18	1976						
		5.38	50	~50,200	144 (1)	Railway culverts at East Street begin to flow (north towards town). Flooding overtops Dawber Road. Access is cut to the Inverleigh-Winchelsea Road. One shed is flooded over floor in Costains Road. Properties between McCallum Road and River Road inundated.	A shed in Costains Road is flooded above floor.	Dawber Road depth 0.10m Cambridge Street depth 0m Hamilton Hwy depth 0m High Street depth 0m East Street depth 0m River Road depth 0.25m Jubilee Street depth 0m Railway Line depth 0m Inverleigh-Winchelsea Road depth 0.44m	VICSES sandbag buildings as needed. Victoria Police evacuate buildings as needed. Regional Roads Victoria to deploy road closure signs and undertake traffic management for the Inverleigh-Winchelsea Road.
		5.59	1995	~55,600		Inverleigh township cut (Hamilton Highway & Inverleigh – Winchelsea Road).			
		6.04	100	~69,900	164 (2)	One additional building is flooded above floor on the corner of River Road and Weatherboard Road. Minor flooding along Cambridge Street. Shallow flooding overtops the Hamilton Highway west of the Leigh River. Access is cut to Dawber Road and River Road.	One additional building may be flooded above floor: 23 WEATHERBOARD ROAD	Dawber Road depth 0.26m Cambridge Street depth 0.15m Hamilton Hwy depth 0.10m High Street depth 0m East Street depth 0.51m River Road depth 0.46m Jubilee Street depth 0.16m Railway Line depth 0m Inverleigh-Winchelsea Road depth 1.2m	Refer to actions listed above.
			200	~95,900	231 (9)	X7 additional buildings are flooded above floor. Flooding between Houghton Lane and Park Street. Extensive flood damage through the Inverleigh township. Access is cut to the Hamilton Highway east and west of the Leigh River bridge. Access is cut to Cambridge Street, High Street and Jubilee Street.	x7 additional buildings may be flooded above floor: Public Toilet, x3 HIGH STREET (1, 6, 8), x2 CAMBRIDGE STREET (1 and unknown number), 94 NAPIER STREET	Dawber Road depth 0.41m Cambridge Street depth 0.97m Hamilton Hwy depth 0.26m High Street depth 0.40m East Street depth 1.45m River Road depth 1.25m Jubilee Street depth 1.15m Railway Line depth 0m Inverleigh-Winchelsea Road depth 2.2m	Access is cut to a significant number of buildings, Victoria Police evacuate buildings as needed. Regional Roads Victoria to deploy road closure signs and undertake traffic management for the Hamilton Hwy.
			500	~143,200	324 (133)	X124 additional buildings are flooded above floor. Extensive flooding along Park Street. Railway line overtopped.	x124 additional buildings may be flooded above floor: x38 HIGH STREET (5, 7, 9, 9A, 12, 13, 14, 15A, 15B, 16, 17, 19, 20, 23, 24, 27, 28, 30, 33, 34, 36, 36A, 38, 38B, 39, 41, 45, 47, 48, 49, 54, 55, 57, 63, 127), x26 NAPIER STREET (27, 29, 30, 37, 38, 39, 40, 47, 47A, 48, 49, 54, 55, 58, 60, 61, 62, 63, 1/70, 2/70, 3/70, 74, 76, 78, 80, 83), x23 PARK STREET (29, 43, 49, 50, 52, 53, 54, 56, 57, 58, 60, 62, 65, 66, 70, 73, 74, 76, 77, 78, 79, 81, 82), x16 MCCALLUM ROAD (3, 6, 7, 8, 9, 11, 19, 29, 34, 35, 37, 40, 41, 44, 57, 59), x13 DUNDAS STREET (9, 12, 16, 20, 22, 23, 24, 49, 50, 77), X2 RIVER ROAD (5, 29) 76 Railway St, 104 FULLER ROAD, 25 CAMBRIDGE STREET, 37 RAWSON ROAD, 9 JUBILEE STREET, 20 WEATHERBOARD ROAD	Dawber Road depth 0.48m Cambridge Street depth 2.25m Hamilton Hwy depth 1.65m High Street depth 1.71m East Street depth 2.92m River Road depth 2.58m Jubilee Street depth 2.49m Railway Line depth 0.85m Inverleigh-Winchelsea Road depth 3.61m	Refer to actions listed above.
			1000		371 (174)	X41 additional buildings are flooded above floor.	x41 additional buildings may be flooded above floor: x15 HIGH STREET (29, 38, 53, 54, 70, 71, 75, 76, 77, 80, 85, 89, 90, 118, 148), x7 MCCALLUM ROAD (10, 14, 37, 39, 45, 73, 81), x6 NAPIER STREET (6, 7, 8, 18, 20, 24), x5 PARK STREET (27, 31, 59, 61, 75), x3 RAILWAY (9, 20), x2 WEST STREET (6, 10), 9 MERCER STREET, 8 CAMPBELL ROAD, 12 JUBILEE STREET	Dawber Road depth 0.69m Cambridge Street depth 3.58m Hamilton Hwy depth 3m High Street depth 3.07m East Street depth 4.22m River Road depth 3.86m Jubilee Street depth 3.84m Railway Line depth 2.21m Inverleigh-Winchelsea Road depth 5.02m	Refer to actions listed above.

**Table 15. Inverleigh (Leigh River dominant) Property Inundation Table (Water Technology 2017).**

No	Address	Depth of building over floor flooding for each ARI event (m)				Building type		
		100	200	500	1000			
1	34 HIGH STREET INVERLEIGH 3321	0.22	0.56	1.01	1.43	Residence	Weatherboard	Stumps
2	CAMBRIDGE STREET INVERLEIGH 3321	0.20	0.55	1.01	1.44	Residence Nth of Dundas intersection	Weatherboard	Stumps
3	127 HIGH STREET INVERLEIGH 3321	0.18	0.56	1.02	1.37	Residence	Weatherboard	Stumps
4	1 CAMBRIDGE STREET INVERLEIGH 3321	0.06	0.43	0.94	1.51	Residence	Bluestone	Slab
5	Public Toilet – I HIGH STREET	0.05	0.45	1.07	1.83	Toilet	Conc	Slab
6	Costains ROAD INVERLEIGH 3321		0.80	1.76	2.79	Shed	Gal iron	No floor
7	38 NAPIER STREET INVERLEIGH 3321		0.37	0.82	1.23	Residence	Brick	Slab
8	39 HIGH STREET INVERLEIGH 3321		0.35	0.79	1.21	Residence	Weatherboard	Stumps
9	57 MERCER STREET INVERLEIGH 3321		0.32	0.75	1.14	Residence	Brick	Stumps
10	41 MERCER STREET INVERLEIGH 3321		0.32	0.76	1.14	Residence	Brick	Slab
11	40 MERCER STREET INVERLEIGH 3321		0.30	0.74	1.13	Residence	Weatherboard	Slab
12	36 HIGH STREET INVERLEIGH 3321		0.30	0.74	1.16	Residence	Weatherboard	Stumps
13	40 NAPIER STREET INVERLEIGH 3321		0.29	0.74	1.15	Residence	Weatherboard	Stumps
14	47A NAPIER STREET INVERLEIGH 3321		0.25	0.70	1.12	Shed	Gal iron	Slab
15	6 HIGH STREET INVERLEIGH 3321		0.25	0.72	1.30	Residence	Weatherboard	Stumps
16	8 HIGH STREET INVERLEIGH 3321		0.25	0.71	1.27	Inverleigh Home Living	Weatherboard	Slab
17	DUNDAS STREET INVERLEIGH 3321		0.23	0.65	1.15	Shed	Gal iron	Slab
18	1 HIGH STREET INVERLEIGH 3321		0.20	0.76	1.46	Hotel	Stone	Slab
19	DUNDAS STREET INVERLEIGH 3321		0.16	0.61	1.08	Shed	Brick	Slab
20	148 HIGH STREET INVERLEIGH 3321		0.15	0.57	0.92	Residence	Weatherboard	Stumps
21	33 HIGH STREET INVERLEIGH 3321		0.14	0.57	0.98	Residence	Alum cladding	Stumps
22	20 HIGH STREET INVERLEIGH 3321		0.13	0.57	1.03	Residence	Plastic cladding	Stumps
23	41 HIGH STREET INVERLEIGH 3321		0.11	0.56	0.98	Residence	Weatherboard	Stumps
24	19 HIGH STREET INVERLEIGH 3321		0.10	0.55	1.03	Inverleigh petrol station	Brick	Slab
25	63 HIGH STREET INVERLEIGH 3321		0.08	0.55	0.97	Returned Service League	Weatherboard	Stumps
26	14 HIGH STREET INVERLEIGH 3321		0.08	0.54	1.05	Gladioli Restaurant	Weatherboard	Slab
27	30 NAPIER STREET INVERLEIGH 3321		0.08	0.53	0.95	Residence	Brick	Slab
28	48 NAPIER STREET INVERLEIGH 3321		0.07	0.52	0.92	Residence	Weatherboard	Stumps
29	54 HIGH STREET INVERLEIGH 3321		0.07	0.40	0.76	School	Hardy Plank	Stumps
30	38A HIGH STREET INVERLEIGH 3321		0.05	0.50	0.92	St Pauls Shop	Weatherboard	Stumps
31	5 HIGH STREET INVERLEIGH 3321		0.04	0.51	1.12	Inverleigh Bakehouse	Brick	Stumps
32	37 MERCER STREET INVERLEIGH 3321		0.02	0.46	0.86	Residence	Weatherboard	Stumps
33	9A HIGH STREET INVERLEIGH 3321		0.00	0.46	1.01	Residence	Weatherboard	Stumps
34	94 NAPIER STREET INVERLEIGH 3321			0.62	1.47	Residence	Weatherboard	Stumps
35	8 CAMPBELL ROAD INVERLEIGH 3321			0.46	0.82	Residence	Brick	Stumps
36	36A HIGH STREET INVERLEIGH 3321			0.45	0.88	Church Sunday School	Bluestone	Slab

No	Address	Depth of building over floor flooding for each ARI event (m)				Building type		
		100	200	500	1000			
37	12 HIGH STREET INVERLEIGH 3321			0.45	0.98	Inverleigh Store	Concrete Render	Slab
38	23 HIGH STREET INVERLEIGH 3321			0.45	0.90	Geelong Landcare Network	Weatherboard	Slab
39	29 MERCER STREET INVERLEIGH 3321			0.43	0.83	Residence	Brick	Slab
40	13 HIGH STREET INVERLEIGH 3321			0.42	0.97	Residence	Cement Sheet	Stumps
41	25 CAMBRIDGE STREET INVERLEIGH 3321			0.42	0.86	Residence	Weatherboard	Stumps
42	23 WEATHERBOARD ROAD INVERLEIGH 3321			0.39	1.41	Shed	Gal iron	Slab
43	48 HIGH STREET INVERLEIGH 3321			0.39	0.76	Tennis Club	Brick	Slab
44	29 NAPIER STREET INVERLEIGH 3321			0.37	0.79	Residence	Weatherboard	Stumps
45	36A HIGH STREET INVERLEIGH 3321			0.37	0.79	Church Sunday School	Bluestone	Slab
46	17 HIGH STREET INVERLEIGH 3321			0.34	0.84	Residence	Weatherboard	Stumps
47	15A HIGH STREET INVERLEIGH 3321			0.34	0.86	Residence	Weatherboard	Stumps
48	47 NAPIER STREET INVERLEIGH 3321			0.33	0.74	Residence	Brick	Slab
49	38B HIGH STREET INVERLEIGH 3321			0.31	0.73	St Pauls Church	Conc block	Slab
50	54 HIGH STREET INVERLEIGH 3321 - School			0.29	0.70	School	Stone block	Slab
51	27 NAPIER STREET INVERLEIGH 3321			0.29	0.72	Residence	Brick	Stumps
52	37 NAPIER STREET INVERLEIGH 3321			0.27	0.69	Residence	Weatherboard	Stumps
53	35 MERCER STREET INVERLEIGH 3321			0.27	0.67	Residence	Brick	Slab
54	24 DUNDAS STREET INVERLEIGH 3321			0.26	0.66	Residence	Brick	Slab
55	9 HIGH STREET INVERLEIGH 3321			0.24	0.81	Residence	Bluestone	Slab
56	39 NAPIER STREET INVERLEIGH 3321			0.24	0.65	Residence	Weatherboard	Stumps
57	16 HIGH STREET INVERLEIGH 3321			0.23	0.71	Residence	Brick	Stumps
58	1/70 NAPIER STREET INVERLEIGH 3321			0.21	0.68	Residence	Brick	Slab
59	54 NAPIER STREET INVERLEIGH 3321			0.21	0.61	Residence	Hardy plank	Stumps
60	76 NAPIER STREET INVERLEIGH 3321			0.21	0.78	Residence	Weatherboard	Slab
61	47 HIGH STREET INVERLEIGH 3321			0.21	0.63	Residence	Brick	Slab
62	7 HIGH STREET INVERLEIGH 3321			0.20	0.79	Telstra	Cement render	Slab
63	2/70 NAPIER STREET INVERLEIGH 3321			0.19	0.65	Residence	Brick	Slab
64	57 HIGH STREET INVERLEIGH 3321			0.19	0.60	Residence	Weatherboard	Stumps
65	83 NAPIER STREET INVERLEIGH 3321			0.19	0.84	Residence	Weatherboard	Stumps
66	80 NAPIER STREET INVERLEIGH 3321			0.17	0.90	Shed	Iron shed	Slab
67	74 NAPIER STREET INVERLEIGH 3321			0.17	0.74	Residence	Brick	Slab
68	23 DUNDAS STREET INVERLEIGH 3321			0.17	0.66	Inverleigh Early Learning	Brick	Slab
69	24 HIGH STREET INVERLEIGH 3321			0.16	0.61	Residence	Hardy plank	Stumps
70	22 DUNDAS STREET INVERLEIGH 3321			0.15	0.56	Residence	Weatherboard	Slab
71	27 HIGH STREET INVERLEIGH 3321			0.14	0.58	CFA	Iron shed	Slab
72	61 NAPIER STREET INVERLEIGH 3321			0.13	0.54	Residence	Stone	Slab
73	45 HIGH STREET INVERLEIGH 3321			0.11	0.53	Residence	Hardy plank	Stumps
74	49 HIGH STREET INVERLEIGH 3321			0.09	0.51	Residence	Brick	Stumps
75	28 HIGH STREET INVERLEIGH 3321			0.09	0.51	Inverleigh Farm	Cement Sheet	Stumps

No	Address	Depth of building over floor flooding for each ARI event (m)				Building type		
		100	200	500	1000			
						Supplies		
76	78 NAPIER STREET INVERLEIGH 3321			0.08	0.73	Residence	Weatherboard	Slab
77	3/70 NAPIER STREET INVERLEIGH 3321			0.07	0.58	Residence	Brick	Slab
78	51 HIGH STREET INVERLEIGH 3321			0.06	0.48	Residence	Brick blocks	Stumps
79	55 HIGH STREET INVERLEIGH 3321			0.06	0.46	Residence	Brick	Stumps
80	15B HIGH STREET INVERLEIGH 3321			0.04	0.54	Sonny Café	Weatherboard	Stumps
81	12 DUNDAS STREET INVERLEIGH 3321			0.00	0.48	Residence	Cement render	Slab
82	9 DUNDAS STREET INVERLEIGH 3321			0.00	0.49	Residence	Weatherboard	Stumps
83	90 HIGH STREET INVERLEIGH 3321				0.21	Police Station	Brick	Stumps
84	118 HIGH STREET INVERLEIGH 3321				0.28	Residence	Brick	Slab
85	59 MERCER STREET INVERLEIGH 3321				0.18	Residence	Hardy plank	Stumps
86	30 HIGH STREET INVERLEIGH 3321				0.28	Residence	Cedar	Stumps
87	49 NAPIER STREET INVERLEIGH 3321				0.24	Residence	Hardy plank	Stumps
88	82 PARK STREET INVERLEIGH 3321				0.62	Residence	Corrugated Iron	Stumps
89	81 PARK STREET INVERLEIGH 3321				0.67	Residence	Weatherboard	Stumps
90	77 DUNDAS STREET INVERLEIGH 3321				0.37	Residence	Concrete Render	Slab
91	9 JUBILEE STREET INVERLEIGH 3321				0.05	Residence	Brick	Slab
92	49 DUNDAS STREET INVERLEIGH 3321				0.03	Residence	Weatherboard	Stumps
93	79 PARK STREET INVERLEIGH 3321				0.09	Residence	Weatherboard	Stumps
94	23 DUNDAS STREET INVERLEIGH 3321				0.42	Inverleigh Early Learning	Hardy plank	Stumps
95	43 PARK STREET INVERLEIGH 3321				0.30	Residence	Brick	Slab
96	77 PARK STREET INVERLEIGH 3321				0.09	Residence	Brick	Slab
97	19 MCCALLUM ROAD INVERLEIGH 3321				0.01	Residence	Brick	Slab
98	20 DUNDAS STREET INVERLEIGH 3321				0.27	Residence	Brick	Slab
99	63 NAPIER STREET INVERLEIGH 3321				0.33	Residence	Weatherboard	Stumps
100	16 DUNDAS STREET INVERLEIGH 3321				0.19	Residence	Weatherboard	Slab
101	58 NAPIER STREET INVERLEIGH 3321				0.29	Residence	Weatherboard	Stumps
102	44 MERCER STREET INVERLEIGH 3321				0.32	Residence	Weatherboard	Slab
103	55 NAPIER STREET INVERLEIGH 3321				0.28	Residence	Weatherboard	Stumps
104	62 NAPIER STREET INVERLEIGH 3321				0.13	Residence	Brick	Stumps
105	60 NAPIER STREET INVERLEIGH 3321				0.16	Residence	Brick	Slab
106	34 MERCER STREET INVERLEIGH 3321				0.21	Residence	Weatherboard	Stumps
107	53 HIGH STREET INVERLEIGH 3321				0.30	Residence	Brick	Stumps
108	38 HIGH STREET INVERLEIGH 3321				0.08	Residence	Cement render	Slab
109	54 HIGH STREET INVERLEIGH 3321				0.03	School	Conc Render	Stumps
110	77 HIGH STREET INVERLEIGH 3321				0.17	Residence	Weatherboard	Slab
111	80 HIGH STREET INVERLEIGH 3321				0.28	Residence	Weatherboard	Stumps
112	75 HIGH STREET INVERLEIGH 3321				0.09	WARES PJ'S	Weatherboard	Slab
113	7 NAPIER STREET INVERLEIGH 3321				0.25	Residence	Weatherboard	Stumps
114	8 NAPIER STREET INVERLEIGH 3321				0.06	Residence	Brick	Slab
115	6 NAPIER STREET INVERLEIGH 3321				0.07	Residence	Brick	Slab



No	Address	Depth of building over floor flooding for each ARI event (m)				Building type
		100	200	500	1000	
116	9 RAILWAY STREET INVERLEIGH 3321				0.18	Residence Brick Slab
117	89 HIGH STREET INVERLEIGH 3321				0.02	Residence Weatherboard Stumps

**Table 16. Inverleigh (Barwon River dominant) Property Inundation Table (Water Technology 2017)**

No	Address	Depth of building over floor flooding for each ARI event (m)					Building type
		50	100	200	500	1000	
1	Costains ROAD INVERLEIGH 3321	0.47	1.22	2.20	3.61	4.96	Shed Gal iron No floor
2	23 WEATHERBOARD ROAD INVERLEIGH 3321		0.12	0.93	2.27	3.61	Shed Gal iron Slab
3	Public Toilet - STREET INVERLEIGH 3321			0.69	2.09	3.45	Toilet Conc Slab
4	94 NAPIER STREET INVERLEIGH 3321			0.42	1.83	3.19	Residence Weatherboard Stumps
5	1 HIGH STREET INVERLEIGH 3321			0.30	1.70	3.05	Residence Stone Slab
6	1 CAMBRIDGE STREET INVERLEIGH 3321			0.30	1.63	2.98	Residence Bluestone Slab
7	6 HIGH STREET INVERLEIGH 3321			0.09	1.44	2.79	Residence Weatherboard Stumps
8	8 HIGH STREET INVERLEIGH 3321			0.03	1.38	2.73	Inverleigh Home Living Weatherboard Slab
9	CAMBRIDGE STREET INVERLEIGH 3321			0.01	1.21	2.55	Residence Nth of Dundas Intersection Weatherboard Stumps
10	82 PARK STREET INVERLEIGH 3321				1.38	2.74	Residence Corrugated Iron Stumps
11	81 PARK STREET INVERLEIGH 3321				1.33	2.70	Residence Weatherboard Stumps
12	5 HIGH STREET INVERLEIGH 3321				1.30	2.65	Inverleigh Bakehouse Brick Stumps
13	DUNDAS STREET INVERLEIGH 3321				1.25	2.60	Shed beside the servo Gal iron Slab
14	80 NAPIER STREET INVERLEIGH 3321				1.24	2.60	Shed Iron shed Slab
15	34 HIGH STREET INVERLEIGH 3321				1.23	2.58	Residence Weatherboard Stumps
16	77 DUNDAS STREET INVERLEIGH 3321				1.16	2.52	Residence Concrete Render Slab
17	9A HIGH STREET INVERLEIGH 3321				1.14	2.49	Residence Weatherboard Stumps
18	57 MERCER STREET INVERLEIGH 3321				1.12	2.47	Residence Brick Stumps
19	83 NAPIER STREET INVERLEIGH 3321				1.11	2.47	Residence Weatherboard Stumps
20	14 HIGH STREET INVERLEIGH 3321				1.11	2.46	Gladioli Restaurant Weatherboard Slab
21	13 HIGH STREET INVERLEIGH 3321				1.11	2.46	Residence Cement Sheet Stumps
22	DUNDAS STREET INVERLEIGH 3321				1.10	2.45	Shed beside the servo Brick Slab
23	12 HIGH STREET INVERLEIGH 3321				1.07	2.42	Inverleigh Store Concrete Render Slab
24	76 NAPIER STREET INVERLEIGH 3321				1.03	2.39	Residence Weatherboard Slab
25	78 NAPIER STREET INVERLEIGH 3321				1.03	2.39	Residence Weatherboard Slab
26	19 HIGH STREET INVERLEIGH 3321				1.03	2.38	Inverleigh petrol station Brick Slab
27	39 HIGH STREET INVERLEIGH 3321				1.01	2.35	Residence Weatherboard Stumps
28	74 NAPIER STREET INVERLEIGH 3321				0.99	2.35	Residence Brick Slab
29	41 MERCER STREET INVERLEIGH 3321				0.99	2.34	Residence Brick Slab
30	20 HIGH STREET INVERLEIGH 3321				0.99	2.34	Residence Plastic cladding Stumps
31	7 HIGH STREET INVERLEIGH 3321				0.99	2.34	Telstra Cement render Slab
32	38 NAPIER STREET INVERLEIGH 3321				0.99	2.33	Residence Brick Slab
33	15A HIGH STREET INVERLEIGH 3321				0.96	2.31	Residence Weatherboard Stumps
34	36 HIGH STREET INVERLEIGH 3321				0.96	2.30	Residence Weatherboard Stumps

No	Address	Depth of building over floor flooding for each ARI event (m)					Building type		
		50	100	200	500	1000			
35	40 MERCER STREET INVERLEIGH 3321				0.95	2.30	Residence	Weatherboard	Slab
36	9 HIGH STREET INVERLEIGH 3321				0.95	2.30	Residence	Bluestone	Slab
37	40 NAPIER STREET INVERLEIGH 3321				0.93	2.27	Residence	Weatherboard	Stumps
38	17 HIGH STREET INVERLEIGH 3321				0.91	2.26	Residence	Weatherboard	Stumps
39	23 DUNDAS STREET INVERLEIGH 3321				0.90	2.26	Inverleigh Early Learning	Brick	Slab
40	47A NAPIER STREET INVERLEIGH 3321				0.90	2.24	Shed	Gal iron	Slab
41	23 HIGH STREET INVERLEIGH 3321				0.88	2.23	Geelong Landcare Network	Weatherboard	Slab
42	1/70 NAPIER STREET INVERLEIGH 3321				0.84	2.19	Residence	Brick	Slab
43	2/70 NAPIER STREET INVERLEIGH 3321				0.83	2.19	Residence	Brick	Slab
44	24 DUNDAS STREET INVERLEIGH 3321				0.83	2.19	Residence	Brick	Slab
45	9 JUBILEE STREET INVERLEIGH 3321				0.83	2.18	Residence	Brick	Slab
46	33 HIGH STREET INVERLEIGH 3321				0.82	2.17	Residence	Alum cladding	Stumps
47	3/70 NAPIER STREET INVERLEIGH 3321				0.81	2.17	Residence	Brick	Slab
48	49 DUNDAS STREET INVERLEIGH 3321				0.80	2.17	Residence	Weatherboard	Stumps
49	104 FULLER ROAD INVERLEIGH 3321				0.79	2.02	Residence	Weatherboard	Stumps
50	41 HIGH STREET INVERLEIGH 3321				0.77	2.11	Residence	Weatherboard	Stumps
51	48 NAPIER STREET INVERLEIGH 3321				0.72	2.07	Residence	Weatherboard	Stumps
52	22 DUNDAS STREET INVERLEIGH 3321				0.72	2.08	Residence	Weatherboard	Slab
53	16 HIGH STREET INVERLEIGH 3321				0.72	2.07	Residence	Brick	Stumps
54	79 PARK STREET INVERLEIGH 3321				0.71	2.08	Residence	Weatherboard	Stumps
55	38A HIGH STREET INVERLEIGH 3321				0.71	2.05	St Pauls Shop	Weatherboard	Stumps
56	23 DUNDAS STREET INVERLEIGH 3321				0.70	2.06	Inverleigh Early Learning	Hardy plank	Stumps
57	25 CAMBRIDGE STREET INVERLEIGH 3321				0.70	2.04	Residence	Weatherboard	Stumps
58	30 NAPIER STREET INVERLEIGH 3321				0.68	2.02	Residence	Brick	Slab
59	37 MERCER STREET INVERLEIGH 3321				0.67	2.02	Residence	Weatherboard	Stumps
60	43 PARK STREET INVERLEIGH 3321				0.66	2.02	Residence	Brick	Slab
61	19 MCCALLUM ROAD INVERLEIGH 3321				0.65	2.01	Residence	Brick	Slab
62	77 PARK STREET INVERLEIGH 3321				0.65	2.02	Residence	Brick	Slab
63	6 MCCALLUM ROAD INVERLEIGH 3321				0.62	1.99	Residence	Weatherboard	Stumps
64	15B HIGH STREET INVERLEIGH 3321				0.62	1.97	Sonny Café	Weatherboard	Stumps
65	29 MERCER STREET INVERLEIGH 3321				0.61	1.95	Residence	Brick	Slab
66	36A HIGH STREET INVERLEIGH 3321				0.60	1.94	Church Sunday School	Bluestone	Slab
67	12 DUNDAS STREET INVERLEIGH 3321				0.57	1.92	Residence	Cement render	Slab
68	9 DUNDAS STREET INVERLEIGH 3321				0.56	1.91	Residence	Weatherboard	Stumps
69	61 NAPIER STREET INVERLEIGH 3321				0.54	1.89	Residence	Stone	Slab
70	47 NAPIER STREET INVERLEIGH 3321				0.53	1.88	Residence	Brick	Slab
71	24 HIGH STREET INVERLEIGH 3321				0.53	1.88	Residence	Hardy plank	Stumps
72	36A HIGH STREET INVERLEIGH 3321				0.52	1.86	Church Sunday School	Bluestone	Slab
73	63 HIGH STREET INVERLEIGH 3321				0.50	1.85	Returned Service League	Weatherboard	Stumps
74	27 HIGH STREET INVERLEIGH 3321				0.50	1.85	CFA	Iron shed	Slab
75	38B HIGH STREET INVERLEIGH 3321				0.50	1.85	St Pauls Church	Conc block	Slab
76	78 PARK STREET INVERLEIGH 3321				0.49	1.86	Residence	Weatherboard	Stumps
77	60 PARK STREET INVERLEIGH 3321				0.49	1.85	Residence	Brick	Slab
78	62 PARK STREET INVERLEIGH 3321				0.47	1.84	Residence	Weatherboard	Stumps
79	35 MERCER STREET INVERLEIGH 3321				0.46	1.81	Residence	Brick	Slab
80	29 NAPIER STREET INVERLEIGH 3321				0.46	1.81	Residence	Weatherboard	Stumps
81	76 Railway St INVERLEIGH 3321				0.45	1.80	Residence	Brick	Slab
82	54 NAPIER STREET INVERLEIGH 3321				0.44	1.79	Residence	Hardy plank	Stumps

No	Address	Depth of building over floor flooding for each ARI event (m)					Building type		
		50	100	200	500	1000			
83	37 NAPIER STREET INVERLEIGH 3321				0.44	1.78	Residence	Weatherboard	Stumps
84	20 DUNDAS STREET INVERLEIGH 3321				0.42	1.78	Residence	Brick	Slab
85	7 MCCALLUM ROAD INVERLEIGH 3321				0.42	1.79	Residence	Hardy plank	Stumps
86	58 PARK STREET INVERLEIGH 3321				0.42	1.78	Residence	Weatherboard	Stumps
87	39 NAPIER STREET INVERLEIGH 3321				0.42	1.76	Residence	Weatherboard	Stumps
88	66 PARK STREET INVERLEIGH 3321				0.41	1.78	Residence	Weatherboard	Stumps
89	56 PARK STREET INVERLEIGH 3321				0.41	1.77	Residence	Brick	Slab
90	3 MCCALLUM ROAD INVERLEIGH 3321				0.40	1.77	Residence	Weatherboard	Stumps
91	50 DUNDAS STREET INVERLEIGH 3321				0.37	1.74	Residence	Weatherboard	Stumps
92	54 HIGH STREET INVERLEIGH 3321				0.37	1.72	School	Stone block	Slab
93	37 RAWSON ROAD INVERLEIGH 3321				0.37	1.47	Residence	Weatherboard	Stumps
94	63 NAPIER STREET INVERLEIGH 3321				0.37	1.72	Residence	Weatherboard	Stumps
95	47 HIGH STREET INVERLEIGH 3321				0.37	1.72	Residence	Brick	Slab
96	54 HIGH STREET INVERLEIGH 3321				0.36	1.71	School	Hardy Plank	Stumps
97	73 PARK STREET INVERLEIGH 3321				0.36	1.73	Residence	Brick	Slab
98	70 PARK STREET INVERLEIGH 3321				0.36	1.73	Residence	Weatherboard	Stumps
99	11 MCCALLUM ROAD INVERLEIGH 3321				0.36	1.72	Residence	Brick	Slab
100	28 HIGH STREET INVERLEIGH 3321				0.36	1.70	Inverleigh Farm Supplies	Cement Sheet	Stumps
101	27 NAPIER STREET INVERLEIGH 3321				0.35	1.70	Residence	Brick	Stumps
102	29 RIVER ROAD INVERLEIGH 3321				0.32	1.66	Residence	Brick	Slab
103	45 HIGH STREET INVERLEIGH 3321				0.30	1.64	Residence	Hardy plank	Stumps
104	16 DUNDAS STREET INVERLEIGH 3321				0.29	1.64	Residence	Weatherboard	Slab
105	49 HIGH STREET INVERLEIGH 3321				0.25	1.60	Residence	Brick	Stumps
106	59 MERCER STREET INVERLEIGH 3321				0.25	1.60	Residence	Hardy plank	Stumps
107	8 MCCALLUM ROAD INVERLEIGH 3321				0.24	1.61	Residence	Weatherboard	Stumps
108	9 MCCALLUM ROAD INVERLEIGH 3321				0.23	1.60	Residence	Hardy plank	Stumps
109	29 PARK STREET INVERLEIGH 3321				0.23	1.59	Residence	Brick	Slab
110	58 NAPIER STREET INVERLEIGH 3321				0.23	1.58	Residence	Weatherboard	Stumps
111	44 MERCER STREET INVERLEIGH 3321				0.22	1.57	Residence	Weatherboard	Slab
112	74 PARK STREET INVERLEIGH 3321				0.21	1.58	Residence	Brick	Slab
113	50 PARK STREET INVERLEIGH 3321				0.21	1.57	Residence	Weatherboard	Stumps
114	54 PARK STREET INVERLEIGH 3321				0.20	1.56	Residence	Brick	Stumps
115	51 HIGH STREET INVERLEIGH 3321				0.20	1.55	Residence	Brick blocks	Stumps
116	65 PARK STREET INVERLEIGH 3321				0.19	1.55	Residence	Brick	Stumps
117	57 HIGH STREET INVERLEIGH 3321				0.18	1.53	Residence	Weatherboard	Stumps
118	49 PARK STREET INVERLEIGH 3321				0.17	1.53	Residence	Hardy plank	Stumps
119	76 PARK STREET INVERLEIGH 3321				0.17	1.54	Residence	Brick blocks	Stumps
120	48 HIGH STREET INVERLEIGH 3321				0.17	1.50	Tennis Club	Brick	Slab
121	55 NAPIER STREET INVERLEIGH 3321				0.15	1.50	Residence	Weatherboard	Stumps
122	62 NAPIER STREET INVERLEIGH 3321				0.15	1.50	Residence	Brick	Stumps
123	127 HIGH STREET INVERLEIGH 3321				0.14	1.42	Residence	Weatherboard	Stumps
124	60 NAPIER STREET INVERLEIGH 3321				0.13	1.48	Residence	Brick	Slab
125	52 PARK STREET INVERLEIGH 3321				0.13	1.49	Residence	Weatherboard	Stumps
126	20 WEATHERBOARD ROAD INVERLEIGH 3321				0.13	1.46	Residence	Brick	Slab
127	57 PARK STREET INVERLEIGH 3321				0.11	1.47	Residence	Weatherboard	Slab
128	30 HIGH STREET INVERLEIGH 3321				0.11	1.45	Residence	Cedar	Stumps
129	5 RIVER ROAD INVERLEIGH 3321				0.08	1.39	Residence	Brick	Slab
130	49 NAPIER STREET INVERLEIGH 3321				0.05	1.40	Residence	Hardy plank	Stumps
131	55 HIGH STREET INVERLEIGH 3321				0.04	1.39	Residence	Brick	Stumps
132	53 PARK STREET INVERLEIGH 3321				0.02	1.38	Residence	Weatherboard	Stumps
133	34 MERCER STREET INVERLEIGH 3321				0.01	1.36	Residence	Weatherboard	Stumps
134	59 PARK STREET INVERLEIGH 3321					1.35	Residence	Cedar	Stumps
135	53 HIGH STREET INVERLEIGH 3321					1.33	Residence	Brick	Stumps
136	20 RAILWAY STREET INVERLEIGH 3321					1.29	Pony Club	Weatherboard	Stumps
137	75 PARK STREET INVERLEIGH 3321					1.29	Residence	Weatherboard	Stumps
138	39 MCCALLUM ROAD INVERLEIGH 3321					1.26	Residence	Cedar	Stumps

No	Address	Depth of building over floor flooding for each ARI event (m)					Building type		
		50	100	200	500	1000			
139	61 PARK STREET INVERLEIGH 3321					1.25	Residence	Brick	Stumps
140	31 PARK STREET INVERLEIGH 3321					1.22	Residence	Weatherboard	Stumps
141	38 HIGH STREET INVERLEIGH 3321					1.20	Residence	Cement render	Slab
142	14 MCCALLUM ROAD INVERLEIGH 3321					1.04	Residence	Weatherboard	Stumps
143	27 PARK STREET INVERLEIGH 3321					1.00	Residence	Weatherboard	Stumps
144	54 HIGH STREET INVERLEIGH 3321 - School					0.98	School	Conc Render	Stumps
145	73 MCCALLUM ROAD INVERLEIGH 3321					0.91	Residence	Weatherboard	Stumps
146	20 RAILWAY STREET INVERLEIGH 3321					0.90	Pony Club	Weatherboard	Stumps
147	8 CAMPBELL ROAD INVERLEIGH 3321					0.90	Residence	Brick	Stumps
148	10 MCCALLUM ROAD INVERLEIGH 3321					0.88	Residence	Brick	Slab
149	148 HIGH STREET INVERLEIGH 3321					0.78	Residence	Weatherboard	Stumps
150	12 JUBILEE STREET INVERLEIGH 3321					0.75	Residence	Weatherboard	Stumps
151	24 NAPIER STREET INVERLEIGH 3321					0.75	Residence	Weatherboard	Stumps
152	77 HIGH STREET INVERLEIGH 3321					0.70	Residence	Weatherboard	Slab
153	80 HIGH STREET INVERLEIGH 3321					0.68	Residence	Weatherboard	Stumps
154	75 HIGH STREET INVERLEIGH 3321					0.67	WARES PJS	Weatherboard	Slab
155	7 NAPIER STREET INVERLEIGH 3321					0.58	Residence	Weatherboard	Stumps
156	37 MCCALLUM ROAD INVERLEIGH 3321					0.52	Residence	Cedar	Stumps
157	71 HIGH STREET INVERLEIGH 3321					0.47	Inverleigh Public Hall	Brick	Slab
158	45 MCCALLUM ROAD INVERLEIGH 3321					0.46	Residence	Brick	Slab
159	90 HIGH STREET INVERLEIGH 3321					0.45	Police Station	Brick	Stumps
160	10 WEST STREET INVERLEIGH 3321					0.43	Residence	Weatherboard	Stumps
161	18 Napier Street					0.42	Residence	Weatherboard	Stumps
162	8 NAPIER STREET INVERLEIGH 3321					0.41	Residence	Brick	Slab
163	118 HIGH STREET INVERLEIGH 3321					0.40	Residence	Brick	Slab
164	6 NAPIER STREET INVERLEIGH 3321					0.37	Residence	Brick	Slab
165	81 MCCALLUM ROAD INVERLEIGH 3321					0.37	Residence	Hardy plank	Stumps
166	9 RAILWAY STREET INVERLEIGH 3321					0.37	Residence	Brick	Slab
167	20 Napier St Inverleigh					0.29	Residence	Weatherboard	Stumps
168	89 HIGH STREET INVERLEIGH 3321					0.24	Residence	Weatherboard	Stumps
169	76 HIGH STREET INVERLEIGH 3321					0.22	Residence	Brick blocks	Stumps
170	9 MERCER STREET INVERLEIGH 3321					0.19	Residence	Brick	Slab
171	70 HIGH STREET INVERLEIGH 3321					0.18	Church	Stone	Slab
172	85 HIGH STREET INVERLEIGH 3321					0.14	Residence	Brick	Stumps
173	6 WEST STREET INVERLEIGH 3321					0.09	Residence	Hardy Plank	Stumps
174	29 HIGH STREET INVERLEIGH 3321					0.03	Residence	Brick	Slab

## Appendix C2: Shelford Flood Emergency Plan

Shelford has experienced extensive and frequent riverine flooding from the Leigh River. The upper reaches of the Leigh River is located to the north east of Ballarat, begins as the Yarrowee River and flows south to Shelford. The Leigh River catchment area upstream of Shelford is approximately 820 km<sup>2</sup>. In general the Leigh River north of Shelford is a well-defined valley. The catchment is predominantly cleared land with some pockets of forested area. Most of the Leigh River catchment is comprised of crop and pasture, so when soils are saturated runoff from heavy rainfall leads to rapid flooding. Stream rises in the Leigh River can occur at Mount Mercer between 4 to 6 hours after rainfall.

The Mount Mercer stream gauge, 25 km upstream of Shelford provides 6 to 10 hours warning time for Shelford. Refer to map below.



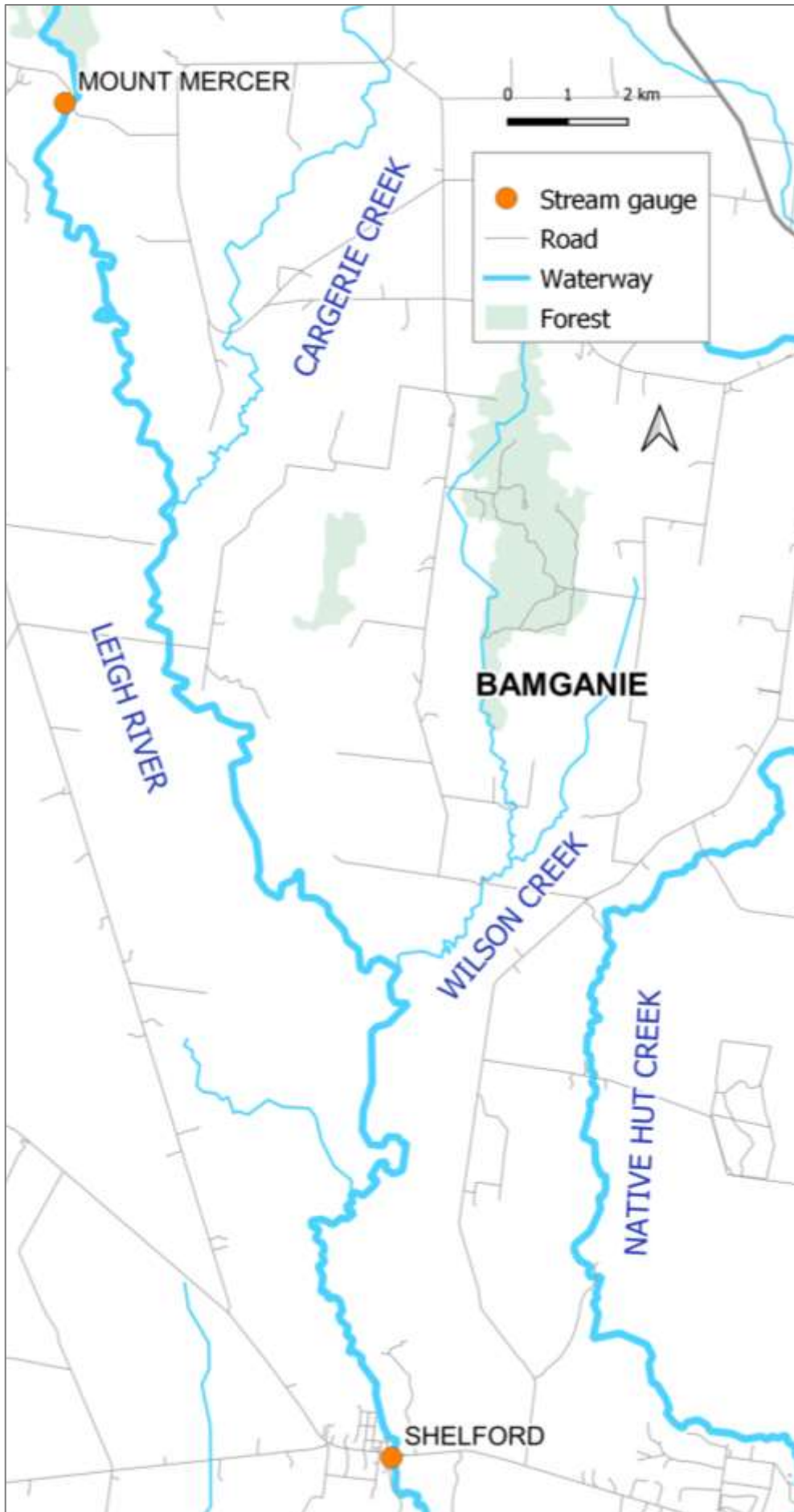


Figure 32. Shelford waterways and stream gauges.

## Historic Flood Events

Shelford has been subject to extensive and frequent riverine flood events, significant flood events have occurred in 1952, 1973, 1974, 1977, 1978, 1981, 1983, 1990, 1995, 2000, 2010, 2011, 2012 and 2016, refer to the graph below. The Mount Mercer stream gauge record was used due to the gaps in the Shelford streamflow record.

The September 2011 flood event was the largest recent flood event. Rainfall records indicate 176 mm fell over four days. This flood event caused considerable damages to buildings, roads and bridges. Eight houses including the Shelford Primary School and the Shelford Cricket Clubrooms were impacted by over floor flooding. Refer to the flood photos below.

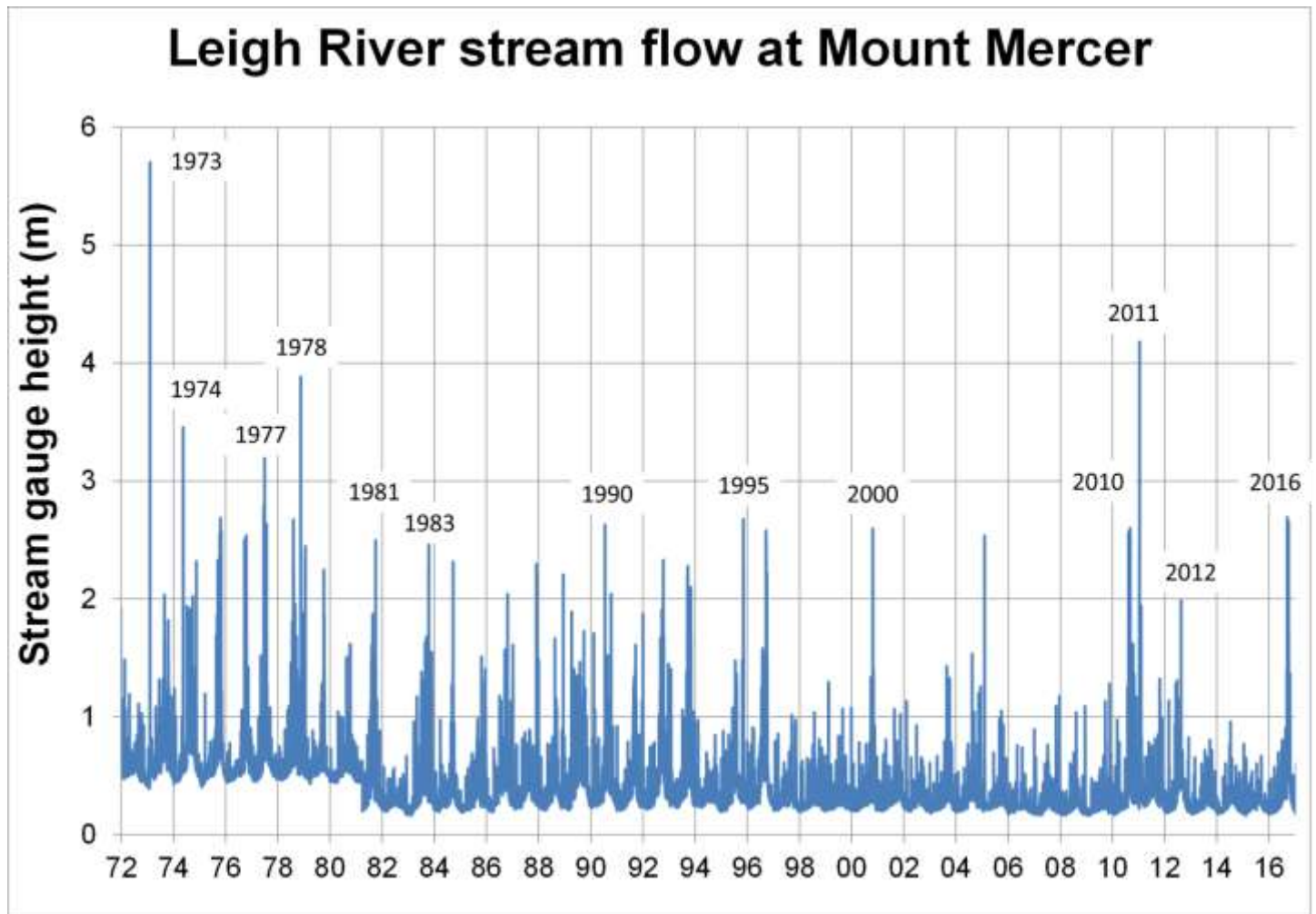


Figure 33. Leigh River stream flow records indicate the frequency of flood events that have occurred in Shelford.



Figure 34. Shelford Recreation Reserve Oval impacted by flooding during the 2011 flood event (source: Jessica Myer).



Figure 35. Shelford gauge boards adjacent to the Bannockburn-Shelford Road bridge during the 2011 flood event (source: Nathan Hansford)



## Warning Time

Flooding can develop quickly in Shelford from heavy rainfall in the upper Leigh River catchment. Rapid rises in floodwater within Shelford can occur within 10 hours from rainfall. The time between heavy rainfall in the upper catchment around Ballarat and rise in streamflow at the Mount Mercer gauge is between 4 to 6 hours. The Mount Mercer gauge is expected to peak between 12 to 18 hours after the start of heavy rainfall. The peak travel time between Mount Mercer and the Shelford gauges is approximately between 6 to 10 hours.

It is important to note that all floods are different, and different rainfall patterns falling on dry or wet catchments may respond differently. The streamflow and travel time numbers below should be used as a guide only.

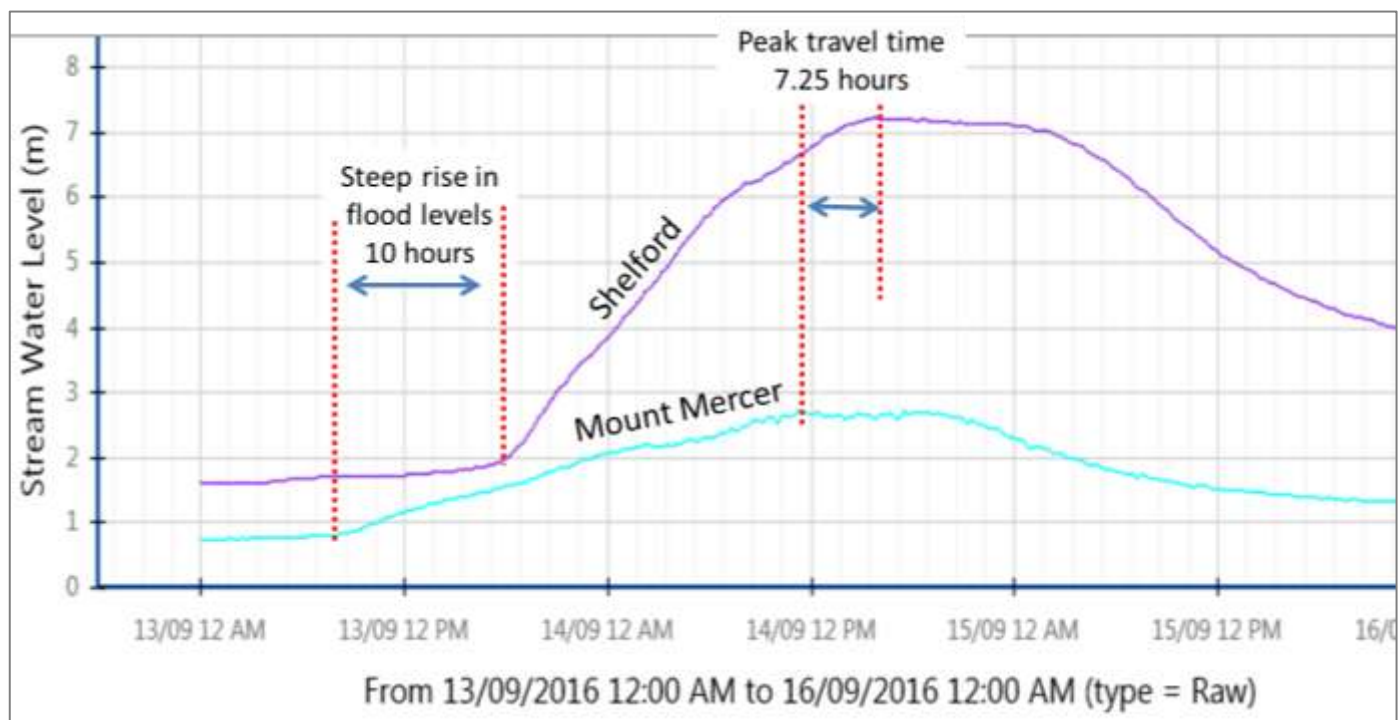


Figure 36. Leigh River stream flows at the Mount Mercer and Shelford gauges during the 2016 flood event.

## Shelford levees

Two levees have been constructed in Shelford, both are located along the eastern bank of the Leigh River. These levees were constructed before 1973 to protect buildings and farm land from inundation. During the 1973 flood these levees were overtopped. Since then no repairs have been undertaken to these levees. The protection level of these levees is unknown.

## Shelford Overland Flash Flooding

Due to the steep terrain surrounding Shelford, heavy localised rainfall can cause overland flooding. Two houses that are known to be impacted by overland flooding include: 60 Cunningham Street and 20 Russell Street. Overland flooding has also washed away the driveway to 10 Carpenters Road, cutting access/egress to the house. Refer to the map below for the location of these properties.

Minor works can be undertaken to reduce flood risk to these properties. These works can involve the construct drains or a small earthen garden bed (or solid fence) to divert water away from the houses. Any works undertaken need to give consideration to impacts on adjacent properties and should be undertaken in consultation with the Golden Plains Shire.



Figure 37. Properties impacted by flash flooding in Shelford.



## Shelford Flood Impacts and Required Actions

Given that no floor level survey was undertaken as part of the Regional Flood Mapping Investigation (DELWP 2016), buildings at risk of flooding were estimated using the Regional Flood Mapping Investigation (DELWP 2016) and anecdotal information collected during historic flood events. It's important to note the building damage information below only indicates buildings that may be at risk of above floor flooding and should be used as a guide only. For additional flood risk information refer to the Shelford Flood Intelligence Card, tables and maps below.

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

Table 17. Shelford key assets at risk of flooding.

Asset register				
Asset Name and location	Average Recurrence Interval (ARI)	Consequence / Impact	Mitigation/ Action	Lead Agency
Bannockburn-Shelford Road, Shelford.	5 year flood	Flooding may cut access to the Bannockburn-Shelford Road, depth 0.55m.	Deploy road closure signs and undertake traffic management as needed	Regional Roads Victoria
Shelford Primary School, 1717 Bannockburn-Shelford Road, Shelford	5 year flood	The grounds of the Shelford Primary School may be impacted by flooding in a 5 year flood event, depth 0.25m. Buildings may be flooded over floor during a 20 year flood.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
Shelford Presbyterian Church, 1716 Bannockburn-Shelford Road, Shelford	5 year flood	The grounds of the Shelford Presbyterian Church may be impacted by flooding in a 5 year flood event, depth 0.29m. The Church may be flooded over floor during a 20 year flood.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police
The Parade Road, Shelford.	5 year flood	Flooding may cut access to The Parade Road, depth 0.71m.	Deploy road closure signs as needed.	Council
Ormond Street, Shelford.	5 year flood	Flooding may cut access to Ormond Street, depth 0.40m.	Deploy road closure signs as needed.	Council
The Shelford Cricket Club Oval, The Parade Road, Shelford	5 year flood	The Shelford Cricket Club Oval is impacted by flooding, depth 0.34m.	Notify the Shelford Cricket Club managers.	Council
Tolson Street, Shelford.	10 year flood	Flooding may cut access to Tolson Street, depth 0.32m.	Deploy road closure signs as needed.	Council
Shelford Tennis Club, Ormond Street, Shelford.	10 year flood	The Shelford Tennis Courts may be impacted by shallow flooding, depth 0.08m.	Notify the Shelford Tennis Club managers.	Council
Three buildings on the Bannockburn-Shelford Road (1727, 1735, 1737), Shelford	50 year flood	Three buildings may be flooded over floor.	Sandbag buildings and undertake evacuations as needed.	VICSES Victoria Police

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



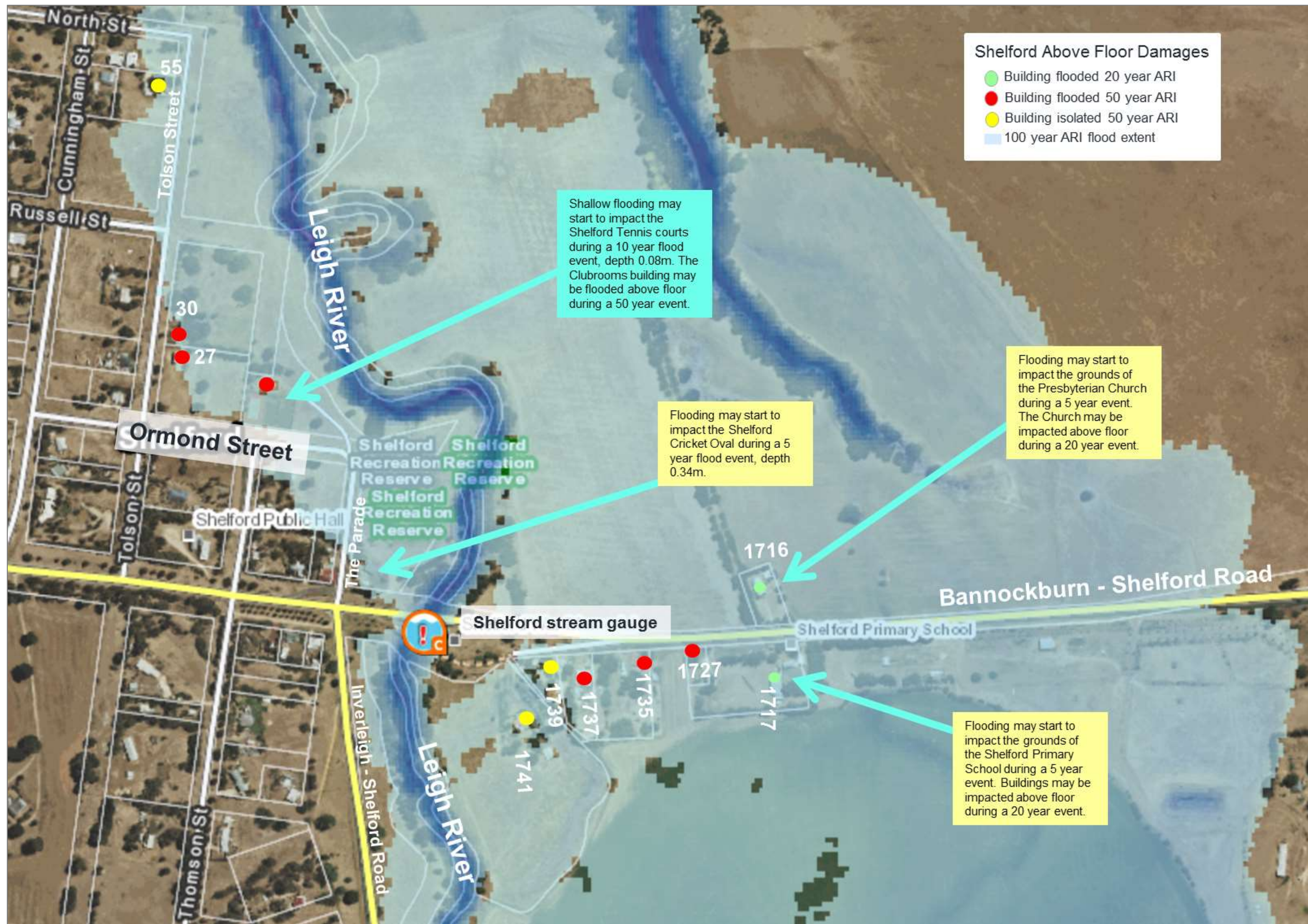


Figure 38. Shelford buildings subject to above floor flooding (source: Corangamite CMA Flood Response Guide and anecdotal observations).





Figure 39. Shelford roads impacted by flooding with the 100 year ARI flood extent (DELWP 2016).



**Table 18. Shelford Flood Intelligence Card (Corangamite CMA Flood Response Guide)**

Flood travel time					Time from start of rain to steep rise in floodwater 6 - 10 hours			
					Time between Mount Mercer and Shelford peak 4 - 6 hours			
					Riverine flooding duration: 2 days			
Leigh River at Mount Mercer gauge height 233215 (m) (DELWP 2016)	Leigh River at Shelford gauge height 233213 (m)	Average Recurrence Interval (ARI) (CCMA)	^Shelford estimated damages	Shelford Flows (ML/d) Water Tech 2018 rating	Consequence / Impact (Corangamite CMA Flood Response Guide)	Houses/ buildings flooded / isolated	Roads Impacted	Action
	3.60	2		2,200				
2.70	5.50	5		6,200	The Shelford Primary School and Presbyterian Church grounds may start to be impacted flooding. Flooding may cut access may to the Bannockburn-Shelford Road, The Parade Road and Ormond Street.	The Shelford Primary School grounds may be impacted, depth 0.25m. The Shelford Presbyterian Church grounds may be impacted, depth 0.29m. The Shelford Recreational Reserve Oval is impacted by flooding, depth 0.34m.	Bannockburn-Shelford Road depth 0.55m The Parade Road depth 0.71m Tolson Street depth 0.16m Ormond Street depth 0.40m	VICSES activate ground observers to take photos and record flood levels at key crossings. Victoria Police evacuate the Shelford Primary School and buildings on the Bannockburn-Shelford Road as needed. Council and Regional Roads Victoria to deploy road closure signs and undertake traffic management as needed.
	5.70	April 2001						
2.00	6.00 (Proposed)	Minor						
3.25	6.60	10		10,700	Flooding may cut access to Tolson Street.	The Shelford Tennis Courts may be impacted by shallow flooding, depth 0.08m.	Bannockburn-Shelford Road depth 0.80m The Parade Road depth 0.79m Tolson Street depth 0.32m Ormond Street depth 0.50m	Refer to actions listed above.
3.00	7.00 (Proposed)	Moderate		12,500	A levee has been construction on the eastern side of the Leigh River. The protection level is unknown (no flood study). Landholders indicated the levee is quickly overtopped during major floods			Council clear debris from waterway crossings, drains and culvers as needed.
4.00		Major						Refer to actions listed above.
	7.22	September 2016		13,661				
	7.35	November 1995						
	7.40	November 1978		15,200				
3.80	7.40	20	12 (2)^	15,200	Buildings at the Shelford Primary School and Presbyterian Church may start to be impacted by over floor flooding. Hamilton Highway east of Inverleigh-Shelford Road begins to flood.	Two buildings may be flooded over floor; The Shelford Primary School (1717 Bannockburn-Shelford Road) may be impacted above floor, depth 0.37m. The Presbyterian Church	Bannockburn-Shelford Road depth 1.01m The Parade Road depth 0.85m Tolson Street depth 0.44m Ormond Street depth 0.55m	VICSES sandbag buildings as needed.



						(1716 Bannockburn-Shelford Road).		
4.21	7.90	January 2011		16,800	178 mm rainfall fell over 4 days. Eight homes, Shelford Primary School, Presbyterian Church, Shelford Cricket Clubrooms, Tennis Clubrooms and Recreation Reserve were flooded. The main road was impassable. Significant impact to rural properties.			
	8.00 (Proposed)	Major						
4.49	8.25	50	25 (10)^	24,200	Additional buildings may be flooded over floor: Shelford Tennis Clubrooms (Ormond Street), Shelford Cricket Clubrooms (The Parade), x4 Bannockburn-Shelford Road (1727, 1737, 1739), x2 Tolson Street (30, 55) Houses may be isolated at x2 Bannockburn-Shelford Road (1739, 1741).	Bannockburn-Shelford Road depth 1.22m The Parade Road depth 0.88m Tolson Street depth 0.53m Ormond Street depth 0.59m	VICSES sandbag buildings as needed. Victoria Police evacuate buildings as needed.	
5.16	8.45	100	38 (12)^	39,300		Bannockburn-Shelford Road depth 1.39m The Parade Road depth 0.90m Tolson Street depth 0.58m Ormond Street depth 0.61m		
	8.50	200		50,000		Bannockburn-Shelford Road depth 1.53m The Parade Road depth 0.92m Tolson Street depth 0.62m Ormond Street depth 0.64m		
5.34		1973 250 year event		45,000	Largest flood on record.			

^Damages have been estimated using information from the Corangamite CMA Flood Response Guide and flood mapping and the Golden Plains Shire Flood Data Transfer Mapping (DNRE 2000).

# Appendix D: Flood evacuation arrangements

## Phase 1 - Decision to Evacuate

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

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

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

The following should be considered when planning for evacuation:

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



## Phase 2 – Warning

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

## Phase 3 – Withdrawal

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

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

VICPOL will control security of evacuated areas.

Evacuees will be encouraged to move using their own transport where possible. Transport for those without vehicles or other means will be arranged.

Landing zones for helicopters are located at:

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

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

## Phase 4 – Shelter

Relief Centres and/or assembly areas which cater for people’s basic needs for floods may be established to meet the immediate needs of people affected by flooding

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

## **Animal Shelter**

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

## **Phase 5 – Return**

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

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

Considerations for deciding whether to evacuate include:

- Current flood situation;
- Status of flood mitigation systems;
- Size and location of the community;
- Access and egress routes available and their status;
- Resources required to coordinate the return;
- Special needs groups;
- Forecast weather;
- Transportation particularly for people without access to transport

## **Disruption to Services**

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



## Appendix E: Public Information and Warnings

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


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


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

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

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

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

	<p><b>EMERGENCY ALERT</b></p> <p>As required, subject to individual circumstances, weather conditions, potential impacts and duration.</p> <p>Refer VICSES SOP057.</p>	<p>As required, based on conditions, changed conditions or impacts of the flood event.</p> <p>Circumstances which warrant the use of EA include:</p> <ul style="list-style-type: none"> <li>• EA is likely to contribute to saving lives and property</li> <li>• EA is likely to be the most effective way to warn the community in an actual or likely emergency</li> <li>• Alternative channels have been considered and alone may not achieve objectives</li> <li>• Time is of the essence and specific action following the receipt of the warning is required</li> </ul> <p>The message is of critical importance and needs to be delivered to a specific geographic area</p>
<p><b>Pre-populated Golden Plains Shire Emergency Alert key messages for a severe flash flood event</b></p> <p>High velocity floodwater may cause risk to life for pedestrians and motorist.          Access to main roads may be cut.          Advise to shelter in place if it is safe to do so.          The flood peak is likely to pass within 6 to 12 hours.</p>		

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

The BOM have issued a Severe Weather Warning: Heavy Rain

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

Locations which may be affected include: Shelford and Inverleigh.

Widespread flooding may occur.

Keep clear of creeks and storm drains

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

Flooding may cause extensive inundation of buildings.

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

The flood peak is likely to pass quickly, within 6 to 12 hours.

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

Waterways likely to be affected include:

- Leigh River
- Barwon River
- Warrambine Creek
- Five Mile Creek
- Woody Yaloak Creek
- Native Hut Creek
- Moorabool River
- Naringhill Creek
- Stony Creek
- Bruce 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

Figure 40. Inverleigh 10 year ARI (Leigh River dominant) flood depth map (Water Technology 2018).

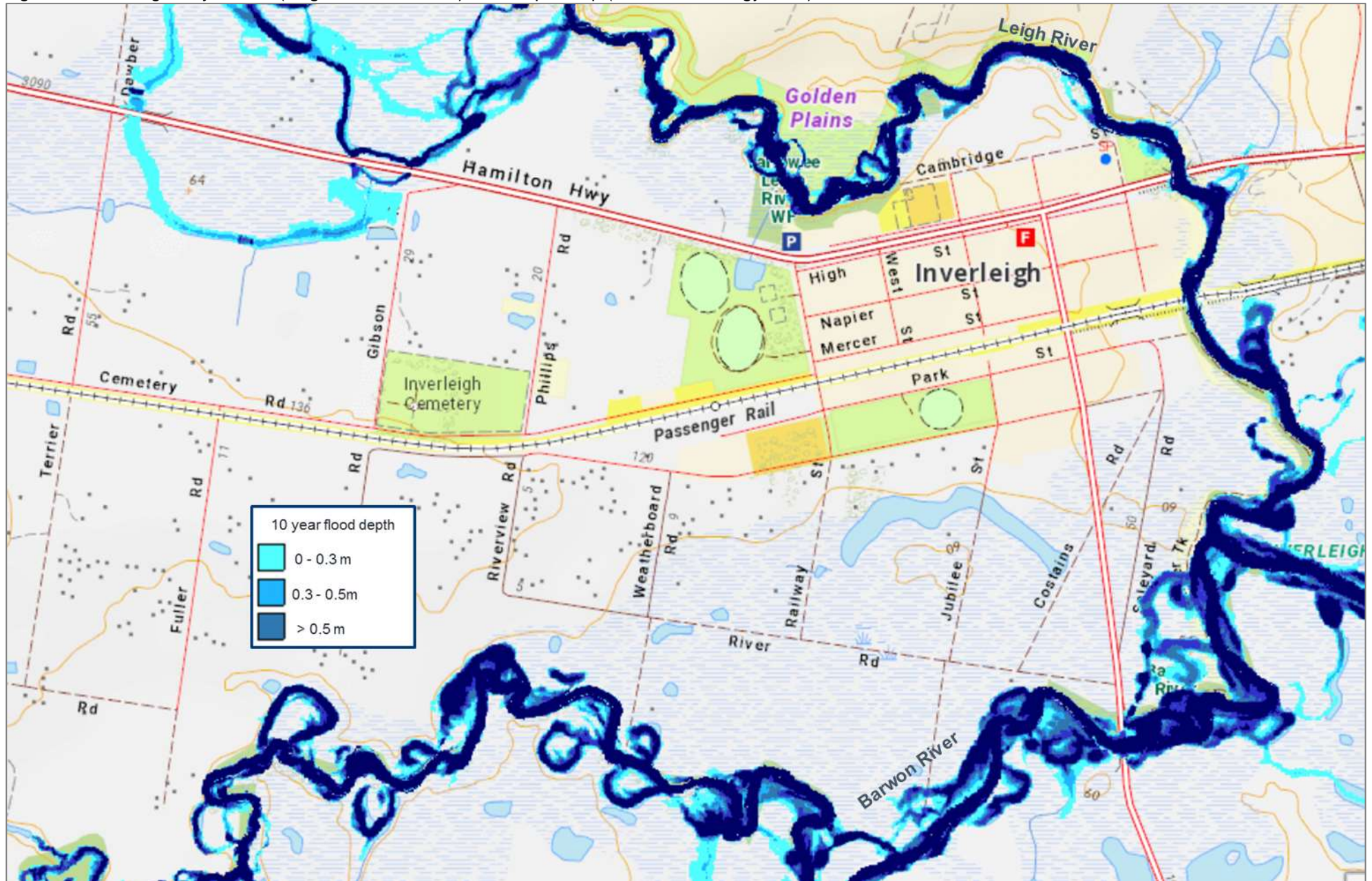




Figure 41. Inverleigh 20 year ARI (Leigh River dominant) flood depth map (Water Technology 2018).

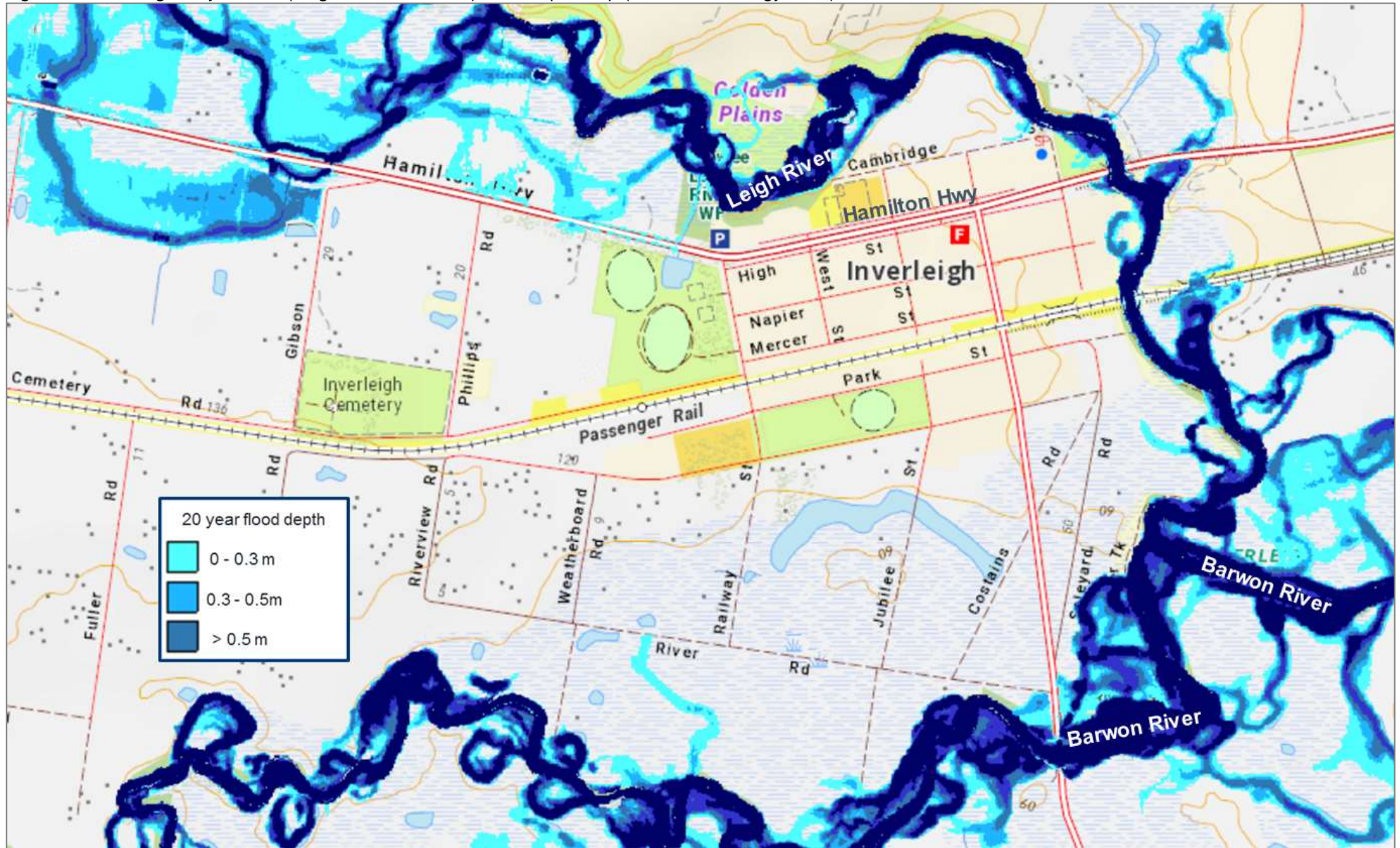




Figure 42. Inverleigh 50 year ARI (Leigh River dominant) flood depth map (Water Technology 2018).

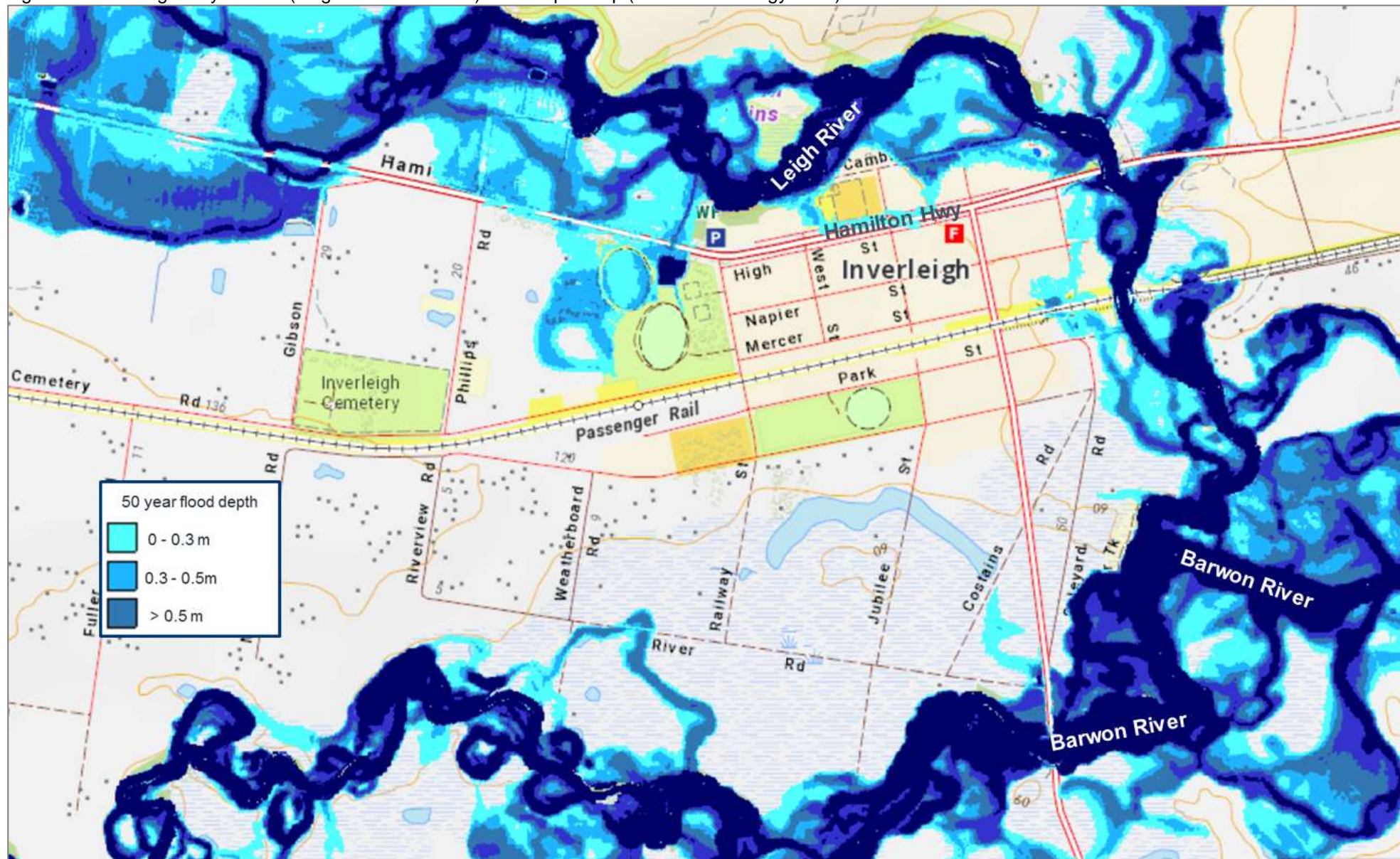




Figure 43. Inverleigh 100 year ARI (Leigh River dominant) flood depth map (Water Technology 2018).

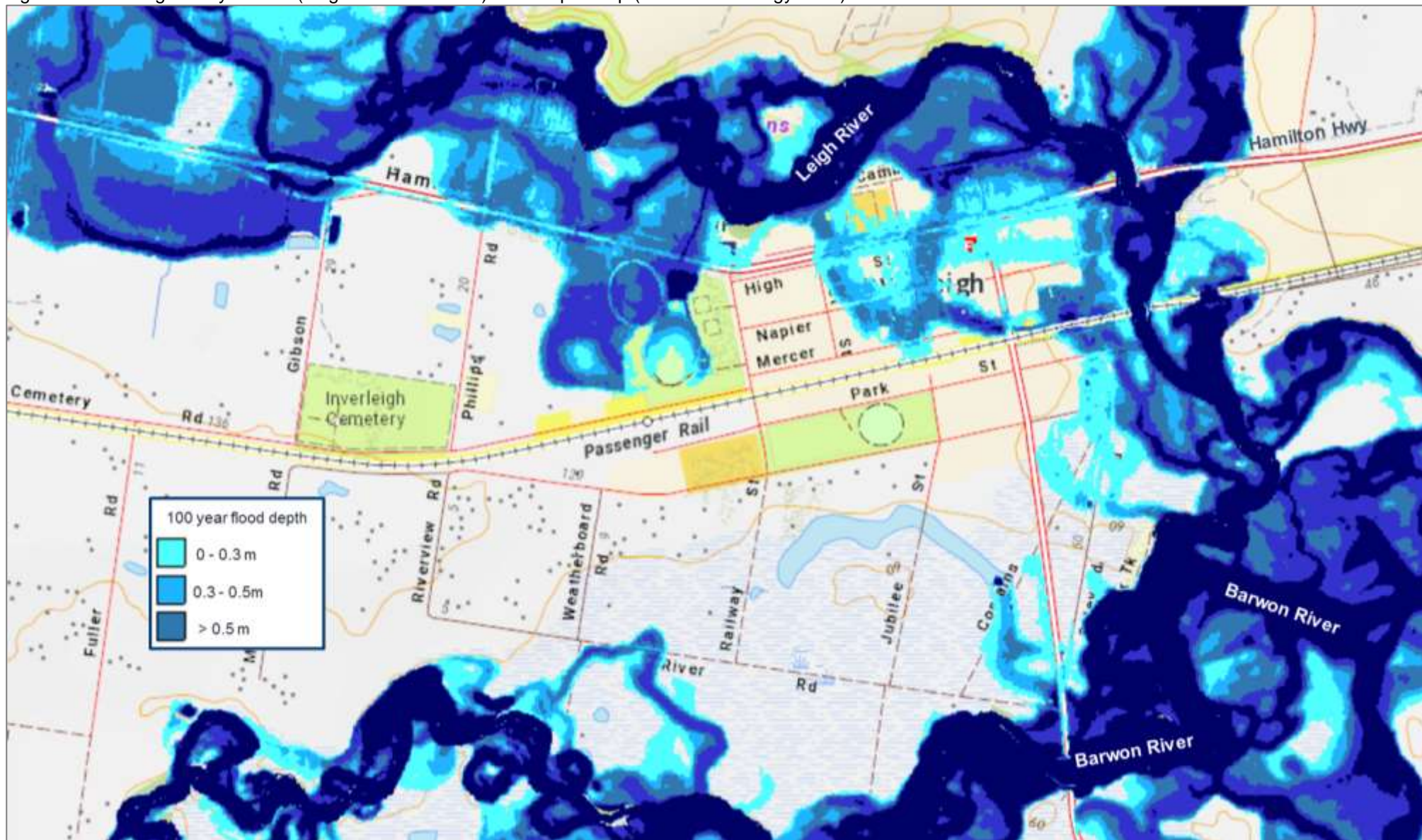




Figure 44. Inverleigh 200 year ARI (Leigh River dominant) flood depth map (Water Technology 2018).

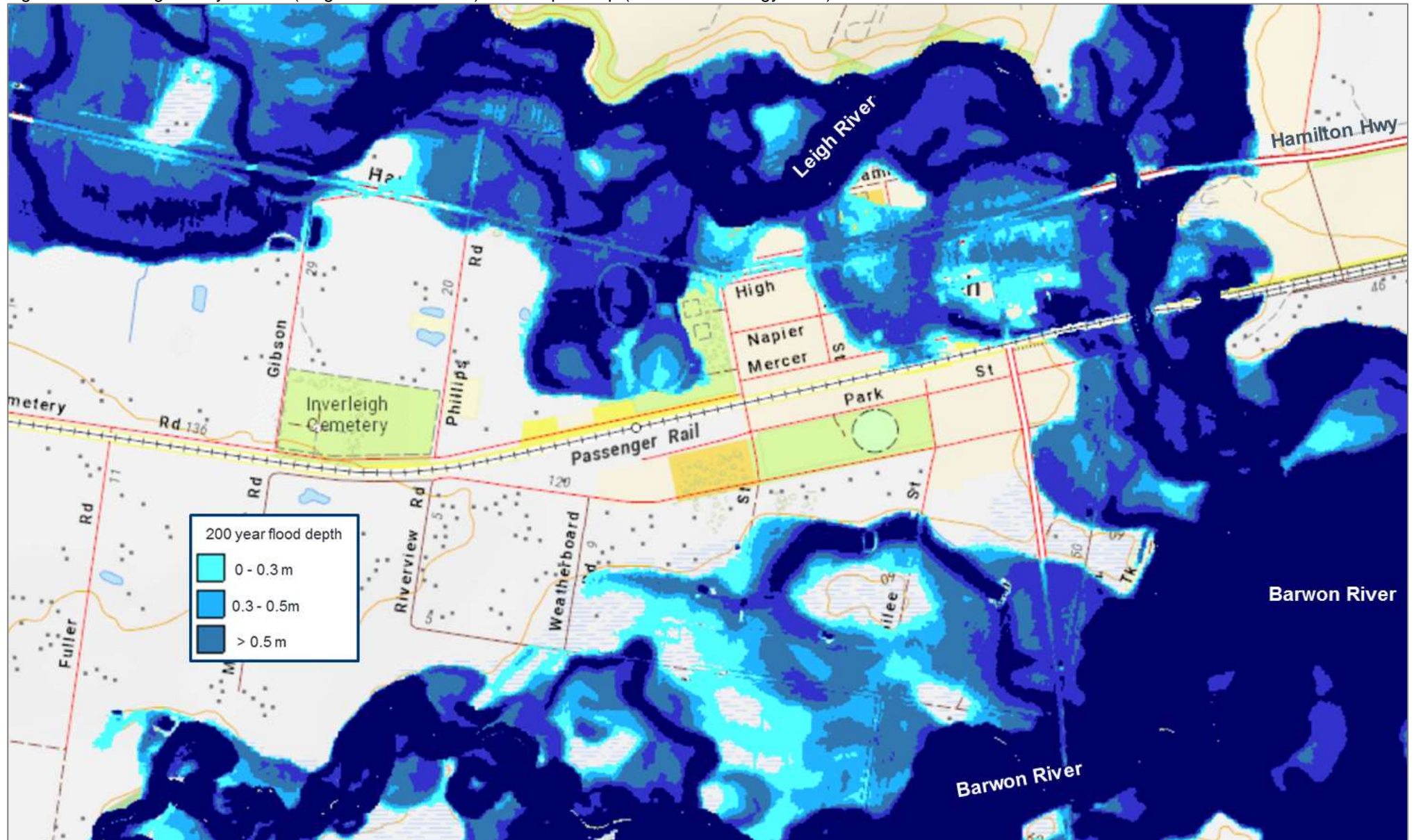




Figure 45. Inverleigh 10 year ARI (Barwon River dominant) flood depth map (Water Technology 2018).

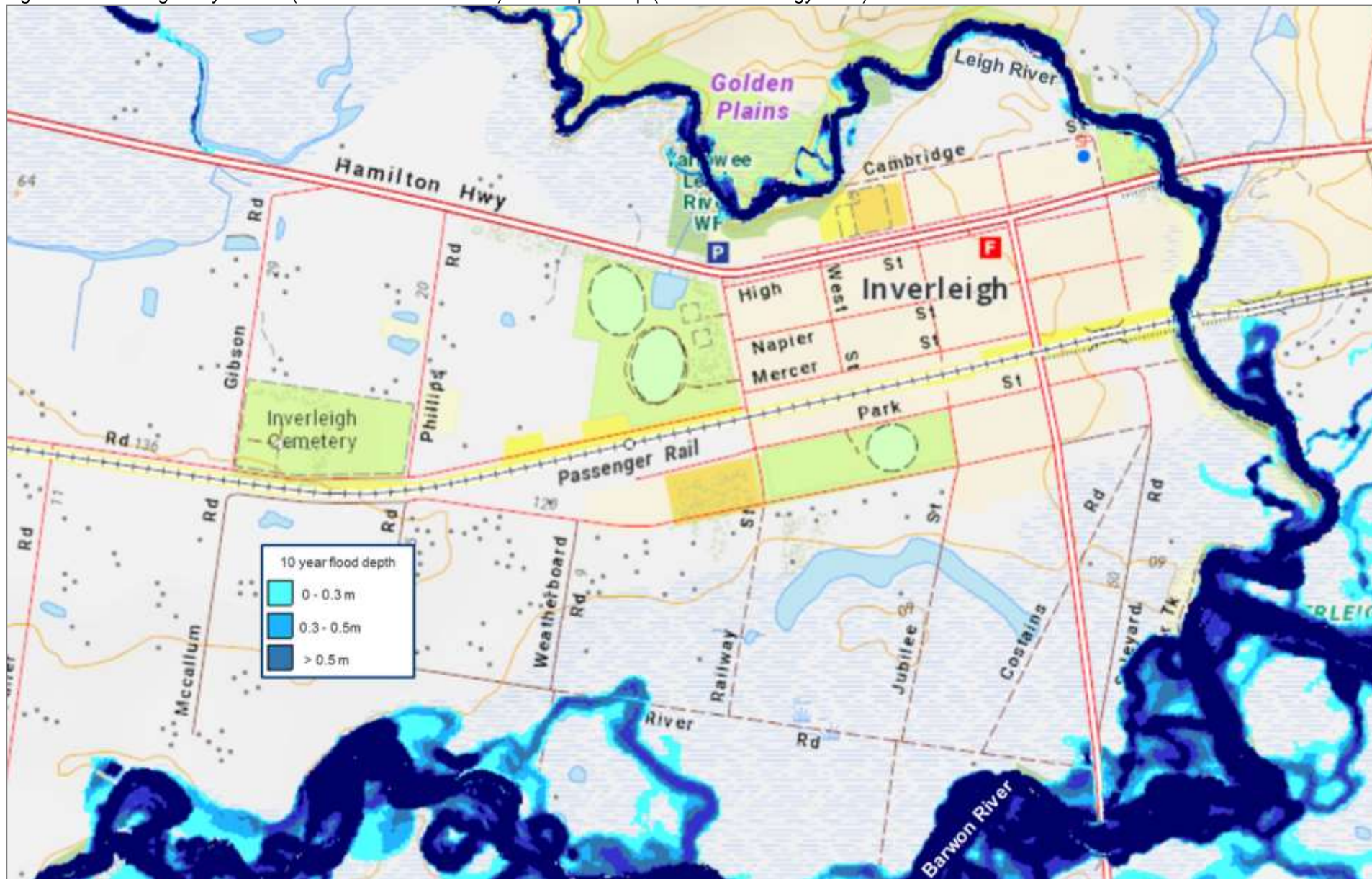




Figure 46. Inverleigh 20 year ARI (Barwon River dominant) flood depth map (Water Technology 2018).





Figure 47. Inverleigh 50 year ARI (Barwon River dominant) flood depth map (Water Technology 2018).

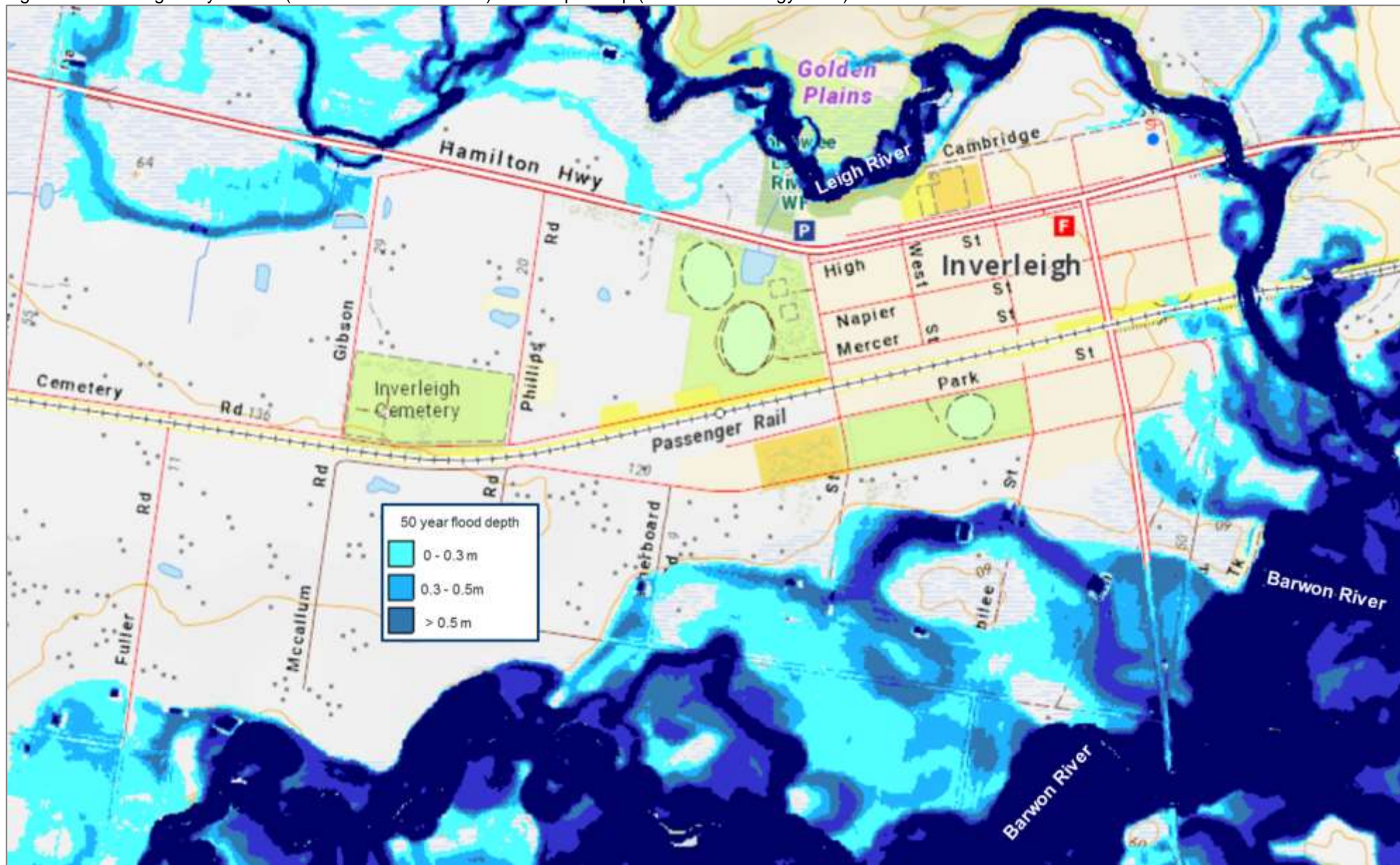




Figure 48. Inverleigh 100 year ARI (Barwon River dominant) flood depth map (Water Technology 2018).

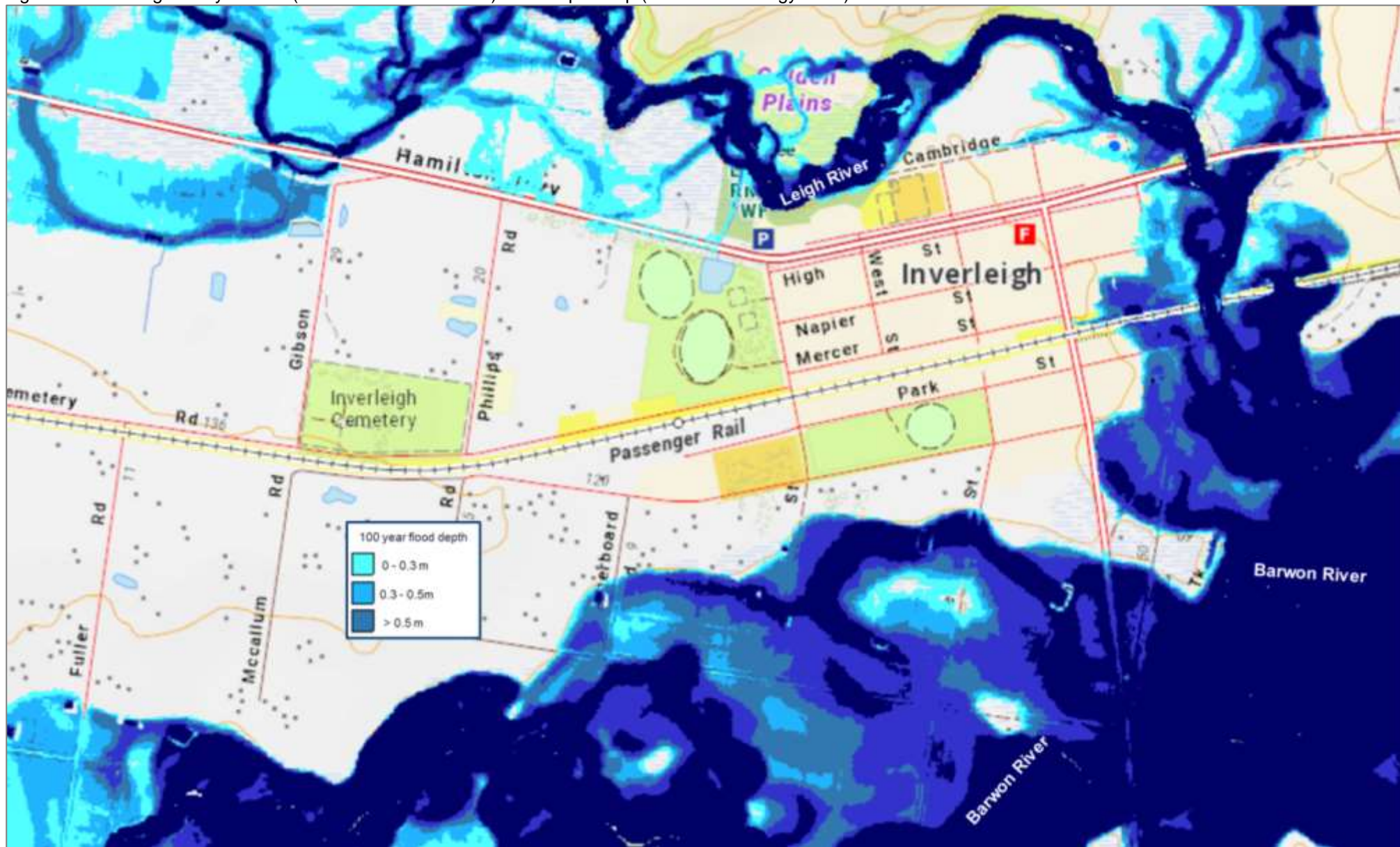




Figure 49. Inverleigh 200 year ARI (Barwon River dominant) flood depth map (Water Technology 2018).

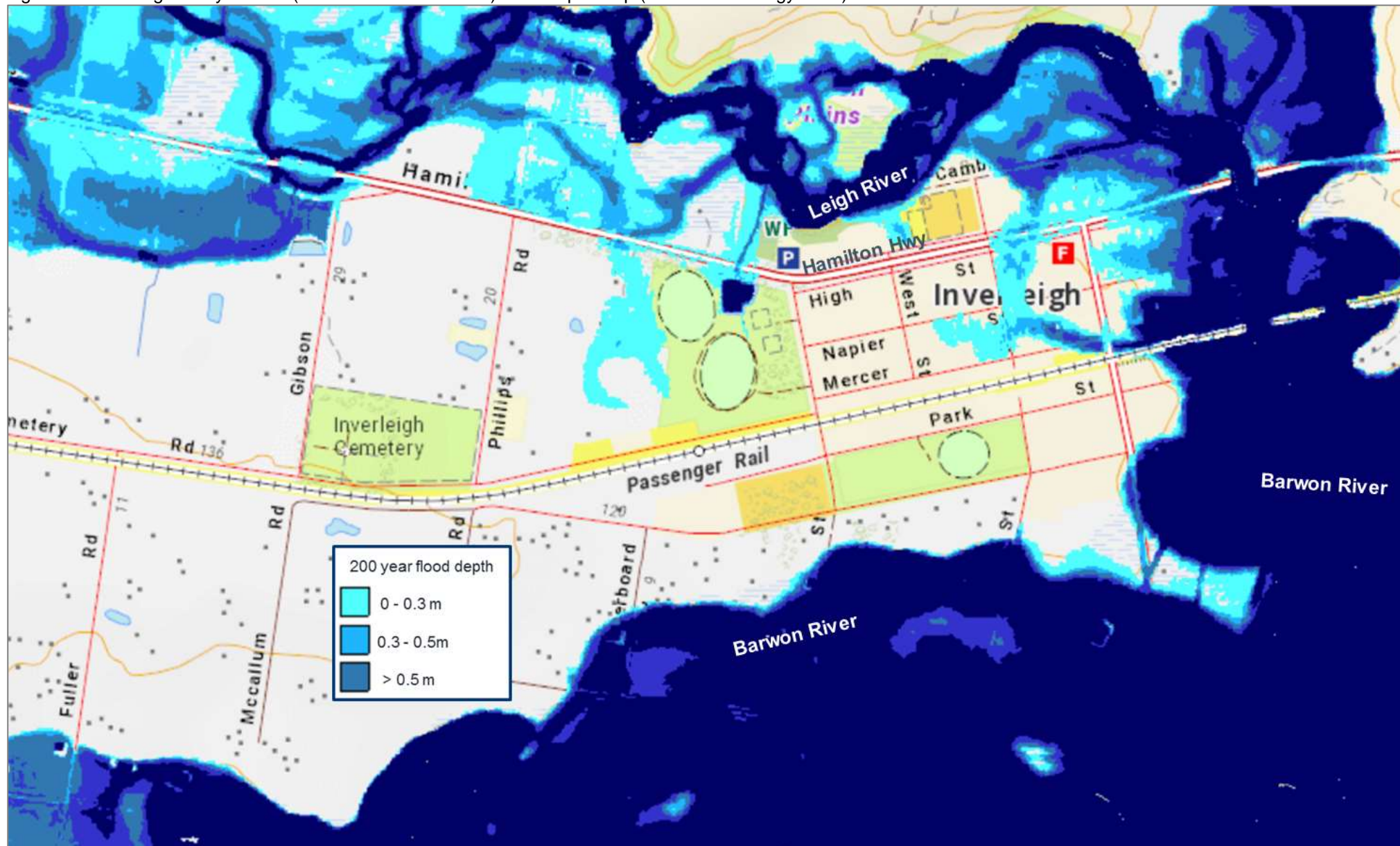


Figure 50. Inverleigh 500 year ARI (Barwon River dominant) flood depth map (Water Technology 2018).

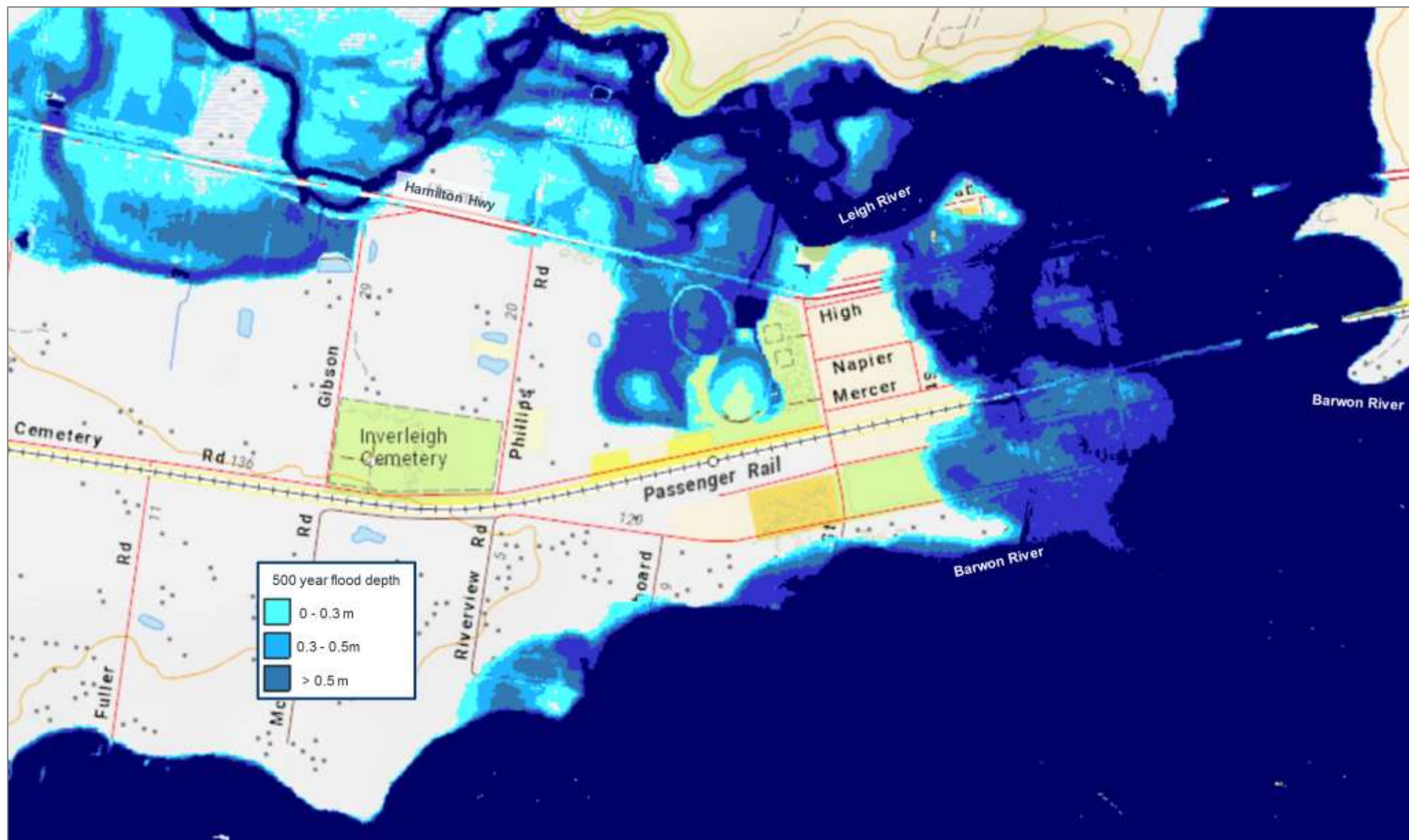




Figure 51. Shelford 5 year ARI flood depth map (DELWP 2016).



Figure 52. Shelford 10 year ARI flood depth map (DELWP 2016).

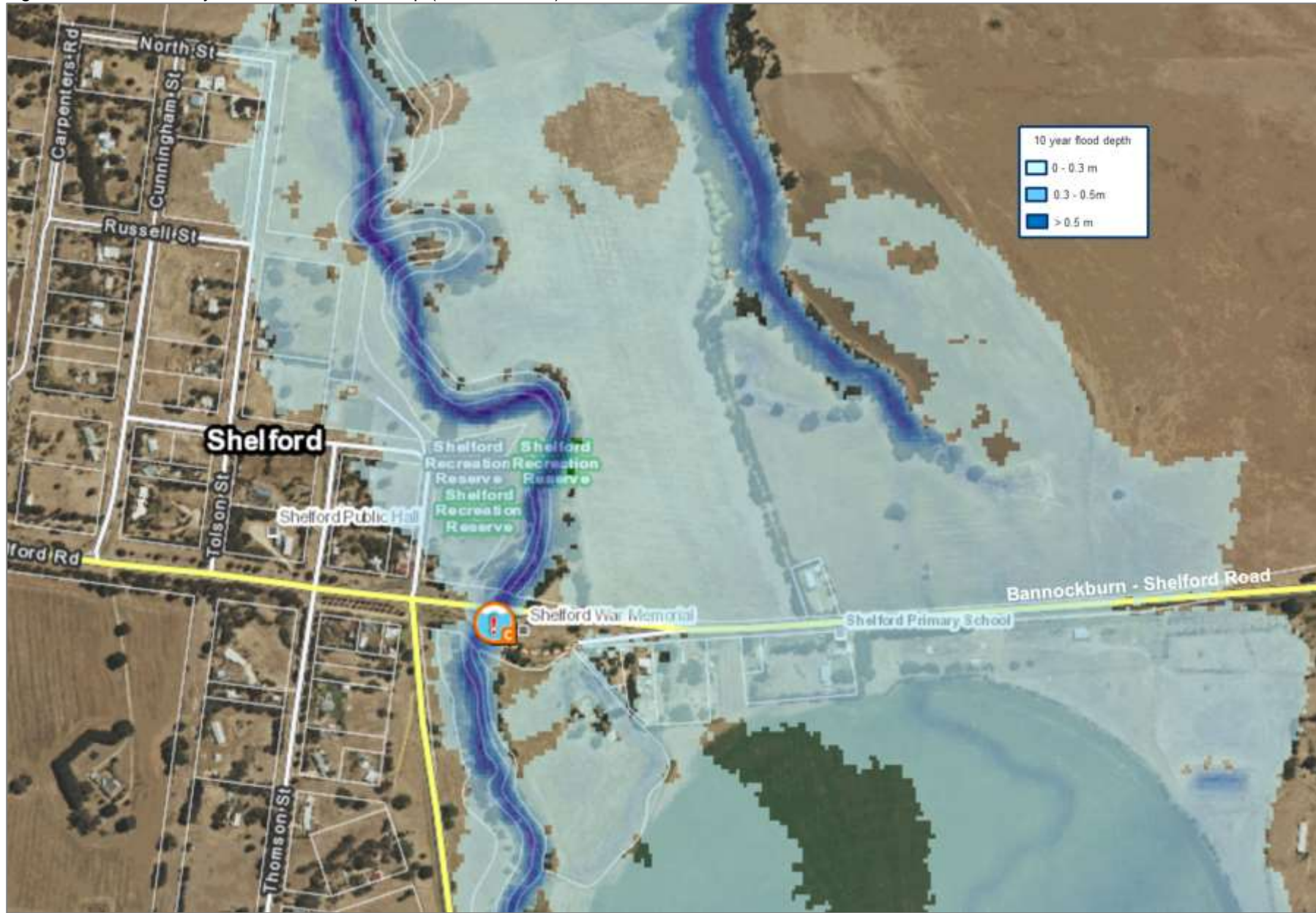




Figure 53. Shelford 20 year ARI flood depth map (DELWP 2016).

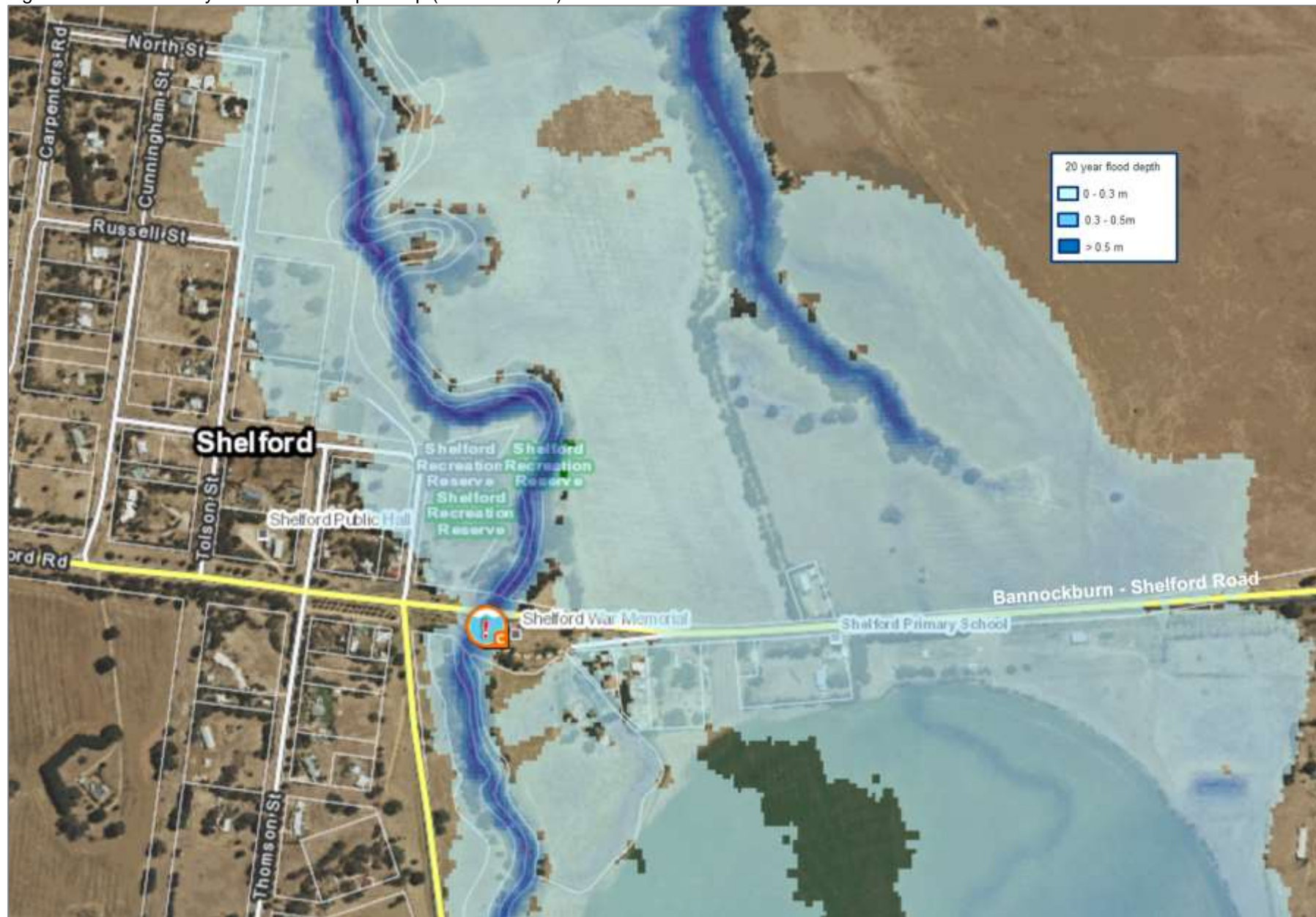


Figure 54. Shelford 50 year ARI flood depth map (DELWP 2016).





Figure 55. Shelford 100 year ARI flood depth map (DELWP 2016).

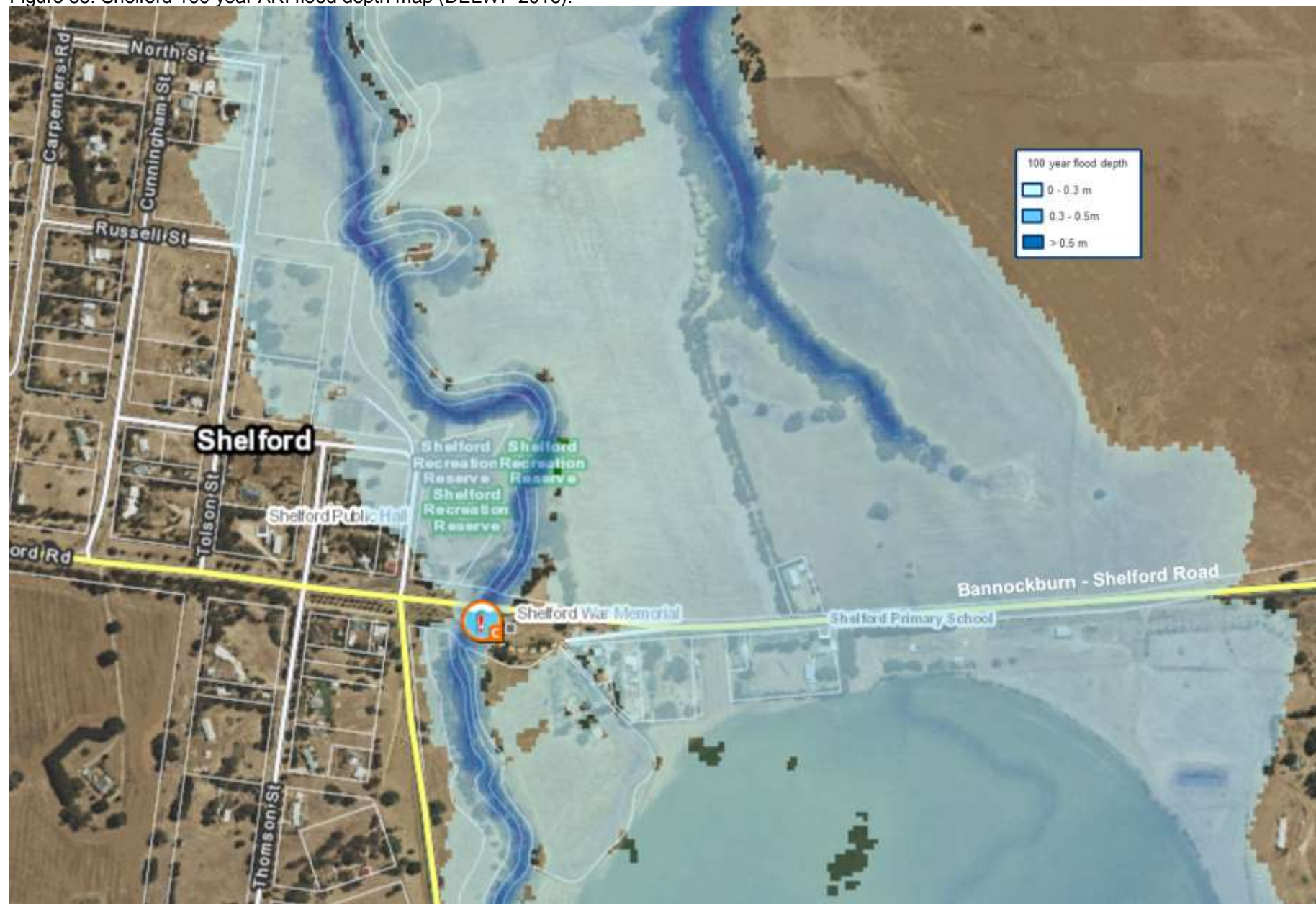
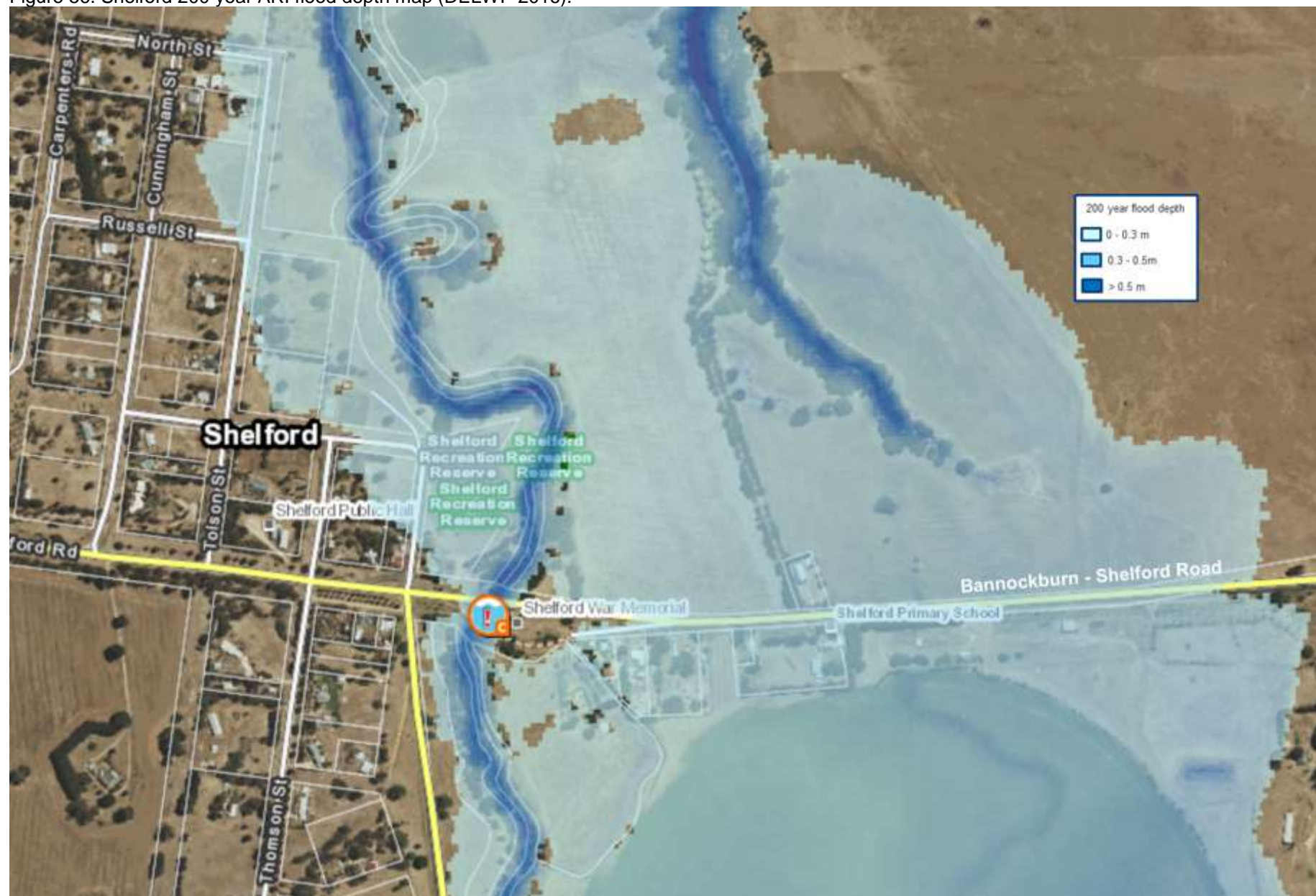


Figure 56. Shelford 200 year ARI flood depth map (DELWP 2016).



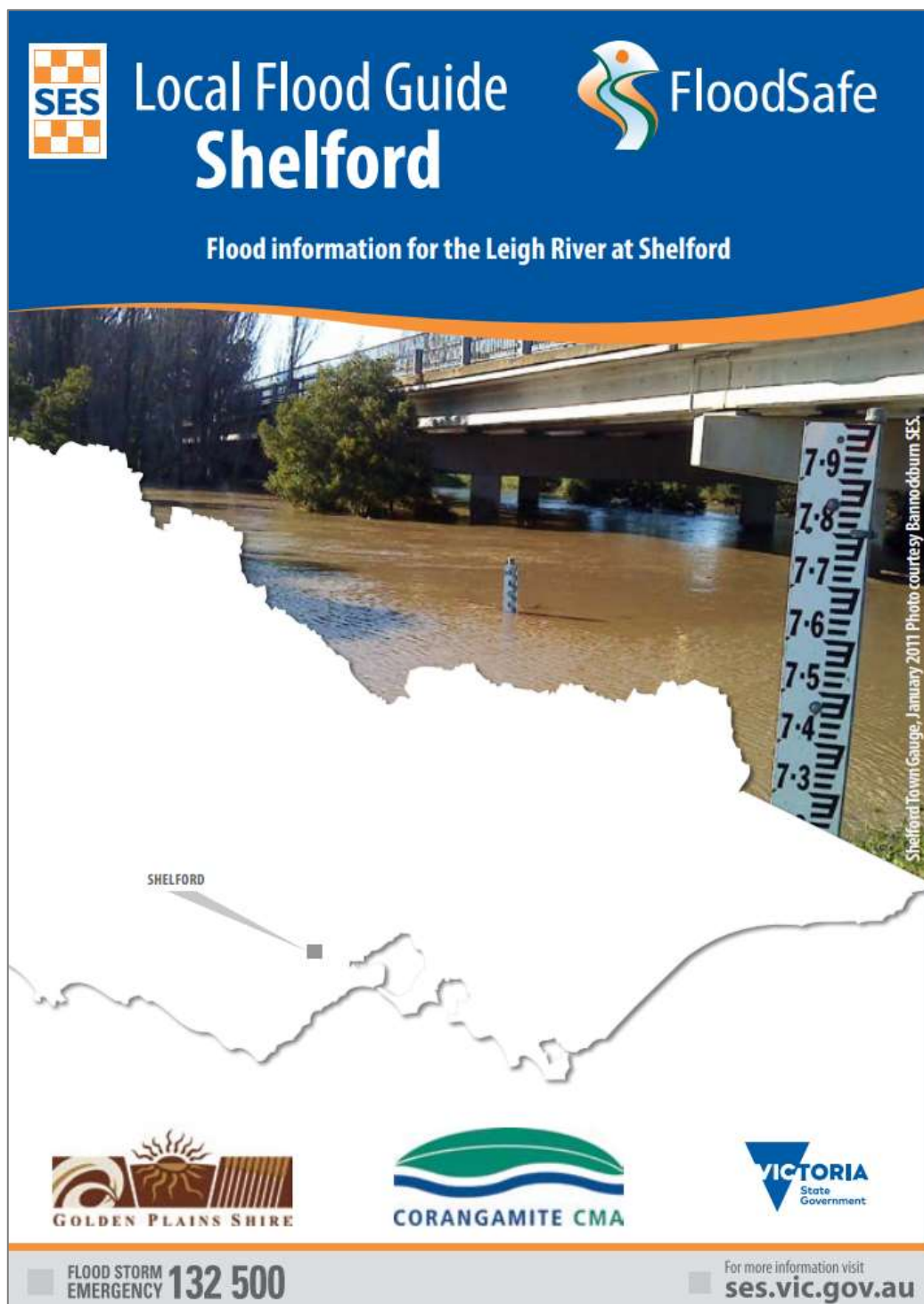


## Appendix G: Local flood information

Two Local Flood Guides have been developed for the Golden Plains Shire Council;

- Refer to the link below for the Shelford Local Flood Guide

<https://www.ses.vic.gov.au/documents/112015/135024/Shelford+Local+Flood+Guide-pdf/3a541497-8896-43b5-b97e-b7d2a9780bcb>



- Refer to the link below for the Inverleigh Local Flood Guide

<https://www.ses.vic.gov.au/documents/112015/135024/2017+-+LFG+-+Inverleigh+14+November+2017-reduced.pdf/9732ca2e-b9e5-e832-6fa8-07567b85bdfc>

**SES** Local Flood Guide **FloodSafe**  
**Inverleigh**

Flood information for the Leigh River at Inverleigh

Inverleigh Hotel, 1952

INVERLEIGH

**GOLDEN PLAINS SHIRE** **CORANGAMITE CMA** **VICTORIA**  
State Government

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



## Appendix H: Local knowledge arrangements

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

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

Refer to table 19 below for the Golden Plains region community flood observers.

Table 19. Golden Plains community flood observers.

Town	Observer Details	Community Observer Name	Contact Details
Inverleigh	VICSES Bannockburn Unit	Nathan Hansford	0409 811 138
Inverleigh	VICSES Bannockburn Unit	Stephen Hicks	0419 009 910
Shelford	VICSES Bannockburn Unit	Michael Boerner	0418 876 434
Shelford	VICSES Bannockburn Unit	Morgana Boerner	0423 383 598

# Appendix I: Golden Plains Community Sandbag Collection Points

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

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

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

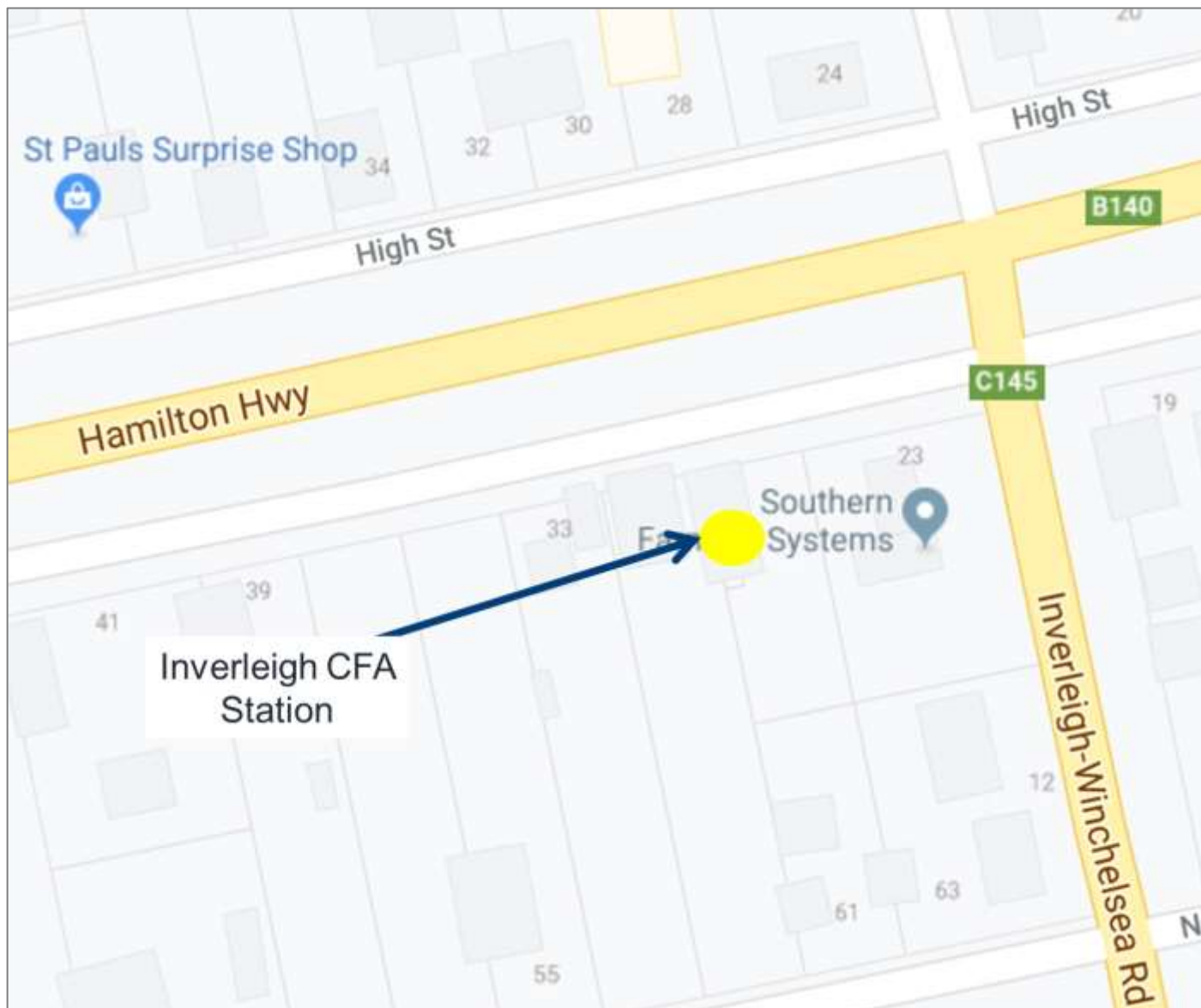
- Inverleigh CFA Station: 27 High Street, Inverleigh.
- Shelford Council Depot: 29 Thomson Street, Shelford.

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

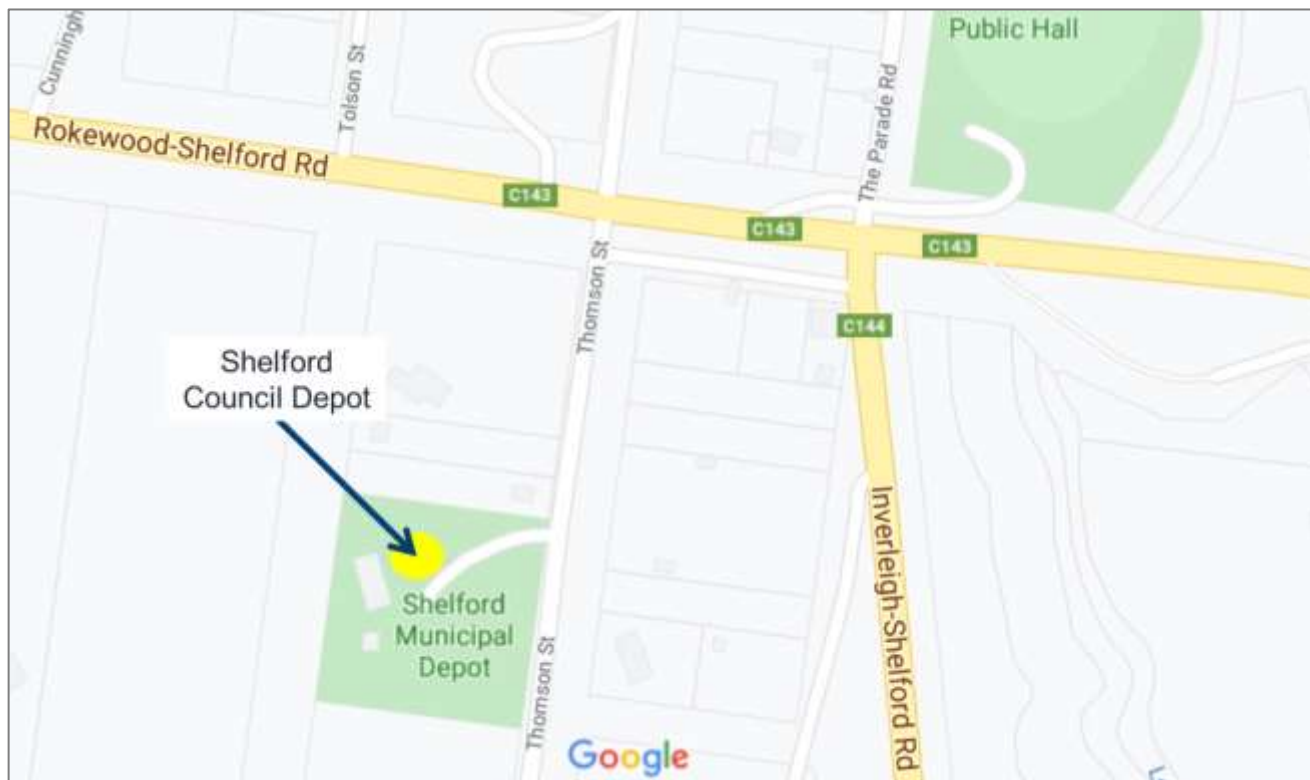
Agency	Task Description
VICSES	Deliver sandbags to the council depot or other nominated sandbag filling point to prefill the sandbags.
Golden Plains Shire	Deliver sand to sandbag filling points documented below.
Golden Plains Shire / VICSES / CFA	Deliver prefilled sandbags either directly to buildings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



**Inverleigh sandbag filling and community collection point:** the Inverleigh CFA Station, 27 High Street, Inverleigh (refer to map below).



**Shelford sandbag filling and community collection point:** the Shelford Council Depot: 29 Thomson Street, Shelford (refer to map below).



## References

Corangamite CMA (2018): Flood Response Guide Report.

DELWP (2016): Barwon River, Thompson Creek and Woody Yaloak Creek Hydrology and Hydraulic Modelling.

DNRE (2000): Golden Plains Shire Flood Data Transfer Mapping Report.

Water Technology (2017): Inverleigh Flood Study Calibration Report.

Water Technology (2018): Inverleigh Flood Study Draft Mitigation Assessment Report.

Water Technology (2018): Inverleigh Flood Study, Flood Warning, Intelligence and Planning Report.

Water Technology (2018): Inverleigh Flood Risk Management Study Report.

Water Technology (2018): Inverleigh Flood Intelligence – Shelford Rating Curve Review.