Gannawarra Shire Council

FLOOD EMERGENCY PLAN

A Sub-Plan of the Municipal Emergency Management Plan

For Gannawarra Shire Council
and the
VICSES Unit Kerang

Version 3.0,
November 2019

As at November 2019

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Distribution of MFEP

Once endorsed and signed the, MFEP should be distributed to all MFEP committee members, MEMPC Chair, council, MERO, Deputy MERO, Representatives from; BoM, CMA, DELWP, Parks Victoria, Ambulance Victoria, VicRoads, DHHS, relevant utilities, MERC, RERC, Police station, VICSES Units, VICSES Regional office, CFA Brigades, CFA Regional office.
It is the responsibility of the agency representative on the MFEPC to arrange distribution of this plan within their agency, distribution to others will be a joint responsibility of the Executive Officer and VICSES representative.

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 northwest@ses.vic.gov.au.

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

Amendment Number	Date of Amendment	Amendment Entered By	Summary of Amendment
1	November 19	Peter Patterson	**A number of minor amendments, new maps and river schematics and transition to new template.**

This Plan will be maintained on the VICSES website at www.ses.vic.gov.au/get-ready/your-local-flood-information and the Gannawarra Shire Council website @ www.gannawarra.vic.gov.au.

List of Abbreviations & Acronyms

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

Part 1. Introduction

1.1 Approval and Endorsement

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

The Gannawarra Shire Council MFPC has undertaken a number of consultations with the following communities in relation to the arrangements within this plan:

- Kerang
- Quambatook
- Murrabit
- Benjeroop
- Lake Charm
- Mystic Park
- Koondrook
- Cohuna
- Leitchville

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

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

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

This Plan is approved by the VICSES Regional Manager.

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

Approval

……

Mr Mark Cattell Date

Loddon Mallee Region VICSES Regional Manager

Endorsement

……..……..

Cr Brian Gibson Date

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 the managing a flood emergency before, during and after it occurs or potentially occurs within Gannawarra Shire Council

As such, the scope of the Plan is to:

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

1.3 Municipal Flood Planning Committee (MFPC)

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

- VICSES (i.e. Unit Controller & Regional Officer – Emergency Management) **(Chair)**,
- Council (i.e. Municipal Emergency Resource Officer)
- Victoria Police (i.e. Municipal Emergency Response Co-ordinator) (MERC),
- North Central Catchment Management Authority (CMA),
- Department of Health and Human Services (DHHS) as required,
- Department of Environment, Land, Water and Planning (DELWP) as required,
- Goulburn, Murray and Lower Murray Water Authorities as required,
- Bureau of Meteorology as required,
- Local community observes who also represent local communities

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 Gannawarra Shire Council and the North Central CMA will coordinate targeted community flood engagement programs within the council area.

Local Flood Guides have been produced for identified at risk areas. Refer to **Appendix I page 95** for the link to the web location for these guides.

Note: These local flood guides are continually being reviewed to ensure they are currently and accurate.

2.2 Structural Flood Mitigation Measures

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

> A large number of levee systems are currently in place within the Gannawarra Shire area some of these systems are strategic (Council controlled) but there is also a significant number of rural levees: Refer to **Appendix C7 page 47**, for detailed information of structural flood mitigation measures and locations of levee systems in the Gannawarra shire.

2.3 Non-structural Flood Mitigation Measures

2.3.1 Exercising the Plan

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

2.3.2 Flood Warning

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

Details on Warnings issued by VICSES through VicEmergency and VICSES channels are outlined in **Appendix E page 57**

2.3.3 Local Knowledge

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

Specific details of arrangements to capture local knowledge are provided in **Appendix G page 81**.

Part 3. DURING: Response arrangements

3.1 Introduction

3.1.1 Activation of Response

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

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

3.1.2 Responsibilities

There are a number of agencies with specific roles that will act in support of VICSES and provide support to the community in the event of a serious flood within the Gannawarra Shire Council. These agencies will be engaged through the EMT.

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

3.1.1 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.

3.1.2 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 Gannawarra 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 list in the table below.

Incident Level	Location	ICC Location	Facility owner	Key contact
3	Epsom	Midland Highway Epsom	DELWP	03 5430 4600
3	Mildura	Cnr Eleventh Street and Coolong Ave	DELWP	03 5051 4336

3.2.4 Divisions and Sectors

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

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

Division	Sector
Kerang Kerang CFA Fire Station, Cnr Fitzroy and Wyndham Streets Kerang	Kerang, Boort, Pyramid Hill, Durham Ox, Cohuna, Serpentine, Koondrook, Lake Charm, Murrabit, Benjeroop, Quambatook
Pyramid Hill	Pyramid Hill, Durham Ox, Boort, Serpentine

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

3.2.5 Incident Management Team (IMT)

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

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

3.2.6 Emergency Management Team (IEMT)

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

Organisations, including the Gannawarra 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 Sever Weather Warning. VICSES RDO (until an incident controller is appointed) or IC will undertake actions as defined within the flood intelligence cards **Appendix C commencing page 25**. General considerations by the IC/VICSES RDO will be as follows:

- Review flood intelligence to assess likely flood consequences
- Monitor weather and flood information – www.bom.gov.au
- Assess Command and Control requirements.
- Review local resources and consider needs for further resources regarding personnel, property protection, flood rescue and air support
- Notify and brief appropriate officers. This includes Regional Control Centre (RCC) (if established), State Control Centre (SCC) (if established), Council, other emergency services through the EMT.
- Assess ICC readiness (including staffing of IMT and IEMT) and open if required
- Ensure flood warnings and community information is prepared and issued to the community where required
  - Flood (Riverine and flash) Warnings are managed by the RDO/RAC
  - Severe Weather/ Thunderstorm warnings are managed by SDO/SAC
- Develop media and public information management strategy
- Monitor watercourses and undertake reconnaissance of low-lying areas
- Ensure flood mitigation works are being checked by owners
- Develop and issue incident action plan, if required
- Develop and issue situation report, if required

3.2.8 On Receipt of the First and Subsequent Flood Warnings

VICSES RDO (until an incident controller is appointed) or IC will undertake actions as defined within the flood intelligence cards **Appendix C commencing page 25.** General considerations by the IC/VICSES RDO will be as follows:

- Develop an appreciation of current flood levels and predicted levels. Are floodwaters, rising, peaking or falling?
- Review flood intelligence to assess likely flood consequences.
- Consider:
  - What areas may be at risk of inundation?
  - What areas may be at risk of isolation?
  - What areas may be at risk of indirect affects as a consequence of power, gas, water, telephone, sewerage, health, transport or emergency service infrastructure interruption?
  - The characteristics of the populations at risk
- Determine what the at-risk community need to know and do as the flood develops.
- Warn the at-risk community including ensuring that an appropriate warning and community information strategy is implemented including details of:
  - The current flood situation
  - Flood predictions
  - What the consequences of predicted levels may be
  - Public safety advice
  - Who to contact for further information
  - Who to contact for emergency assistance
- Liaise with relevant asset owners as appropriate (i.e. water and power utilities)
- Implement response strategies as required based upon flood consequence assessment.
- Continue to monitor the flood situation – www.bom.gov.au/vic/flood/
- Continue to conduct reconnaissance of low-lying areas

3.3 Initial Impact assessment

Initial impact assessments will be conducted in accordance with Part 3 section 5.2.5 of the EMMV to assess and record the extent and nature of damage caused by flooding. This information may then be used to provide the basis for further needs assessment and recovery planning by DHHS and recovery agencies.

3.4 Preliminary Deployments

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

3.5 Response to Flash Flooding

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

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

1. Determine if there are barriers to evacuation by considering warning time, safe routes, resources available and etc;

2. If evacuation is possible, then evacuation should be the adopted strategy and it must be supported by a public information capability and a rescue contingency plan;

3. Where it is likely people will become trapped by floodwaters due to limited evacuation options safety advice needs to be provided to people at risk. Advise 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 Gannawarra 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 A2, page 18** for information regarding 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 D page 52, and the Gannawarra Shire 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 Gannawarra Shire to assist with rescue operations:

- 2 x Rescue Boats @ the Kerang VICSES Unit.

Known high-risk areas/communities (i.e. low-lying islands) where rescues might be required include: **Note this area is still under development.**

NOTE: There are no specialised Swift Water Rescue resources within the Gannawarra municipality. Should these resources be required they will need to be accessed through the ICC/VICSES Regional Duty Officer.

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:

- Kerang Aerodrome, Airport Road Kerang
- Cohuna Airstrip, Chuggs Road Cohuna
- Kerang Hospital Heliport

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 Gannawarra Shire maintains a stock of sandbags, and back-up supplies are available through the VICSES Regional Headquarters. The IC will determine the priorities related the use of sandbags, which will be consistent with the strategic priorities.

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

Property may be protected by:

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

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

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

Maps of sand and sandbag community collection location can be found in **Appendix F, page 78 to 80** (figures F16 to F20).

Refer to **Appendix C, page 51** for further specific details of essential infrastructure which may require protection.

3.11 Disruption to Services

Disruption to services other than essential community infrastructure and property can occur in flood events. Refer to **Appendix C, page 51** for specific details of likely disruption to services and proposed arrangements to respond to service disruptions in Gannawarra Shire

3.12 Road/Rail Closures

Gannawarra Shire, VicRoads and VicTrack will carry out their formal functions of road/rail closures including observation and placement of warning signs, road blocks etc. to its designated local and regional roads, bridges, walking and bike trails. Gannawarra Shire staff should also liaise with and advise VicRoads as to the need or advisability of erecting warning signs and / or of closing roads and bridges under its jurisdiction. VicRoads are responsible for designated main roads and highways and councils are responsible for the designated local and regional road network. VicTrack are responsible for the rail infrastructure within the shire

VICROADS/VicTrack and the Gannawarra Shire will communicate community information regarding road/rail closures. Information will be updated on the VIC Traffic website: https://traffic.vicroads.vic.gov.au/

Refer to **Appendix C, page 51** for potential road/rail 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.

There are no major dams located in the Gannawarra municipality. There is a large lake system within the municipality but most of these do not have significant banks or structures that would be affected by a flooding event. The structures and regulators such as Kow Swamp Box Creek outlet, on the lakes and waterways are the responsibility of Goulburn Murray Water.

A number of significant water storages are located within the Loddon basin, all outside the Gannawarra municipality. The most downstream dam is at Laanecoorie Reservoir.

Torrumbarry Weir is also outside the Shire. However, flooding resulting from failure of either of these two dams is likely to cause significant structural and community damage within Gannawarra municipality.

Location	Owner and Operator	Primary Embankment Height (m)	Dam Capacity at FSL (ML)	FSL (m AHD)	Comments
Laanecoorie Reservoir	G-MW	22	7,980	160.21	Fixed crest thus at FSL inflow = outflow
Torrumbarry Weir	MDBA G-MW	5	36,810	86.05	At minor flood flow and above, the aim is to maintain outflow = inflow and for the weir to have minimal impact on flows.
Cairn Curran	G-MW		147,130	208.46	

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 Gannawarra 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

VICSSES 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 Gannawarra Shire is detailed in the [Gannawarra Shire Council MEMP and the Recovery Sub-plan.

4.2 Emergency Relief

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

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

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

Details of the relief arrangements are available in the MEMP.

4.3 Animal Welfare

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

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

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

Refer to **Appendix D page 55** for animal shelter compound locations.

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.

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Appendix A1: - Flood threats for the Gannawarra Shire

1. General

The Gannawarra municipality is located at the southern end of the Murray Darling Basin on the alluvial floodplains of three major rivers; the Murray, Loddon and Avoca. The Murray forms the north and part of the eastern boundary of the municipality while the Avoca and Loddon flow into the Murray near the northwest corner. The floodplains of the Avoca and Loddon are wide and complex with numerous tributaries, effluent streams, storages and levees. Superimposed on this is the Torrumbarry Irrigation System which comprises numerous channels, off-takes, flow control structures and salinity mitigation works.

The main watercourses and water bodies include the:

- Lower Loddon River;
- Lower Avoca River
- Little Murray River (short section only);
- Murray River;
- Pyramid Creek;
- Barr Creek;
- Bannacher Creek;
- Wandella Creek;
- Calivil, Nine Mile & Bullock Creeks;
- Sheepwash Creek and the Kerang Lakes;
- Lalbert Creek, Mosquito Creek and Back Creek;
- Kow Swamp; and
- Many irrigation and drainage channels.

2. Overview of Flooding

The town's most at risk of flooding within the Municipality are generally protected by rural levees this includes the locations of; Benjeroop, Murrabit, Cohuna, Koondrook, Leitchville and Quambatook. Kerang is also at risk but is protected by a strategic township levee this offers protection to the 1% AEP (1 in 100 years ARI) flood standard, with up to 600 mm freeboard. A map detailing the location of the levee and scope of protection can be found in **Appendix F, pages 71 & 72.Figures F9 & F10,**

Large areas of rural land on either side of the Loddon River downstream from Laanecoorie Reservoir and particularly downstream from Kerang through Benjeroop to the Little Murray River and Pental Island are subject to flooding, similarly, along the lower Avoca River and through the Avoca Marshes.

From a flooding perspective, the Loddon River dominates. Floodplain gradients are low, the drainage patterns are complex and water courses are poorly defined. Flood waters move slowly, are generally relatively shallow and extensive (i.e. widespread) with the main flow distributed between interconnected depressions. The peak flows at Laanecoorie Reservoir can be used as a guide to determine the potential impacts downstream of Serpentine, however caution must be applied as the relationship is not strong. Antecedent conditions as discussed below impact the timing, volume and peak flood level.

Flooding characteristics across the lower Avoca floodplain are similar.

Because of the very large storage capacity and effluent distribution characteristics within the Loddon floodplain, the impact of a flood must be considered both in terms of flood peak and flood volume. Flooding will be caused by large flood volumes occurring as one large single flood or a succession of moderate floods. The significance of a given flood is complicated by antecedent conditions (how wet the catchment is) and the density of crops and pasture on the floodplain and the level of vegetation and debris in the drainage levies prior to the flood[1]. These factors are also a significant consideration for the Lower Avoca River floodplain.

Note that a large Murray flood upstream from Barmah is not indicative of future Murray flooding within the Shire. This is because the Barmah Choke restricts Murray River flows past Barmah to around 35,000 ML/d with the balance being forced northwards into NSW along the Edwards River. Flooding through Torrumbarry Weir and downstream to Swan Hill is therefore very much dependent on the magnitude of flows coming from the Goulburn River and Campaspe Rivers and, to a much lesser extent, from the Broken Creek. On the Victorian side, the Murray River is confined by levees and G-MW irrigation supply channels. The levees are not formally maintained and have the potential to either breach or overtop during a large flood. Most of the levees are low as they are located on relatively high ground close to the Murray River. Further, downstream from Torrumbarry Weir, the myriad of effluent streams, swamps and waterways on the New South Wales side of the river, provide a natural relief valve for high flows. Much of this water re-joins the Murray via the Edwards and Wakool River systems 120 or so river kilometres downstream from Swan Hill.

Refer to Appendix C6 for a history of notable flood events within the Municipality.

3. Riverine Flooding

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

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

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

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

Water level rises through the Municipality usually occur sometime after the rain that caused the flooding has passed. Typically, initial rises occur 3 or more days after rain with the peak following a few days later. Rises in the Murray River tend to be more delayed and are driven by flows from the Campaspe and Goulburn Rivers.

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

[1] *This is demonstrated by the 1973, 1974 and 1975 floods which all had major impacts downstream from Kerang but which were not particularly large at Laanecoorie.*

Appendix A2: - Flash Flood & Overland Flow

1. Flash Flooding and Overland Flows

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

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

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

Drainage Hot Spots within the Shire – areas that have a high risk of flooding during heavy rain events

Map references are Spatial Visions Map Book North West Region (3rd edition)

Still under development as information is needed to confirm arrangements with council, including what actually happens and what if anything needs to be done

Town & Street Name	Map Reference	Location
Corner Mitchell Street and Boundary Street	8424 E 10	KERANG
Corner Murray Street and Wyndham Street	8424 D 7	KERANG
Corner East Street and Murrabit Road	8424 E 4	KERANG
Corner Victoria Street and Ninth Street	8424 F 4	KERANG
Corner Cleeland Place and Ninth Street	8424 D 4	KERANG
Corner Lilac Avenue and Taverner Court	8424 F 5	KERANG
Mokana Street End	8424 F 9	KERANG
McCann Crescent	8424 G 5	KERANG
Forest Street	8245 F 10	KOONDROOK

Refer to Appendix G, page 76 Figure G12 for a plan of the drainage system and the drainage hot spots listed above.

Appendix A3: - Major Waterways and Drains

1. Description of Major Waterways and Drains

The **Murray River** forms the northern boundary of the municipality and as such flooding from the Murray River is restricted to those towns bounding the river including Koondrook, Murrabit and to a lesser extent Cohuna and major flooding upstream of Barmah is not indicative of flooding of the shire from the Murray River. This is because the Barmah Choke restricts Murray River flows past Barmah to around 35,000 ML/d with the balance being forced northwards into NSW along the Edwards River. Flooding through Torrumbarry Weir and downstream to Swan Hill is therefore very much dependent on the magnitude of flows coming from the Goulburn River and Campaspe Rivers and, to a much lesser extent, from the Broken Creek. On the Victorian side, the Murray River is confined by levees and G-MW irrigation supply channels. The levees are not formally maintained and have the potential to either breach or overtop during a large flood. Most of the levees are low as they are located on relatively high ground close to the Murray River. Further, downstream from Torrumbarry Weir, the myriad of effluent streams, swamps and waterways on the New South Wales side of the river, provide a natural relief valve for high flows. Much of this water re-joins the Murray via the Edwards and Wakool River systems 120 or so river kilometres downstream from Swan Hill.

The **Loddon River** rises upstream of Laanecoorie Reservoir on the northern slopes of the Great Dividing Range, enters the municipality upstream of Appin South and joins the Murray River via the Little Murray River at the eastern end of Pental Island near Swan Hill. Around Serpentine, the Loddon floodplain widens and flattens to become a complex leveed and braided system of effluent watercourses. These watercourses include **Serpentine Creek**, **Bannacher Creek**, **Twelve Mile Creek** and **Nine Mile Creek** on the east side and **Kinypanial Creek**, **Venables / Johnsons Creek** and **Wandella Creek** on the west side. To the north of, and downstream from Kerang, are the Kerang Lakes and the lower reaches of Barr Creek.

Effluent flows/watercourses are waterways that carry water that break away from the main river. Effluent flows to the western side of the Loddon generally do not return to the river and experience considerable attenuation in the natural lake systems of Boort, Lyndger, Yando, Leaghur and Meran and the adjacent State Forests. In contrast, the eastern effluent flows are into relatively steeper slopes (because they have been modified and deepened to provide drainage to the surrounding land) and enter an extensive and interconnected drainage system made up of Serpentine Creek, Bannacher Creek, Nine Mile Creek and other effluent watercourses that either drain directly back into the Loddon River or into Pyramid Creek.

Wandella Creek is the eventual recipient of all western effluent overflows and flows through to the Kerang Lakes.

Effluent flows along the Loddon River commence around 10km upstream of Serpentine and result in a peak flow reduction of at least 20%. This reduction increases downstream to Kerang although the effect is substantially reduced if a second flood arrives while the floodplain is still “wet” from the first flood, as occurred in August 1981 and in January 2011.

Note that flood flows that enter the Kerang Weir pool pass uncontrolled into the Loddon River and the Sheepwash Creek over low fixed crest weirs. Only flows into the Washpen Creek can be regulated at Washpen Creek.

The **Pyramid Creek** / **Bendigo Creek**[2] / **Bullock Creek** system drains the extensive eastern part of the Loddon basin. Bullock Creek, Bendigo Creek and tributary Myers Creek rise in the hills around Bendigo. The Bendigo Creek (*Mt Hope Creek*) enters Kow Swamp to the South at Normans Bridge before passing via the Box Creek Regulator to Box Creek. The Box Creek becomes the Pyramid Creek at the junction of Bullock and Box Creek immediately upstream of Flannery's Flume on the No2 channel and joins below Kow Swamp to become Pyramid Creek which enters the Loddon River just below (to the north of) Kerang.

Pyramid Creek has been remodelled to act as a water supply carrier and its capacity has been considerably enlarged. This enlargement together with the levees along much of its length (up to about the 5% AEP (1 in 20 year ARI) flood except near the confluences with Bullock and Calivil Creeks) has reduced the risk of breakaway flows into most of the natural overflow paths to the north and south. Breakaways to the south run into **Piccaninny Creek** which returns to Pyramid Creek while breakaways to the north enter **Barr Creek**. Pyramid Creek overflowed to the north during the 1973 and 1974 floods near the Calivil Drain depression, opposite the Nine Mile Creek confluence. The creek also overflowed in the January 2011 flood.

Calivil Creek drains the Calivil Plains area between the Loddon floodplain and Bullock Creek and is joined by the Nine Mile Creek upstream of its confluence with Pyramid Creek.

Land gradients around the **Calivil, Nine Mile and Bullock Creeks** are low, the drainage patterns are complex and water courses poorly defined. Generally flooding is shallow and widespread with flood waters being distributed between a number of interconnected depressions.

Barr Creek drains the riverine plains between Pyramid Creek and the Murray River, joining with the Loddon River 35km downstream of the Pyramid Creek confluence.

The **Avoca River** has a long narrow catchment to the west of the Loddon and is subject to similar flood producing mechanisms. The Avoca flows into a series of retarding lakes and floodway's to the south of Quambatook. The effluent stream systems of **Lalbert Creek** and **Tyrrell Creek** restrict the flow that reaches the Avoca Marshes. The Avoca River passes adjacent to the township of Quambatook, which until recently was protected by low level levees. At the time this protected the town from small flood events.

During 2019 extensive works have been carried out to construct a permanent strategic levee to protect the township of Quambatook. This levee has been designed to 600mm above the 1%, and a map showing the location of the levee is contained in **Appendix F, page 77 Figure F 15**.

Within the Shire, flooding is generally widespread and shallow along the **Avoca River** and **Lalbert and Back Creeks**.

Back Creek, a breakaway from the Avoca River, passes near the north-western outskirts of Quambatook but there is no record of it affecting the town.

During high flows and when the Avoca Marshes are full, the Avoca flows through the **Avoca Outfall** to Lake Boga via the Avoca Floodway. The major problems in this area relate to the difficulty of discharging flood waters from the Avoca Marshes and Kangaroo Lake through Lake Boga and the 6/7 Channel into the Little Murray River. If the Loddon and Murray river flows have elevated water levels in the Little Murray River the latter becomes impossible.

Gunbower Creek, an anabranch of the Murray River, is used by G-MW as part of the Torrumbarry Irrigation System. **Gunbower Creek** is connected to **Kow Swamp** via **Taylors Creek. Gunbower Creek** flows from Gunbower and through Cohuna to Koondrook, with flows being returned to the **Murray River** at Koondrook or diverted for irrigation along the way. Due to G-MW regulatory works the risk of flooding is low. However, failure of levees on the Victorian side of the Murray River,

[2] *From just north of Dingee to Kow Swamp, Bendigo Creek is also been known as both Mt Hope Creek and Piccaninny Creek.*

particularly, particularly upstream of the **National Channel**, would cause widespread flooding and threaten the townships of Cohuna and Leitchville.

Taylors Creek flows from **Gunbower Creek / National Channel** at Gunbower to Kow Swamp. This is also part par the G-MW irrigation system and regulated, via National Channel and Taylors Creek Regulator.

On **Gunbower Island**, floodwaters are prevented from leaving the State Forest by levees constructed predominantly in the forest near the boundary of the freehold land. These levees are not formally maintained and have the potential to overtop during large floods. The levee banks play an important role in protecting alienated land on Gunbower Island.

2. Flood Inundation Mapping and Floor Levels

For areas of the municipality not covered by detailed flood maps, the Gannawarra Planning Scheme shows areas along the waterways within the municipality hire likely to be inundated by a 1% AEP (100-year ARI) flood event as Land Subject to Inundation Overlay (LSIO). While it is not practical to reproduce the overlay as an attachment to this Plan, hard copies are available from Gannawarra Shire Council offices. They are also available as PDF digital copies on the Gannawarra Shire Council website www.gannawarra.vic.gov.au or,
Via Floodzoom for registered users @: https://www.floodzoom.vic.gov.au

Appendix B1: - Loddon River, Typical flood peak travel times

In using the information contained in these Appendices, consideration needs to be given to the time of travel of the flood peak. A flood on a 'dry' waterway will generally travel more slowly than a flood on a 'wet' waterway (eg. the first flood after a dry period will travel more slowly than the second flood in a series of floods). Hence, recent flood history, soil moisture and forecast weather conditions all need to be considered when using the following information to direct flood response activities. The amount of debris and vegetation and volume of water in the systems at the time will impact on travel times. This is more relevant to the Loddon and the Avoca Rivers – and impacts on roads and infrastructure.

Note that flooding will start some time ahead of the time indicated by the following travel times – these are the time between the flood peaks at respective sites.

Location From	Location To	Typical Travel Time (approx)	Comments
Laanecoorie Reservoir	Appin South	65 to 120 hours	Time of travel will vary depending on river conditions, i.e. if the river is already in flood time would be ≥ 65 hours compared to a low river ≤ 120 hours.
Laanecoorie Reservoir	Kerang	5 Days (January 2011 event)	Flow time could be affected as above
Laanecoorie Reservoir	Fish Point	11 Days (January 2011 event)	The flows downstream of Kerang can be attenuated by inflows in to the lake systems; this can be controlled by GMW. Should this occur it has to potential to cause a significant issue in Middle Lake which is an Ibis rookery and a RAMSAR sight. These flows are around 10 meg per day, in and out with out causing a significant problem to the rookery. Outlying areas of Murrabit are also affected by overland flows. In a significant event the Benjeroop community can be significantly impacted due to levees overtopping.
Appin South	Kerang	36 hrs January 2011 145 hrs December 2010 71 hrs September 1993	Big flood on wet river. Medium flood on dry river

Approximate travel times can also be found on each of the river schematics Appendix F.

Appendix B2: - Avoca River, Typical flood peak travel times

Location From	Location To	Typical Travel Time (approx)	Comments
Charlton Down Stream	Quambatook	4 Days	Prior to reaching Quambatook the Avoca breaks out into a number of overland flows including significant inflows into both the Tyrell and Lalbert Creek systems.
Quambatook	The Marshes	u/k	

Approximate travel times can also be found on each of the river schematics Appendix F

Appendix B3: - Murray River, Typical flood peak travel times

Location From	Location To	Typical Travel Time (approx)	Comments
Echuca Wharf	Torrumbarry Weir	≥12 hrs	Travel times do not vary significantly
Echuca Wharf	Barham/Koondrook	7 to 10 Days	
Torrumbarry Weir	Barham/Koondrook	2 Days	
Barham/Koondrook	Swan Hill	2 to 3 Days	

Approximate travel times can also be found on each of the river schematics Appendix F

Appendix C1: - Kerang Community Flood Emergency Plan

1. Overview

Kerang is protected from flooding from the Loddon River and Pyramid Creek up to a 1% AEP (1 in 100 years ARI) Loddon River flood with freeboard allowance. The surrounding area including all access roads are however inundated for a considerable time during large floods (eg. January 2011).

2. Overview of Flooding Consequences

2.1 Warning times

Flood warning times for Kerang are in the order of 5 days or more. Bigger floods generally have less warning time.

2.2 Areas affected

The floodplain outside the Kerang Township Protection Levee is affected by floods. This includes many rural properties as well as roads and other infrastructure. During larger floods (eg. bigger than around 5% AEP (1 in 20 year ARI) event), rural levees are likely to be overtopped and / or breached resulting in the inundation of a large area.

During the January 2011 event the existing Kerang Township Protection Levee was not overtopped or compromised. Flood waters remained for an extended period – weeks rather than days.

2.3 Properties affected

Houses outside the Kerang Township Protection Levee are not protected from flooding. The number of houses inundated could be substantial as the floodplain does not offer many opportunities to build above flood level.

In the 2011 flood event, 144 houses in the municipality were reported as damaged due to the flooding. Of these, 103 houses were inundated. Houses were classified as inundated if they had water above floor board. Damaged houses were houses which had required repairs as a direct result of the flood water surrounding or being underneath the house. A number of commercial buildings such as dairies and piggeries were directly impacted by the flood as was a large area of farmland which was inundated.

2.4 Isolation

Properties start to become isolated to the north and south of Kerang for events equal to or greater than the 20% AEP (1 in 5 year ARI) event (ie. around 77.20m AHD on the gauge).

Significant isolation occurs when the Murray Valley Highway, Loddon Valley Highway, Koondrook Road and the Kerang Quambatook Road are all closed. This occurred in January 2011. The township of Kerang was totally isolated for a number of days and for the following weeks some access routes into Kerang were inaccessible. The landing strip at the Kerang Aerodrome remained serviceable as it is located within the township protection levee.

2.5 Critical infrastructure

The Kerang electricity substation is located outside the township protection levee and was not flooded in January 2011. This was due to the extensive works being undertaken by emergency services and community organisations to construct a temporary levee around the site. In future this facility is unlikely to be inundated as significant structural mitigation work has been undertaken to provide protection to 600 mm above the 1% AEP.

3. Flood Mitigation

3.1 Kerang Township Protection Levee

The township protection levee at Kerang was constructed between 1980 and 1987 as part of a formal Flood Mitigation Scheme and is managed and routinely maintained by Council.

In 2013 the Kerang Township Protection Levee Upgrade project was completed. The project saw the construction of permanent levee on three sections of roads (Murray Valley and Loddon Valley Highways; Kerang Murrabit Road; and Lower Loddon Road) surrounding the Kerang township. Works included:-

- Construction of a levee adjacent to the Murray Valley and Loddon Valley Highways to connect to existing levees on Sleepy Lane;
- Construction of a levee adjacent to the Ibis Caravan Park; and
- Raising of the Lower Loddon and Murrabit Roads to fill in the gaps in the existing levee bank system.

The Kerang Township Protection Levee now has a total length of approximate 18km with the levee having a freeboard of between 530mm and 950mm.

The township protection levee is generally located on crown land, road reserve or freehold land, although there are some sections with no rights at all. Parts of the levee are up to 3m high. Other parts are public roadway including Hayman Lane.

The Kerang township protection levee is designed to provide protection from a 1% AEP (1 in 100 years ARI) Loddon River flood with between 600mm and 800mm freeboard. However, the following summary (extracted from the 1998 levee audit report) shows that some sections of the levee have less than the design freeboard, though generally there is at least 600mm of freeboard available. Note that there is a 300mm layer of rock ballast under the rail track which would be permeable giving an effective freeboard of 410mm.

As the flood water rises, drains, channels and culverts need to be blocked by closing flap gates and in a major flood event. Sandbags or an earthen bund is required to be placed across the Kerang to Bendigo rail line on the southern levee

An Operations and Maintenance Manual has been prepared by Council for the Township Protection Levee. The manual outlines appropriate triggers for closing gate valves on stormwater drains and channels and blocking culverts including GMW drains, and the drainage culverts near on the railway line on the Murray Valley Hwy. A copy of the manual is available from Council.

The following summary of the strategic levees that exist within the Council area:

Section No	Section Length (m)	Running Distance (m)	Section	Section Starts	Section Ends	Minimum freeboard (m)	Total design freeboard (m)
1	1885	00 to 1885	Back Swamp	Murray Valley Hwy (Twin Bridges)	148m past end of Ninth Street along railway line	0.70	0.95
2	1570	1885 to 3455	Ninth Street	148m past end of Ninth Street along railway line	Lower Loddon Road	0.71	0.95
3	1938	2455 to 5393	Northern Levee	Lower Loddon Road	Corner Kerang Murrabit Road and Haymans Lane	0.84	0.95
4	1098	5393 to 6491	Haymans Lane	Corner Kerang Murrabit Road and Haymans Lane	1.1kms down Haymans Lane	0.70	0.95
5	3332	6491 to 9823	Fosters Swamp	Haymans Lane	Kerang Koondrook Road	0.65	0.95
6	1880	9823 to 11703	Sleepy Lane	Corner Kerang Koondrook Road and Sleepy Lane	Corner Sleepy Lane and Murray Valley Highway	0.53	0.53
7	1830	11703 to 13533	Southern Levee	Corner Sleepy Lane and Murray Valley Highway	Loddon Valley Highway		
8	3884	13533 to 17417	Collins Road	Loddon Valley Highway	GMW outfall at end of access track opposite Leng St		
9	1155	17417 to 18572	Murphy Street	End of access track off Collins Road	Murray Valley Hwy (Twin Bridges)	0.30	0.70

3.2 Kerang Rural Levees

On the western side of the Loddon River, south west of Kerang a rural levee has been constructed on private property to contain flood flows within the Loddon River from events up to approximately the 30 year ARI. However, in larger flood events such as the January 2011, this levee overtops to provide a natural relief and ensure that the Kerang Township Protection Levee continues to provide a 100 year ARI level of protection. The rural levee extends from Taverners Road through to the Murray Valley Highway. In events greater than the 30 year ARI (marginally greater than the Nov 2011 flood event), a number of properties become isolated and floor levels may become inundated.

4. Flood Impacts and Required Actions

Refer to following action table (page 29). Note that users of the action table should be careful to use levels from the Murray Valley Highway Bridge gauge and not the Kerang Weir gauge. Failure to observe this difference will result in substantial underestimation of likely impacts.

5. Control, Command and Coordination

The Control, Command and Coordination arrangements in the Gannawarra Municipal Flood Emergency Plan are as detailed in the Emergency Management Manual Victoria (EMMV).

All flood response activities within the Shire of Gannawarra will be under the Control of the Incident Controller.

An incident Emergency Management Team (EMT) may be established by the Incident Controller in accordance with the Emergency Management Manual Victoria.

The local response in Kerang will initially be managed by the VICSES Kerang Unit while it is a manageable incident. Once the magnitude of the flood event is predicted to increase, local incident control shall be conducted from predetermined Incident Control Centres (ICCs) in Swan Hill and commanded by an Incident Controller. It will operate in accordance with VICSES arrangements. During significant events, VICSES will conduct incident management using multi-agency resources.

The Incident Controller will ensure that control is exercised at the lowest effective level. For the local response in Kerang, the Incident Commander may establish a Kerang Division Command Point functioning from the CFA Brigade facility with Sectors established in relevant locations for a targeted response. The Incident Controller in the ICC and the Division Commander in the Division Command Point will ensure that local knowledge is incorporated through the role of Local Information Officer embedded in the Division Command to ensure an effective and informed response.

Refer to the VICSES Local Knowledge Policy

Photo above: Kerang Power Sub-station, Jan 2011 (photo courtesy Gannawarra Shire Council

6 Gauge Location: Loddon River at Kerang (Murray Valley Highway Bridge)

Flood impacts described in the following tables relate primarily to riverine flooding. It should be noted that local impacts or impacts in excess of those indicated, may occur as a result of local stormwater runoff and drainage and / or be attributable to flooding emanating from tributary streams. Similarly, local increases in flood levels and impacts may result from local factors such as blockages at bridges and culverts and from obstructions to overland flows such as works, channels, fences, buildings and the like.

River Height (m) and / or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Actions in consultation with ICC
75.65m AHD		Sheepwash Creek commences to run	➢ Landowners notified
77.00m AHD	**Minor Flood Level** 25% AEP (4 year ARI)		➢ VICSES to activate flood warning system and advise organisations that flood warnings have been issued – if not already done. ➢ VICSES to commence community information and warning program. ➢ Council staff to initiate routine inspections of the Kerang Township Protection Levee. Need to pay particular attention to the older sections of levee which weep. ➢ Council to prepare information for website, recorded telephone message and Customer Service Centres. ➢ Local Information Officers downstream from Kerang to initiate routine inspections of levees. ➢ GMW to close flood gate on GMW drain at Leng St (may require a temporary pump). ➢ GMW implement a plan for the management of the lakes in advance of the flood (storage within lakes, available outfall capacity at No.7 and 6/7 channels and inflow to lakes from other sources such as Wandella Creek and Sheepwash Creek). ➢
77.20m AHD			➢ Flood Emergency Management Team to liaise closely.
77.30m AHD			➢ VICSES Incident Controller to consider convening an Emergency Management Team (EMT) if not already done. ➢ MERC, MERO and MRM to consider activating MOC
77.40m AHD	10 December 2010 flood September 2016 flood		➢ Council to deploy signs and begin closing roads in the vicinity as appropriate. ➢ VICSES to notify people outside levee system.

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

Gauge Location: Loddon River at Kerang (cont'd)

River Height (m) and / or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Actions in consultation with ICC
77.50m AHD	**Moderate Flood Level** 5.9% AEP (17 year ARI)		➢ **Council will:** ➢ Block the two culverts under the Murray Valley Highway in order to prevent backflow (located approx. 500m and 1480m north from Maxwell St). ➢ Block culvert under the rural levee approx. 1490m north from Maxwell St. ➢ If not fixed, close flap gates on channels and drains. ➢ **IC – Prepare options analysis for the Kerang Lakes system specifically Third Lake Ibis rookery and RAMSAR site**
77.60m AHD	September 1993 flood		➢
77.80m AHD	**Major Flood Level** x% AEP (xx year ARI) do we know this??		➢ Begin to pay close attention to the railway line and the potential for water to seep through the rock ballast under the rail line. This should not occur for a further 410mm rise in water level. ➢ Monitor the low section of levee north of Koondrook Road where the earth levee merges into the road embankment if required VICSES and Council should arrange sandbagging to provide sufficient freeboard.
77.84m AHD	1981 flood		
77.90m AHD	1% AEP (100 year ARI)		➢ Closely monitor levees, especially the older weeping sections. ➢ **If height is predicted to reach or exceed this level evacuations should be considered, mainly due to Kerang township being isolated.**
78.00m AHD	19 January 2011 flood		
78.10m AHD			➢ VicPol to consider developing and implementing (evacuation) strategy for Kerang.

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

Appendix C2: - Appin South Community Flood Emergency Plan

1. Overview:

In general the area around Appin South is largely agricultural land and is used for primary production purposes, as such the area is scattered with mostly isolated farm buildings and residences. Local residence have a good understanding of the flood risk and on early advise will take appropriate actions to mitigate the effects. It is essential that early advice is provided to this community to ensure that they are aware of the expected risk and can prepare.

2. Gauge Location: LAANECOORIE

NOTE: Need to have regard for flood travel times - the faster the travel, the larger the volume of flood, hence higher expected levels. Recent flood events, soil moisture conditions and impending weather conditions, therefore, need to be considered.

River Height (m) and / or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Actions in consultation with ICC
1.50m (2,000 ML/day)	**Minor Flood Level (1963)**		➢ VICSES warning system activated if not already done.
3.00m (9,400 ML/day)	**Moderate Flood Level (1945)**		
4.50m			➢ Local Information Officers advised to conduct levee checks at Appin South and Tragowel. ➢ VICSES and Council review sandbag supplies. ➢ Liaison to commence between Incident Emergency Management Team members.
5.00m			➢ Council in consultation with GMW consider removing the earth bund roadway on Flood Lane at Scotts Creek - 30,000 ML/day at Laanecoorie for larger volume flood.
5.28m (36,500 ML/day)	1996 Flood Peak		
5.50m (43,700 ML/d)	**Major Flood Level (1988)**		➢ Consider convening Incident Emergency Management Team.
5.67m (54,700 ML/d)	1981 flood peak		

Gauge Location: Laanecoorie (cont'd)

River Height (m) and / or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Actions in consultation with ICC
5.82m (55,000 ML/d)	Sep 1993 flood peak		Refer to Loddon MFEP for information regarding upstream effects.
5.93m (65,000 ML/d)	1956 flood peak		
6.35m (65,200 ML/d)	Nov 2010 flood peak		
6.34m (87,300 ML/d)	Sep1975 flood peak		
7.50m (194,700 ML/d)	14 January 2011 flood peak		
7.80m (195,140 ML/d)	Aug 1909 flood peak		

3. Gauge Location: LODDON WEIR (actual location)

River Height (m) and / or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Actions in consultation with ICC
3.30 m	**Minor Flood Level**	No residential properties will be affected, some areas of rural land will be inundated	➢ VICSES warning system activated if not already done.
5.00 m			➢ IC/Kerang Divisional Command to liaise with Local Information Officers at Appin South based on earlier contact on Laanecoorie gauge.
6.00 m	**Moderate Flood Level**	No residential properties will be affected large areas of rural land will be inundated to varying degrees.	➢ Council in consultation with GMW consider removing the earth bund roadway on Flood Lane at Scott's Creek.
6.78 (9,580 ML/day)	1992 Flood Event 2016 September Flood event		Council and VicRoads to close affected roads. VICSES to consult with council and Local information officer leader to ascertain isolated properties and arrange welfare checks and monitor flood levels. .
6.80 (9,660 ML/day)	1981 Flood Event		
6.83 m (9,780 ML/day)	1993 Flood Event 1996 Flood Event		
6.93 m (10,140 ML/day)	1983 Flood Event		
7.00 m	**Major Flood Level**	Large areas of agricultural land inundated. A number of properties will be isolated and significant road closures	Consult with council and Local information officer leader re isolated properties ensure contact with affected properties and monitor welfare.
7.18 m (36,000 ML/day)	Nov 2010 flood event		
7.29 m (45,200 ML/day)	Jan 2011 flood event		

4. Gauge Location: APPIN SOUTH.

River Height (m) and / or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Actions in consultation with ICC
2.80 m	**Minor Flood Level** (2.33 year ARI event)	Low lying area's adjacent to river will start to be impacted.	➢ VICSES warning system activated if not already done. ➢ Local Information Officers to check levees if not already done, based on Laanecoorie gauge.
3.00 m		Some local road floodways will be operating	➢ Council staff to monitor need for road closures/signage.
3.03 m	20% AEP (5 year ARI) event		
3.06 m (2,850 ML/day)	1975 flood peak		
3.07 m (2,880 ML/day)	Sep 1983 flood peak		
3.10 m	**Moderate Flood Level** (8 year ARI event)	Similar to Minor flood level but water will be spreading out over agricultural land	Confirm with either CMA or Hydrologist regarding the potential impact and property isolations.
3.11 m (3,000 ML/day)	Aug 1981 flood peak		
3.13 m (3,200 ML/day)	Oct 1992 flood peak		
3.14 m	10% AEP (10 year ARI) event		VICSES to arrange to contact affected residence in Appin South and advise of situation, and provide advice.
3.15 m		Inundation of Appin South Road. Houses in Appin South Road under threat.	VICSES to arrange contact with affected properties to ensure their welfare
3.18 m (3,550 ML/day)	Sep 1993 flood peak		
3.19 m (3,600 ML/day)	Oct 1996 flood peak		
3.21 m (11,300 ML/day)	Nov 2010 flood peak Sept 2016 flood event (approx.)		
3.22 m	4% AEP (25 year ARI) event		
3.27 m	2% AEP (50 year ARI) event		
3.30 m	**Major Flood Level**		
3.58 m (50,500 ML/day)	Jan 2011 Flood Peak		

Appendix C3: - Lower Avoca and Quambatook Community Flood Emergency Plan

1. Overview

The Avoca River system downstream between Glenloth and Quambatook is a perched river system, i.e. the natural banks of the river are higher than surrounding land. The physical size of the Avoca River reduces as it travels downstream towards Quambatook; therefore the capacity of the river is limited. It is estimated that on average once every one to two years, river flows will overtop the banks of the Avoca River and spread onto the surrounding floodplain. Significant work was undertaken in the late 1960s to limit the impact of this frequent flooding and to ensure the equitable distribution of flood flows across the floodplain. This included the construction of structures and floodway's as well as regular maintenance of the waterways. These works were undertaken by the former Avoca River Improvement Trust (the Trust) utilising rates collected from landowners. Upon its formation North Central Catchment Management Authority took on the roles and responsibilities of the Trust, however as it does not currently have the legal ability to rate landowners, it has not had the necessary funds to undertake routine maintenance.

Downstream of Charlton, floodwaters are distributed away from the Avoca River via a number of flow paths / watercourses. It is estimated that in flood events approximately only 10 to 20% of the total flow rate in the Avoca River at Charlton reaches Quambatook. These flow paths include:

- Tyrell Creek (which flows towards Culgoa and terminates at Sea Lake);
- Lalbert Creek (which terminates at Lake Lalbert)
- Back Creek
- Mosquito Creek
- Eastern Floodway

Quambatook is only likely to experience flood inundation in severe flood events such as the January 2011 flood event. Quambatook was not inundated during the January 2011 flood event, however this was only due to the extensive works undertaken by the local council, emergency services and the local community to protect the town

Picture above: temporary Works at River Street, Quambatook in January 2011 (photo courtesy Gannawarra Shire)

The Quambatook Flood Management Plan was completed in 2014. The plan detail flood behaviours for a range of flood events and recommends a number of possible structural and non-structural mitigation measures to reduce future flood risk to the residents of Quambatook. A number of these flood mitigations options have now been implemented. Further information is available in the Quambatook Flood Management Plan which can be obtained from the North Central Catchment Management Authority website @ ; http://www.nccma.vic.gov.au/resources/publications/quambatook-flood-management-plan

In 2013 the Quambatook Weir was replaced. The project saw the removal of the existing weir. This was replaced with a weir of new design and construction. The new weir is a permanent structure with the sections of the manual flood gate boards being replaced with a full width, air operated gate that is controlled from the bank this new gate is variable in height settings, the Gannawarra Shire is responsible for the operation of the weir.

Photos above and to the left: Before and after shots of the Quambatook Weir (courtesy of Gannawarra Shire Council)

2. Overview of Flooding Consequences

2.1 Warning times

The Charlton DS (downstream) river level gauge is used to provide predictions for Quambatook. Flood warning times for Quambatook are in the order of 4 days or more:

- River levels at Quambatook start to rise 3 days after river levels start to rise at the Charlton DS gauge;
- Flood levels peak at Quambatook approximately 4 days after flood levels peak at the Charlton DS gauge.

2.2 Areas affected

The floodplain between Charlton and the Avoca Marshes is affected by floods. This includes many rural properties as well as roads and other infrastructure. In events as little as the 1-2 year ARI event, river flows are likely to overtop the banks of the Avoca River and spread onto portions of the adjacent floodplain.

2.3 Properties affected

A number of properties and farming houses in the rural areas between Charlton and Quambatook are at risk becoming inundated or isolated in major flood events. It is only in severe flood events such as the January 2011 flood event that the township of Quambatook was at significant risk of flooding. Without temporary works, the entire township is at risk of inundation.

2.4 Isolation

In the 2011 event, properties at the end of Fenton Lane, Quambatook were isolated.

2.5 Critical infrastructure

In the 2011 event:-

Water supply – the water quality became a concern. Water was carted in for human consumption until such time as GWMW could guarantee safe potable water. The existing town water supply infrastructure is located outside of the limited town protection levee.

Sewerage – As Quambatook is currently unsewered and the community rely on onsite effluent treatment (septic tanks). As these rely on functioning transpiration beds, during the flood event these transpiration beds became flooded resulting in little or no operating effluent disposal. During the September and December 2010 events, an ablution block was hired and located in Quambatook.

Electricity/Communication – The electricity substation at Charlton was directly impacted by flood waters resulting in Quambatook being without power for a considerable period of time. This caused the telecommunication repeater stations to fail resulting in no communication whatsoever for the area. The CFA radio system was the only form of communication.

3. Flood Mitigation

3.1 Structures

The Avoca River Improvement Trust constructed a number of assets in the late 1960s. Many of these structures have been decommissioned or are no longer required, however there are a few structures that remain and need to be monitored/operated during flood events.

Structure	Location	Purpose	Asset Owner	Action Required
Kops Orchard Outfall	Ninyeuook Road	To offset the levees constructed on the western side of the Avoca River and ensure the equitable distribution of flood flows.	North Central CMA / Grampians Wimmera Mallee Water	No operation required. Drop boards have been removed.
Mosquito Sills	Jeruk River Road	To maintain the distribution of flows between the Avoca River and Mosquito Creek in small flows.	North Central CMA / Grampians Wimmera Mallee Water	No operation required. Drop boards have been removed.
Quambatook Weir	Weir Road, Quambatook	To preserve weir pool in Quambatook for recreation purposes	Gannawarra Shire Council	Lower gates on structure during flood events.

4. Control, Command and Coordination

The Control, Command, and Coordination arrangements in the Gannawarra Municipal Flood Emergency Plan are as detailed in the Emergency Management Manual Victoria.

All flood response activities within the Gannawarra municipality will be under the Control of the Incident Controller.

An Incident Emergency Management Team (EMT) may be established by the Incident Controller in accordance with the Emergency Management Manual Victoria.

The local response in Quambatook will initially be managed by the VICSES Kerang Unit while it is a manageable incident. Once the magnitude of the flood event is predicted to increase, local incident

control shall be conducted from predetermined Incident Control Centres (ICCs) in Swan Hill and commanded by an Incident Controller. It will be operate in accordance with VICSES arrangements. During significant events, VICSES will conduct incident management using multi-agency resources.

The Incident Controller will ensure that control is exercised at the lowest effective level. For the local response in Quambatook, the Incident Commander may establish a Kerang Division Command Point functioning from the CFA Bridge facility with Sectors established in relevant locations for a targeted response. The Incident Controller in the ICC and the Division Commander in the Division Command Point will ensure that local knowledge is incorporated through the role of Senior Flood Observer embedded in the Division Command to ensure an effective and informed response.

Refer to the VICSES Local Knowledge Policy

5. Flood Impacts and Required Actions

Refer to the action tables below. The flood class levels for both the Charlton and Quambatook gauges were reviewed in October 2015 and again during 2018 and have been amended to reflect the recommendations of the Local Information Officers to the 2010-11 Victorian Floods Review and the BoM Flood class definitions.

6. Gauge Location: CHARLTON DS

Need to have regard for flood travel times - the faster the travel, the larger the volume of flood, hence higher expected levels. Recent flood events, soil moisture conditions and impending weather conditions, therefore, need to be considered

River Height (m) and / or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Actions in consultation with ICC
3.50m	Minor Flood Level		VICSES warning system activated if not already done.
4.77 m	August 2010	River flows overtop the Avoca River near Glenloth spreading onto surrounding farm land; some minor Council roads were affected.	
5.00 m	Moderate Flood Level	Inundation of some rural land, no properties affected, stock and equipment will need to be moved to higher ground	
6.50 m			➢ Council to monitor need for road closures / signage in Quambatook South, Lalbert Creek and Back Creek areas. ➢ Local Information Officers at Quambatook South and Sandhill Lake to check levees.
7.00 m	Major Flood Level September 1993 Flood Peak		➢ VICSES Region/ICC to liaise with G-MW and Council regarding the need to convene Flood Emergency Management Team. ➢ VICSES/ICC and Council review sandbag supplies. ➢ VICSES/IC in consultation with council to undertake monitoring of the Quambatook Levee.
7.10 m	30 November 2010 flood peak		
7.20 m	October 1992 flood peak		
7.30 m	6 September 2010 flood peak		VICSES/IC in consultation with council to undertake monitoring of the Quambatook Levee.
7.50 m	September 2016 flood event		
8.05 m	15 January 2011 flood peak (150 year ARI flood Event)		

Note: Flood waters will commence flowing into both the Lalbert and Tyrrell Creek systems at floods greater that 20% AEP (5 year ARI)

7. Gauge Location: QUAMBATOOK

River Height (m) and / or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Actions in consultation with ICC
2.00 m	**Minor Flood Level**		➢ VICSES warning system activated if not already done. ➢ Check expected river heights if near or over 2.80 m consider community notifications
2.18 m	December 2010 flood peak		
2.20 m	**Moderate Flood Level**	Assess likely impact on Lalbert Creek.	➢ Council staff to monitor need for road closures / signage. ➢ Seek advice from G-MW regarding gauge levels at The Marshes and also flood plain storage at Lake Boga and advise the Incident controller of situation and any potential issues. ➢ Operate the Quambatook South gauge. ➢
2.23 m	September 2010 Flood Peak		➢ VICSES Region/ICC to liaise with G-MW and Council regarding the need to convene Flood Emergency Management Team. ➢ VICSES/ICC and Council review sandbag supplies. ➢ VICSES/IC in consultation with council to undertake monitoring of the Quambatook Levee.
2.30 m	1993 flood peak	Water crosses Kerang - Quambatook Road. Water crosses Quambatook - Boort Road.	➢ Council in consultation with Incident Controller and VicRoads monitor the need to close these roads.
2.32 m	1992 Flood Peak		
2.40 m	**Major Flood Level**	The Marshes likely to fill and overflow.	➢ Council in consultation with the Incident Controller close Mystic Park Road and construct earthen bunds either side of the Avoca outfall.
2.42 m	June 1995 flood peak		
2.43 m	October 1996 flood peak		
2.50 m	September 1983 flood peak		
2.80 m			**If river height is expected to reach this level the Evacuation of Quambatook should be a serious consideration**
3.04 m	18 January 2011 flood peak		

8. Gauge Location: TOP MARSH

River Height (m) and / or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Actions in consultation with ICC
73.50m AHD			➢ Check levee at north end of The Marshes.
74.00m AHD		Flow enters Avoca Outfall Channel and flows to Lake Boga	➢ Incident Emergency Management Team to monitor relationship between flows in Avoca Outfall and Loddon River.

Appendix C4: - Murray River Community Flood Emergency Plan

1. Overview

Significant failure of the levee system in the Torrumbarry / Gunbower area could cause problems for Gunbower, Cohuna, Kerang and other downstream townships. The structural integrity of these levees is not known.

The levee around the Torrumbarry Headworks weaves its way through private land and Crown land, over a distance of about 16kms. The depth of water held back by the levee can vary from very little to almost 2 metres where the bank crosses effluent creeks and depressions. Under natural conditions all these depressions would have fed into the Gunbower Creek, and the water would have followed the creek system to Gunbower and Cohuna and eventually back into the Murray River. Although the Gunbower Creek is cut off from the river by the Headworks Channel, any major flows through bank breeches find their way into the Gunbower Creek, and are then free to follow the irrigation system. Because of this, a major break in the bank system could have serious repercussions many kilometres away from Torrumbarry. Many sections of this levee are showing signs of deterioration.

The section of bank downstream from the Torrumbarry Headworks is different in that it is totally situated on Crown land under the control of either DELWP. This bank is almost all inside the Gunbower Forest and generally follows the river. It is mainly in better condition than the bank further upstream, having had more work done on it after floods in the 1980's. There is also potentially less water against this bank, which is also about 16km long, and it is also backed up by a secondary bank system which follows along inside the freehold boundary. This secondary bank being situated on much lower land would not control a major collapse, but would hold a certain amount of leakage and overtopping in the forest, and prevent water flooding onto farm land.

In September 2010, works to infill a number of low points in this levee were undertaken by the local Progress Association with the approval of the Incident Control Centre. These low points were caused by vehicles accessing the Murray River for recreational purposes.

Downstream of the Torrumbarry Headworks Channel, there have been historically two levee bank systems. A levee that follows the banks of the Murray River in addition to a perimeter levee that follows the boundary of the Gunbower State Forest. The banks of the Murray River have eroded over time and the levee bank that follows the Murray River within the Gunbower Forest cannot be relied upon. The perimeter levee prevents water flooding onto farm land, however this levee is not maintained and the condition is unknown.

2. Gauge Location: TORRUMBARRY WEIR (Zero gauge 78.545m AHD)

River Height (m) and / or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Actions in consultation with ICC
7.30m AHD	**Minor Flood Level**		➢ VICSES warning system activated if not already done. ➢ Local Information Officers at Koondrook, Murrabit and Benjeroop to check levees.
7.60m AHD	**Moderate Flood Level**	A number of rural levees up stream may be overtopped.	Monitoring of the upstream levees will need to be undertaken
7.80m AHD	**Major Flood Level** October 2016 flood event		
7.81m AHD	1981 flood peak		
7.86m AHD	1993 flood peak		
8.10m AHD	August 1909 peak 5% AEP (20 year ARI) event		
8.11m AHD	4% AEP (25 year ARI) event		
8.16m AHD	2% AEP (50 year ARI) event		
8.20m AHD	1% AEP (100 year ARI) event		

3. Gauge Location: BARHAM (Zero gauge 71.434m AHD)

River Height (m) and / or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Actions in consultation with ICC
5.50m AHD	**Minor Flood Level**		➢ VICSES warning system activated if not already done. ➢ Local Information Officers at Koondrook, Murrabit and Benjeroop to check levees.
5.80m AHD	**Moderate Flood Level**	Flows will predominantly be downstream of Cohuna and should not cause any significant issues but need to be monitored if flood increases.	➢ G-MW to monitor Gunbower Creek for any flows entering the Creek. ➢ Commence monitoring of the levee banks on the Victorian side
6.10m AHD	**Major Flood Level**		➢ 6.08m AHD October 2016 flood event. ➢ Monitor flows and height through the creek and channel systems around Cohuna as there is potential for flooding to occur from these systems ➢ Continue to monitor the levee banks on the Victorian side, Information should be forwarded to the ICC.

Appendix C5: - Eastern Boundary of Municipality Community Flood Emergency Plan

1. Overview

When the Bendigo Creek floods. Many of the east west roads crossing the creek can be cut. Generally flood waters take many days to travel along the creek and through Kow Swamp. Farm land situated in low lying areas some distance from the creek can be flooded. A few houses can also be affected. This includes the area around the Elmore - Mitiamo Road.

The Bullock Creek and Pyramid Creek, along with Bendigo Creek/Kow Swamp can add significant levels at Kerang. GMW would look to manage outfalls from Kow Swamp to work around peaks on the Bullock and Loddon rivers, where possible.

2. Gauge Location: MITIAMO

River Height (m) and / or River Flow (ML/d)	Annual Exceedance Probability	Consequence / Impact	Actions in consultation with ICC
1.41m AHD	December 2010 flood level		➢ East west roads across the creek require signage due to water over the road.
2.08m AHD	January 2011 flood level	Kow Swamp regulator had limited ability to release sufficient flows which resulted in exceeding full supply level.	➢ GMW to monitor inflows and releases at Kow Swamp.
2.39m AHD	August 1981 flood level		➢ East west roads across the creek require signage due to water over the road.
2.86m AHD	May 1974 flood level – record		➢ East west roads across the creek require signage due to water over the road.

Appendix C6: - Historical Flooding in the Gannawarra Shire

1. Overview

Significant flood events within the Municipality occurred in 1870, 1909, 1931,1956, 1973, 1974, 1975, 1981, 1983, 1989, 1993, 1996 and January 2011.

The great flood of 1870 is the highest recorded event on the Murray River since European Settlement.

The 1974 and 1975 floods caused problems in the Kerang Lakes, Pyramid Creek, Lower Loddon, Appin South and upstream of Kerang. 1981 levels were the highest recorded at Kerang but did not cause the same problems as the floods of 1974 and 1975 due to levee upgrades.

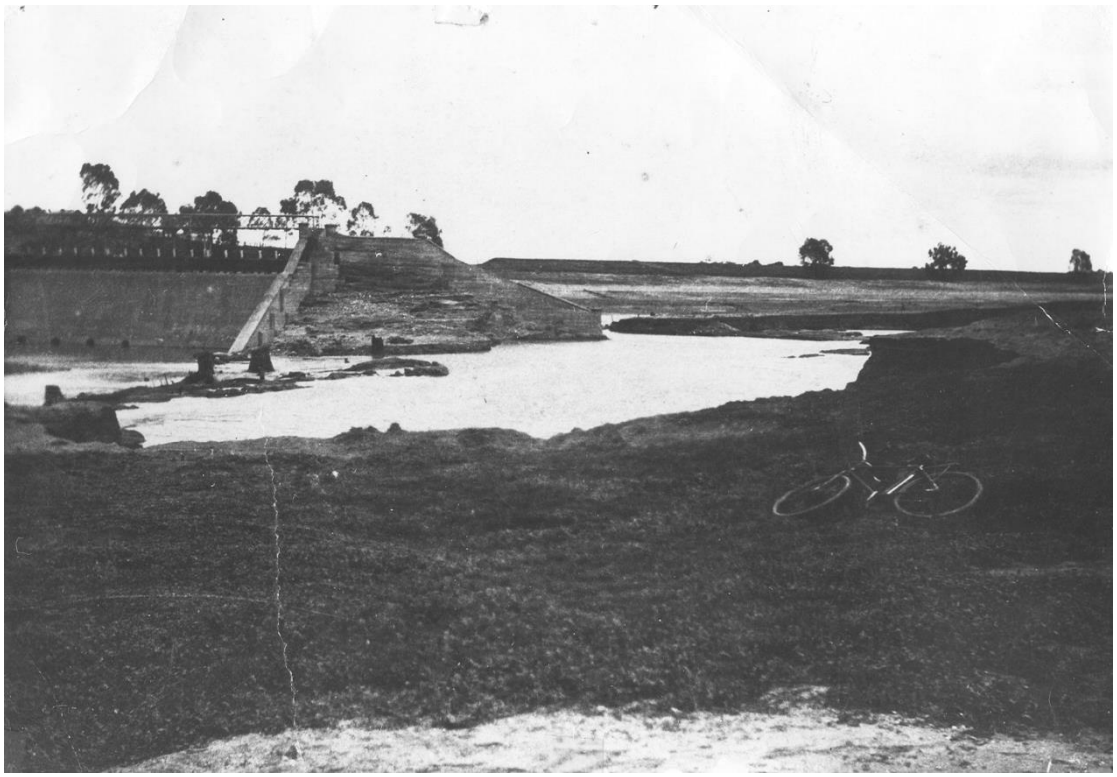
The 2011 flood event caused the most significant problems. 75% of the municipality was inundated. The Loddon River, Avoca River and Pyramid Creek all experienced major flooding. The township of Benjeroop was severely flooded for an extended period. Kerang and Quambatook were isolated but not inundated. While the townships of Leitchville, Cohuna, Koondrook and Murrabit were not inundated, outlying areas were flooded for some considerable time.

Significant floods (greater than a major flood) have occurred within the Municipality as follows:

Murray River	Avoca River	Loddon River
1867		
1870		
	August 1909	August 1909
September 1916		
1917		
1931		
1956	1956	1956
1973	February 1973	February 1973
May & October 1974		May 1974
November 1975		November 1975
July 1981		July 1981
	September 1983	September 1983
		1989
October 1993		October 1993
		1996
January 2011	January 2011	January 2011

August 1909 flood

The largest flood recorded at Laanecoorie Reservoir since it was constructed. Similar in magnitude to the January 2011 flood event but caused the failure of the Laanecoorie Reservoir dam wall.



Picture above: Laanecoorie Reservoir Dam Wall Failure, 1909

August 1956 flood

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

May 1974 floods

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

November 1975 flood

The 1975 flood was the third largest in the Murray at Echuca since 1870 (~3% AEP). It was also the third biggest (in terms of volume) along the Avoca River.

September 1983 flood

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

September and October 1993 floods

In September 1993 a major flood substantially reduced flood storage along the lower reaches of the Goulburn River floodplain. Consequently, a larger flood in October 1993 along the Goulburn (3% AEP at Shepparton) and Murray rivers (~4% AEP at Echuca) produced a peak a little higher than the 1916 event.

January 2011 flood

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

Appendix C7: - Structural Flood Mitigation Measures

1. Overview

There are numerous levees within the municipality in close proximity to most of the watercourses and flow paths, aimed primarily at keeping floods off agricultural land and confined to flow paths and storage depressions. The Murray is also contained by levees. Most of the levees are privately owned and are generally neither well-constructed nor well maintained: their structural integrity, the date of construction, the extent of maintenance and the protection provided by many is unknown or dubious.

Most private levees appear to provide protection from around the 20% AEP (1 in 5 year ARI) event up to about the 4% AEP (1 in 30 year ARI) event. Few levees, if any other than for Kerang Township Protection Levee, provide a higher level of protection.

There are too many levees to discuss individually. Most watercourses are contained by levees, some larger than others. The main levees are discussed below along with the location of master plans detailing the features and locations of levees across the lower Avoca and Loddon floodplains.

South of Kerang roads, water supply channels and levee banks interfere with natural flooding patterns. A master plan of floodway's and levees in this area is available in the *Lower Loddon Floodplain Management Study, Serpentine to Kerang*. The plan identifies the extent of recorded flooding, levee locations and land likely to be flooded in a 1%AEP (1 in 100 years ARI) event.

Large levees align with the Loddon River from Tragowel Swamp just upstream of Kerang to Kerang.

NOTE: details regarding known and/or approved levees within the municipality can be found in Floodzoom @ https://www.floodzoom.vic.gov.au – this is for registered users only.

2 Kerang Township Protection Levee

The township protection levee at Kerang was constructed between 1980 and 1987 as part of a formal Flood Mitigation Scheme and is managed and routinely maintained by Council.

In 2013 the Kerang Township Protection Levee Upgrade project was completed. The project saw the construction of permanent levee on three sections of roads (Murray Valley and Loddon Valley Highways; Kerang Murrabit Road; and Lower Loddon Road) surrounding the Kerang township. Works included:-

- Construction of a levee adjacent to the Murray Valley and Loddon Valley Highways to connect to existing levees on Sleepy Lane;
- Construction of a levee adjacent to the Ibis Caravan Park; and
- Raising of Lower Loddon and Murrabit Roads to fill in the gaps in the existing levee bank system.

The Kerang Township Protection Levee now has a total length of approximate 18km. The remainder of the levee has a freeboard of between 530mm and 950mm.

The township protection levee is generally located on crown land, road reserve or freehold land, although there are some sections with no rights at all. Parts of the levee are up to 3m high. Other parts are public roadway including Hayman Lane.

The Kerang township protection levee is designed to provide protection from a 1% AEP (1 in 100 years ARI) Loddon River flood with between 600mm and 800mm freeboard. However, the following summary (extracted from the 1998 levee audit report) shows that some sections of the levee have less than the design freeboard, though generally there is at least 600mm of freeboard available. Note that there is a

300mm layer of rock ballast under the rail track which would be permeable giving an effective freeboard of 410mm.

As flood water rises, drains, channels and culverts need to be blocked by closing flap gates and in a major flood event sandbags or an earthen bund is required to be placed across the Kerang to Bendigo rail line on the southern levee

Operations and Maintenance Manual has been prepared for Council's Township Protection Levee. The manual outlines appropriate triggers for closing gate valves on stormwater drains and channels and blocking culverts including GMW drains. A copy of the manual is available from Council if required.

North of Kerang a highly developed man-made system of floodway's and levees is documented in the *Lower Loddon Floodplain Management Study, Kerang to Little Murray River*.

3. The Kerang Lakes area,

The extent of flooding is limited by levees and water supply works along the western bank of the Loddon River at Kerang for floods up to around the 5% AEP (1 in 20 year ARI) level. Larger floods will overtop the levees and inundate large areas of land, as happened in January 2011.

4. Pyramid Creek

More than 20,000ha of agricultural land incorporating some 237 properties on either side of Pyramid Creek are protected by around 140km of levees on both sides of the creek. These levees generally provide protection up to about the 5% AEP (20 year ARI) flood event except near its confluence with Bullock Creek and with Calivil Creek. As with other rural levees, they are poorly constructed with no proper provisions for maintenance and reconstruction. These levees would not be inadequate in large floods such as occurred in January 2011.

5. Murray River

On the Victorian side, the Murray River is confined by levees and G-MW irrigation supply channels. The levees are not formally maintained and have the potential to either breach or overtop during a large flood. Most of the levees are low as they are located on relatively high ground close to the Murray River, therefore, making large breaches unlikely. Further, as there are a myriad of effluent streams, swamps and waterways on the New South Wales side of the river, there is a natural "relief valve" for high flows. Nevertheless, while the levees contained the 1993 and 2011 floods, they are generally in poor condition and are likely to be overtopped or breached by larger floods.

The structural integrity of the levee system in the Torrumbarry / Gunbower area is not known. Significant failure could cause problems for Gunbower, Cohuna, Kerang and other downstream townships.

The **Koondrook** Township is protected by both natural and man-made levees, these are located along Gunbower Creek and the Murray River. Flooding of the town from the Murray River has not occurred within living memory. Although some of the manmade levees are poorly constructed and are not much higher than the flood level, the town is reasonably well protected from flooding this is due to the factors below::

- Floods tend to reach an upper limiting level at Barham gauge (due to the natural "relief valve" into New South Wales), irrespective of the magnitude of the flow further upstream. Future floods are therefore unlikely to significantly exceed this level unless flow distributions are altered in some way by works upstream.
- Existing levees are generally not higher than 300mm to 450mm and were successful in holding back the 1975 flood. In many cases, a roadway, which extends the full river frontage, is higher than the levees. The roadway, together with the levees, offers an excellent line of defence.

6. Lalbert Creek

Lalbert is protected from most floods by private levees along Lalbert Creek which confine flows to the main channel. The town may flood if the levees are overtopped or breached. The town has been flooded in the past but was not flooded by either the 1981, 1983 or 2011 floods.

7. Mystic Park

The **Mystic Park** Township is protected by an informal system of levees. Without the levees, the town would be subject to shallow flooding. If the levees failed under existing conditions, flooding may be more serious due to the effects of various nearby embankments (channels, levee banks, etc.).

8. Quambatook

Quambatook is adjacent to the Avoca River and protected by levees. However, a windrow is required on the Kerang - Quambatook Road at the north east end of the town during a large flood. During the 1995 flood, the windrow failed and caused partial flooding around houses to the north west of the Kerang - Quambatook Road.

Floods in excess of about the 5% AEP (1 in 20 year ARI) event will overtop many of the rural levees and spread across the natural floodplain. While this will cause some immediate damage, further damage is likely as once behind the levees, the water will have no way of re-entering the drainage system as flood levels recede.

Photo above: breach in the Lower Loddon Levee, Jan 2011 Flood (photo courtesy North Central CMA)

Kerang Township strategic levees:

Section No	Section Length (m)	Running Distance (m)	Section	Section Starts	Section Ends	Minimum freeboard (m)	Total design freeboard (m)
1	1885	00 to 1885	Back Swamp	Murray Valley Hwy (Twin Bridges)	148m past end of Ninth Street along railway line	0.70	0.95
2	1570	1885 to 3455	Ninth Street	148m past end of Ninth Street along railway line	Lower Loddon Road	0.71	0.95
3	1938	2455 to 5393	Northern Levee	Lower Loddon Road	Corner Kerang Murrabit Road and Haymans Lane	0.84	0.95
4	1098	5393 to 6491	Haymans Lane	Corner Kerang Murrabit Road and Haymans Lane	1.1kms down Haymans Lane	0.70	0.95
5	3332	6491 to 9823	Fosters Swamp	Haymans Lane	Kerang Koondrook Road	0.65	0.95

Kerang Township strategic levees (cont'd)

Section No	Section Length (m)	Running Distance (m)	Section	Section Starts	Section Ends	Minimum freeboard (m)	Total design freeboard (m)
6	1880	9823 to 11703	Sleepy Lane	Corner Kerang Koondrook Road and Sleepy Lane	Corner Sleepy Lane and Murray Valley Highway	0.53	0.53
7	1830	11703 to 13533	Southern Levee	Corner Sleepy Lane and Murray Valley Highway	Loddon Valley Highway		
8	3884	13533 to 17417	Collins Road	Loddon Valley Highway	GMW outfall at end of access track opposite Leng St		
9	1155	17417 to 18572	Murphy Street	End of access track off Collins Road	Murray Valley Hwy (Twin Bridges)	0.30	0.70

The following is a summary of the strategic levees located within the municipality:

Location	**Owner**	**Responsibility if other than owner.**	**Protection Level**
Kerang Township Protection Levee	Gannawarra Shire Council		1% AEP (1 in 100 year ARI)
Kerang Power substation (note: this bunding was put in place sometime after the 2011 flood event and has been constructed to code.)	NorthVIC/SP Ausnet		.6 above the 1% AEP
Pyramid Creek north bank levees	TBC (To be confirmed)	No public agency or authority is currently responsible for undertaking maintenance	TBC
Loddon River/Back Swamp west bank between Murray Valley Hwy and Sheepwash Weir	TBC	As above	TBC
Loddon River west bank upstream Murray Valley Hwy	TBC	As above	TBC
Loddon River east bank between Kerang and the Glut	TBC	As above	TBC
Loddon River/Barr Creek/Benjeroop forest north east bank between Benjeroop and Capels Creek	TBC	As above	TBC
Loddon River west bank from Benjeroop to Bowdens Bridge	TBC	As above	TBC
Murray River upstream of Torrumbarry Headworks Channel	TBC	As above	TBC
Gunbower Forest Perimeter Levee	TBC	As above	TBC
Koondrook Township Bank	TBC	As above	TBC
Murray River from Murrabit to Little Murray River	TBC	As above	TBC
Little Murray River south bank from the Murray River to Fish Point	TBC	As above	TBC
Avoca Floodway Banks	TBC	As above	TBC

Need to confirm if there is any at risk?????

Asset register						
	Asset Name and location	Observed Rainfall	AEP % of flood	Water level [insert location gauge]	Consequence / Impact	Mitigation/ Action

Provide a general overview of flooding consequence. * Modify Table to suit.

Appendix D - Flood evacuation arrangements

Phase 1 - Decision to Evacuate

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

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

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

The following should be considered when planning for evacuation:

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

The table below details triggers for evacuation, if these heights are predicted or are likely to occur evacuation should be considered

Sector	Gauge	Trigger
Kerang	Murray Valley Hwy	77.90 m AHD
Quambatook	Quambatook South	2.8m

The table below details time required to evacuate established areas.

Sector	Likely time required for evacuation (including resource assumptions)
Kerang	2 days
Quambatook	2 days

Phase 2 – Warning

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

Phase 3 – Withdrawal

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

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

VICPOL will control security of evacuated areas.

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

Possible Evacuation Routes to be used:

Sector	Evacuation Route	Evacuation route closure point and gauge height of closure
Kerang	Murray Valley Highway	
Quambatook	Quambatook Swan Hill Road	

Landing zones for helicopters are located at:

- Kerang District Health, Burgoyne Street Kerang (no fuel available)
- Kerang Aerodrome (Avgas and JetA1 available)
- Cohuna Aerodrome (no fuel available)

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

from Gannawarra Shire Council's MEMPlan Appendix E for special needs groups to authorised personnel only.

Phase 4 – Shelter

Relief Centres and/or assembly areas which cater for people's basic needs for floods may be established to meet the immediate needs of people affected by flooding. Details of available Relief Centres can be obtained in Appendix C of the Gannawarra Shire MEMP.

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

Animal Shelter

Animal shelter compounds will be established for domestic pets and companion animals of evacuees. These facilities may be located at locations detailed below and coordinated by

Sector	Animal Shelter (include address)	Comments
Kerang Pound	Kerang Murrabit Road, Kerang	Dog and cat only
Cohuna Pound	Murray Valley Hwy, Cohuna	Dog only
Kerang Saleyards	Markets Road, Kerang	Livestock

Caravans

Caravans or caravan parks may be relocated to the following locations:

Sector	Caravan evacuation location (include address)	Comments
Cohuna	Cohuna Caravan Park	
Quambatook	Lake Boga Caravan Park	**Note:** there are also a number of caravan parks in Swan Hill that may be a suitable alternative.

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.

Kerang

Service	Impact	Trigger Point for action	Strategy/ Temporary Measures
Water	Potential for loss or contamination.		Potable water tankers to be deployed
Communications	Loss due to power failures.		Temporary Mobile Station Provide alternate power supplies in the interim.
Sewage	Flooding of sewage ponds, inability to process effluent.		If required the acquisition and provision of Mobile ablution blocks.
Waste	Build-up of rubbish, health concerns, vermin.		Council EHO in consultation with other agency develop a waste management plan as required.

Quambatook

Service	Impact	Trigger Point for action	Strategy/ Temporary Measures
Water	Potential for loss or contamination.		Potable water tankers to be deployed
Communications	Loss due to power failures.		Temporary Mobile Station Provide alternate power supplies in the interim.
Sewage	The town sewerage is mostly based on a septic tank process in a major flood the systems would be overloaded.		If required the acquisition and provision of mobile ablution blocks.
Waste	Build-up of rubbish, health concerns, vermin.		Provide skip bins in the town centre for residence to use

Essential Community Infrastructure and Property Protection

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

To be completed.

[List facilities, trigger point for action and strategy to be employed. Consequence maps based on AEP may exist.]]

Facility	Impact	Trigger Point for action	Strategy/ Temporary Measures

[Enter Municipality Name] will establish a sandbag collection point at

- [Enter details as appropriate e.g: front of Council Depot or another community facility]

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).

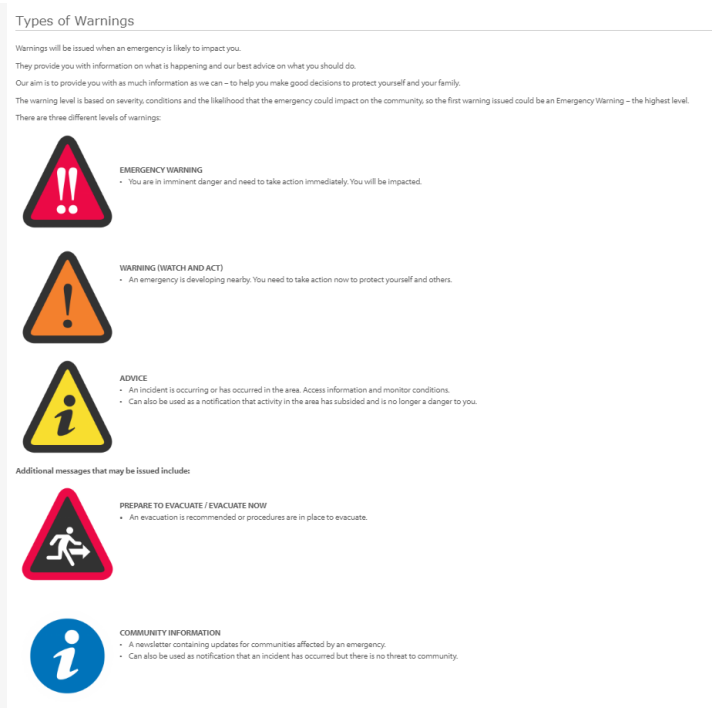
If verified reports are received of flash flooding posing, or resulting in, a significant threat to life or property, VICSES Regions (or ICCs) will issue a flash flood warning product via EM-COP.

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 using the Emergency Alert (EA) platform to send an SMS to mobile phones or a voice message to landlines.

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.

Types of Warning issued by VICSES include:



Appendix F - Sandbag Arrangements

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

1. Use of sandbags

Sandbags can be used to block doorways, drains and other openings into properties as well as to weigh-down manhole covers, garden furniture and to block sinks, toilets and bath drains to prevent water backing up. They have proven to be successful in keeping water out for short periods of time. Sandbagging is not always the most effective option and should be considered in the context of this Flood Emergency Plan which includes alternatives for managing flood risk. Other alternatives include moving possessions to higher places, securing objects so they do not float away and placing valuables in water tight containers. During a flood event he Incident Controller and operational staff in the flood affected community will assess the overall risk to communities and allocate sandbag resources based on risk.

2. Responsibilities

VICSES responsibilities include:

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

Council responsibilities include:

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

Community Critical Facility owners' responsibilities include:

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

Other 'Response' agencies responsibilities include:

- Supporting VICSES in their response role.

Residential and commercial property owners' responsibilities include:

- Understanding their own flood risk
- Preparing an emergency plan for their home or business

- Procurement and storage of sandbags to protect their own property
- Filling and movement of sandbags to protect their property
- Seek advice from their local council regarding the removal of sandbags from their property, as part of the community recovery

3. Community and business education

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

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

Practical information on:

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

Key messages:

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

4. Procurement of sandbags

VICSES

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

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

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

Council
Council will procure sandbags to protect council owned facilities including community critical facilities managed by Gannawarra Shire Council.

Residential and commercial property owners'
Sandbags may be obtained (purchased) from a number of online shops. There are a number of local businesses who sell sand such as Mawsons (Cohuna), C Wandin (Kerang), Dahlsens (Kerang), Elliotts (Gunbower)

5. Storage of sandbags

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

VICSES sandbags storage locations and initial quantities are as follows:

Kerang VICSES Local Headquarters (LHQ)	4000 bags (minimum)
Swan Hill VICSES Local Headquarters (LHQ)	4000 bags (minimum)

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

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

Council sandbags storage locations and quantities are as follows:

- Council Works Depot, Park Road, Kerang.

6. Distribution of sandbags

Priorities
The Incident Controller may make sandbags and sand available for flood mitigation activities during declared flood emergencies.
Sandbags will be issued consistent with the Strategic Control Priorities within the State Flood Emergency Plan, in the following order of priority to protect:
1. Critical Infrastructure and Community Critical facilities identified:
   (a) in the MFEP; or
   (b) by the Incident Management Team
2. Residential properties identified in the potential flood area
3. Commercial properties identified in the potential flood area
4. Environmental and conservation areas identified in the potential flood area.

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

The Floodsafe Sandbag Quick Reference Guide provides details to community members about the indicative number of sandbags required for residential property protection and guidance on the safe use, for the filling and laying of sandbags.

Refer to www.ses.vic.gov.au/prepare/floodsafe/floodsaferesources/sandbag-reference-guide

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

Sand and Sandbag distribution locations:
See maps in attachment 1, pages 62 to 64 Figures 1,2,3,4 & 5, for locations across the municipality

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

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

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

7. Disposal and relocation of used sandbags

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

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

Attachment 1: Sand and Sandbag distribution locations;
Figure F1.

Quambatook

Figure F2

Durham Ox

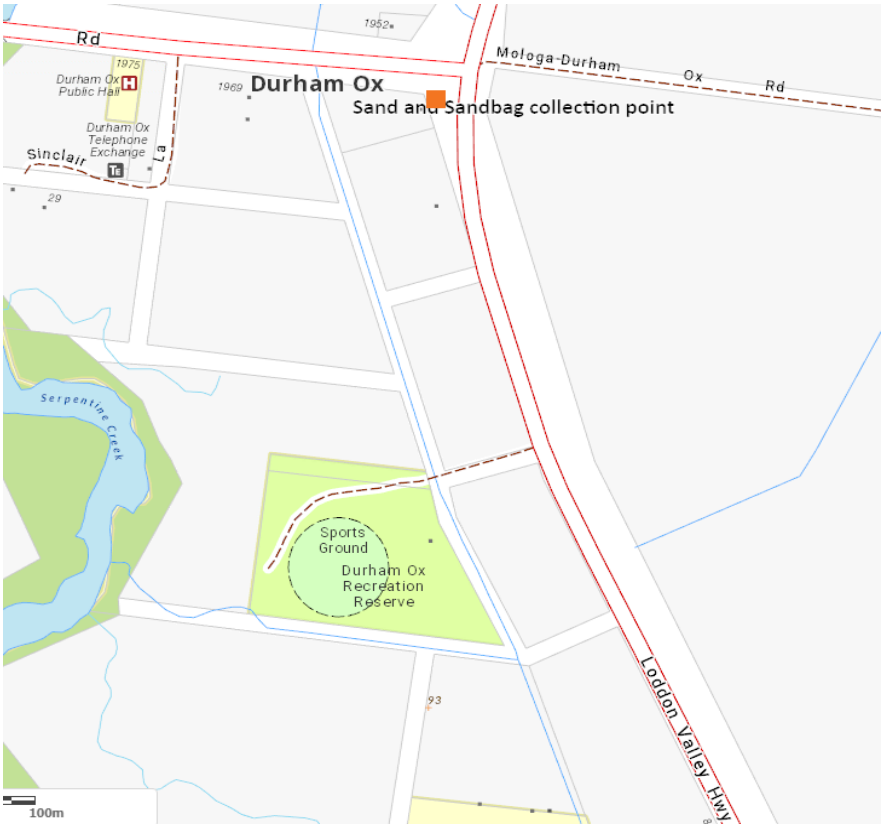


Figure F3

Kerang

Figure F4

Murrabit

Figure F5

Benjeroop

Appendix G: - Maps and Schematics

Figure G1: - Gannawarra Shire Local Government boundaries

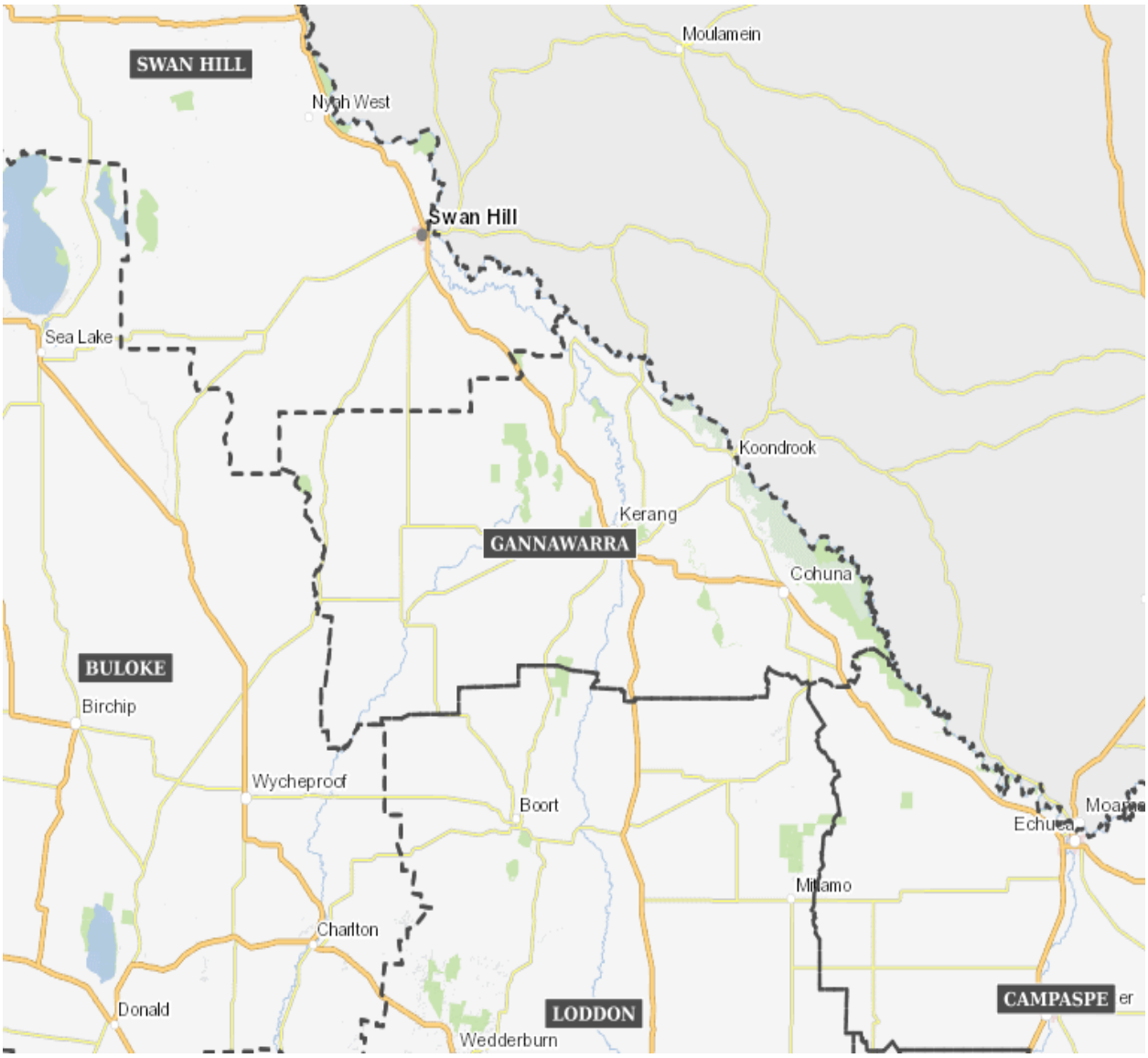


Figure G2 – Loddon River Lower Catchment

Figure G3 – Avoca River Basin

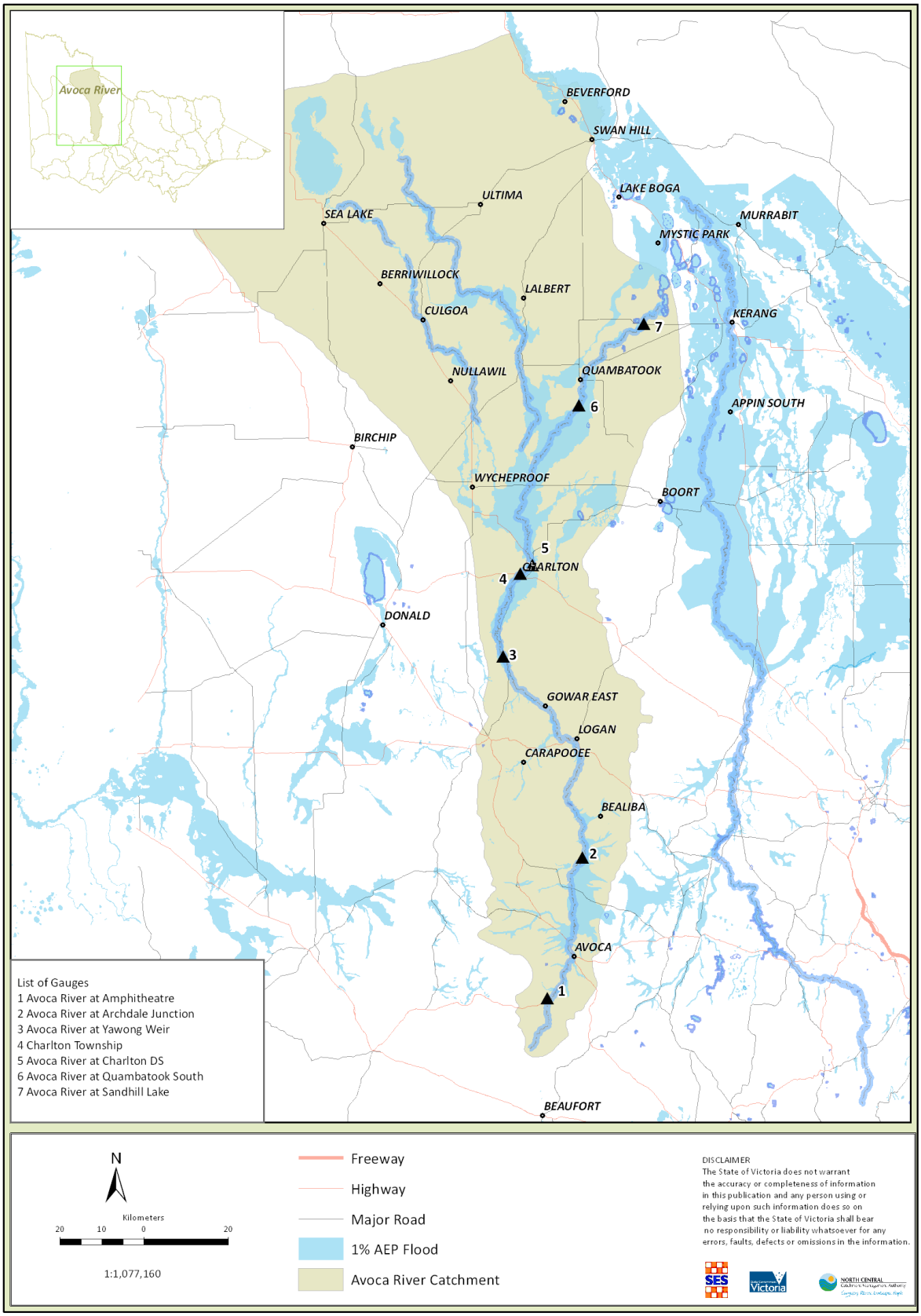


Figure G4 – Pyramid Creek Catchment

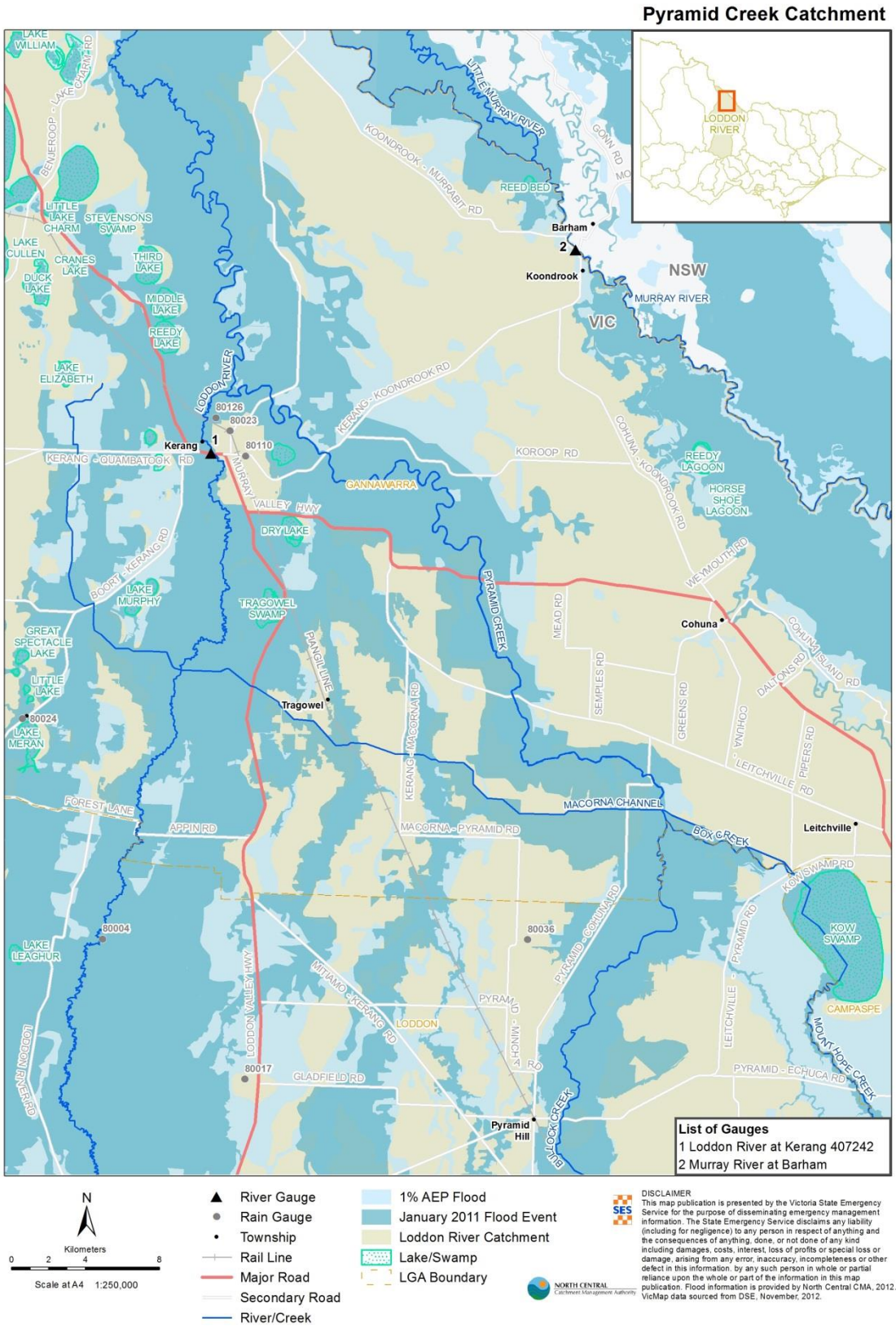


Figure G5 – Kerang Lakes

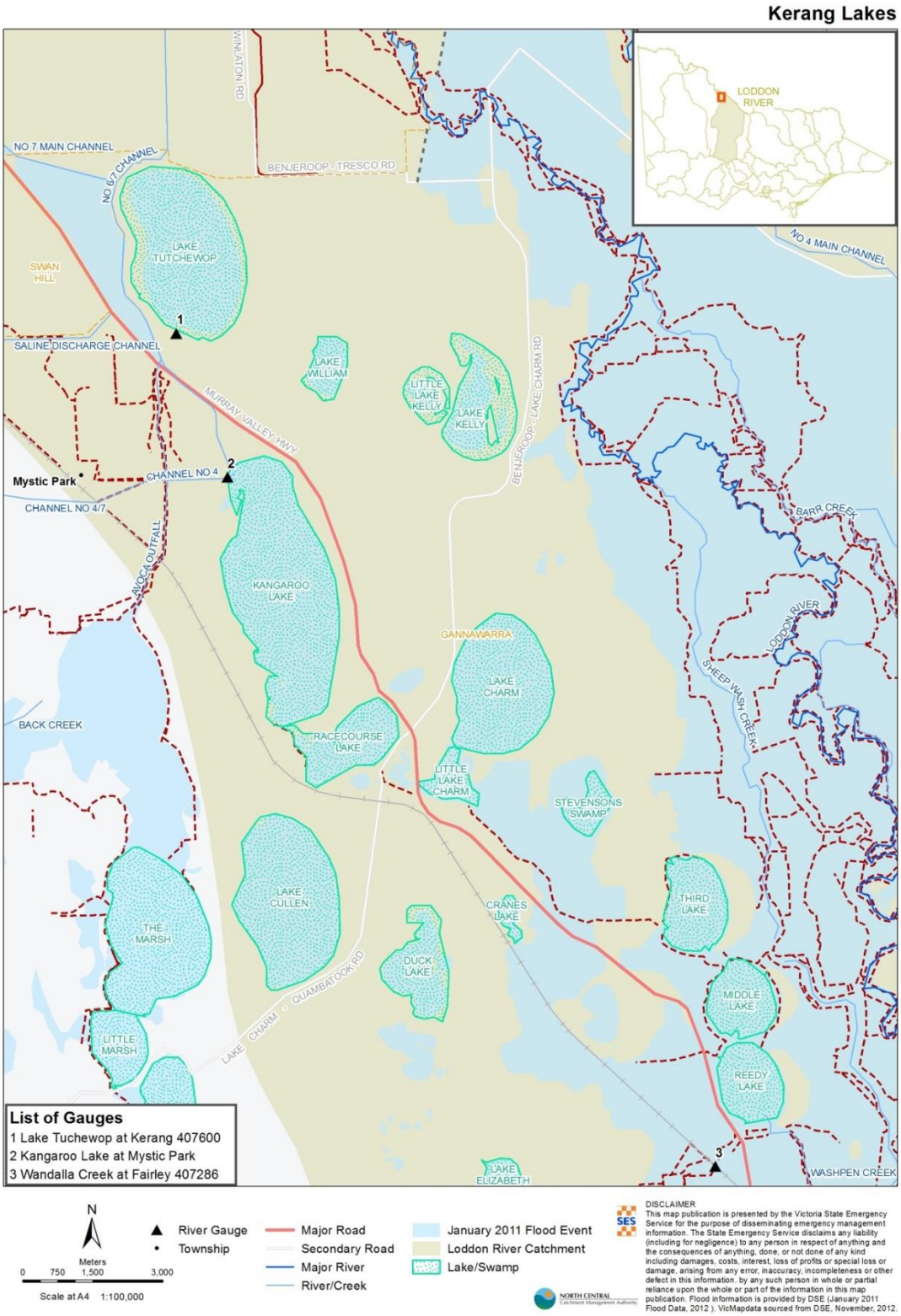


Figure G6 – Upper Loddon River Schematic

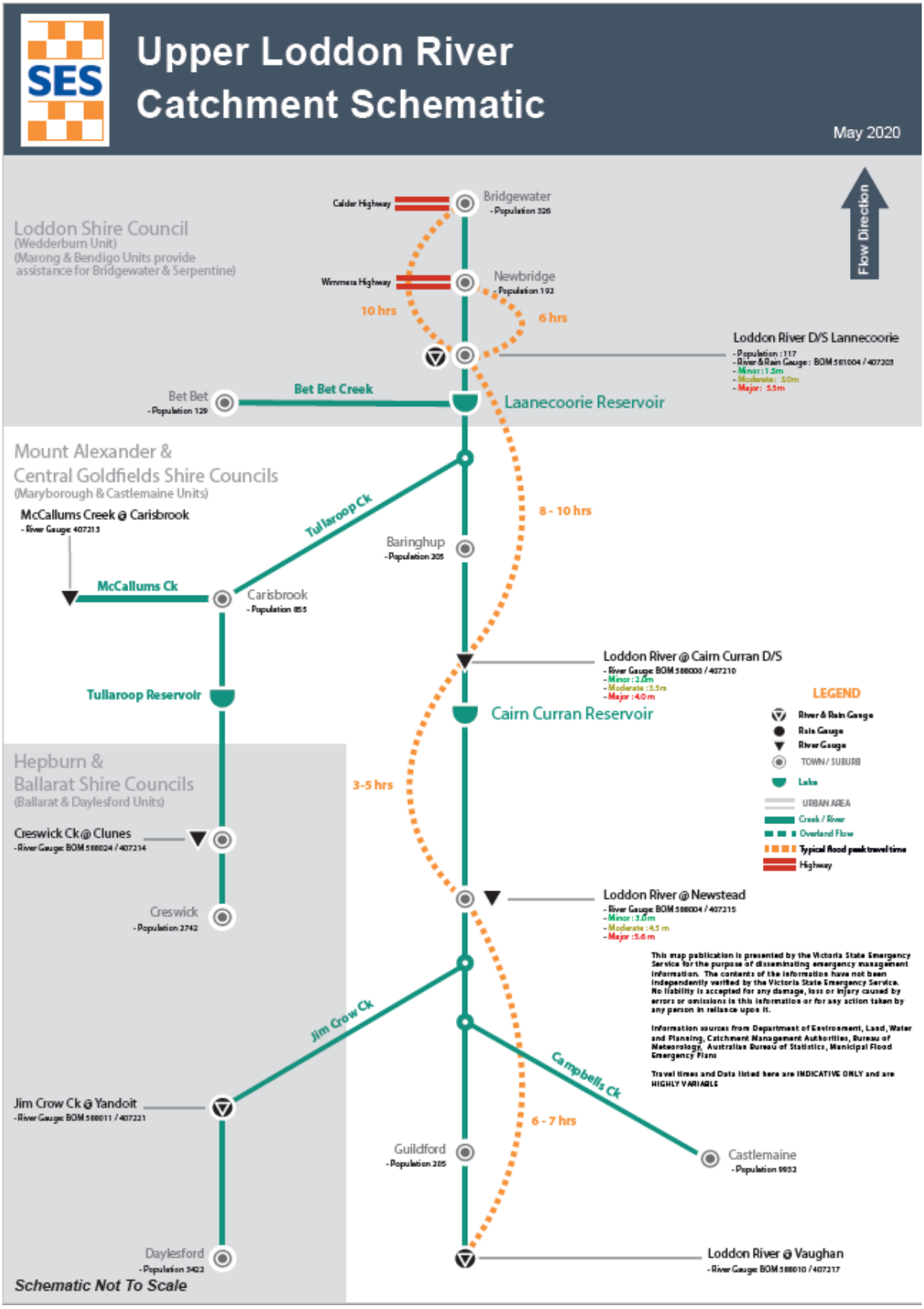


Figure G7 – Lower Loddon River Schematic

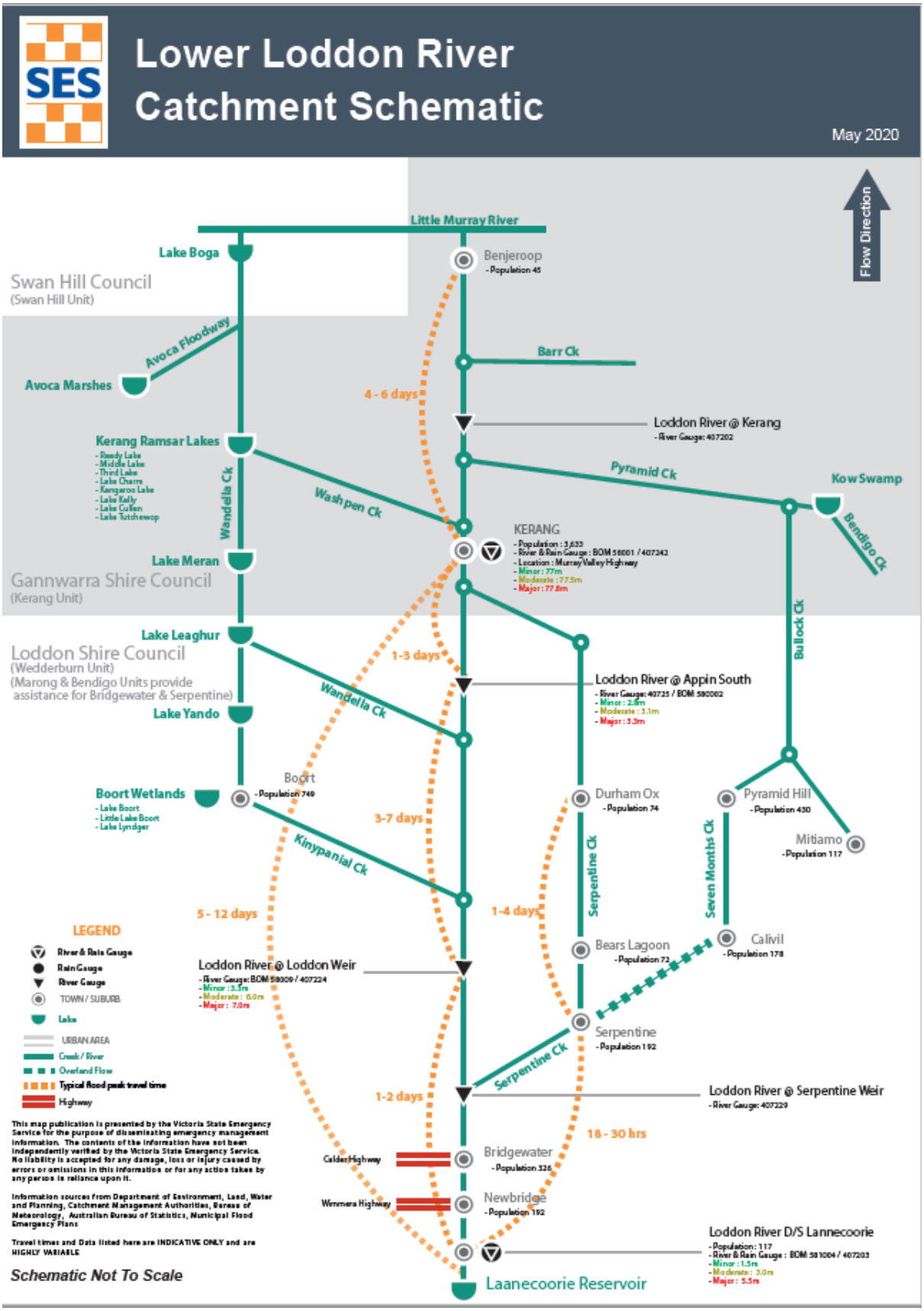


Figure G8 – Avoca River Schematic

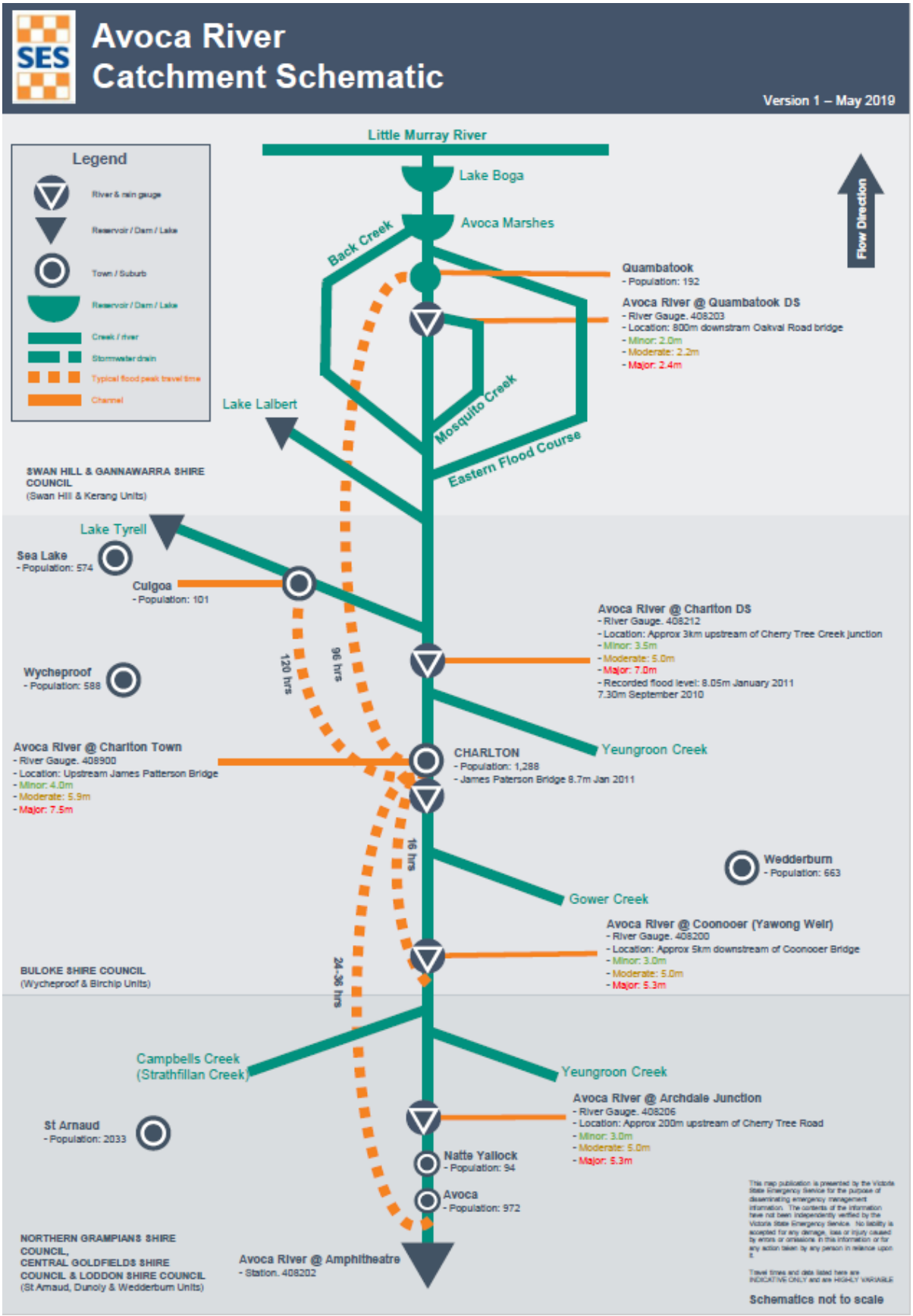
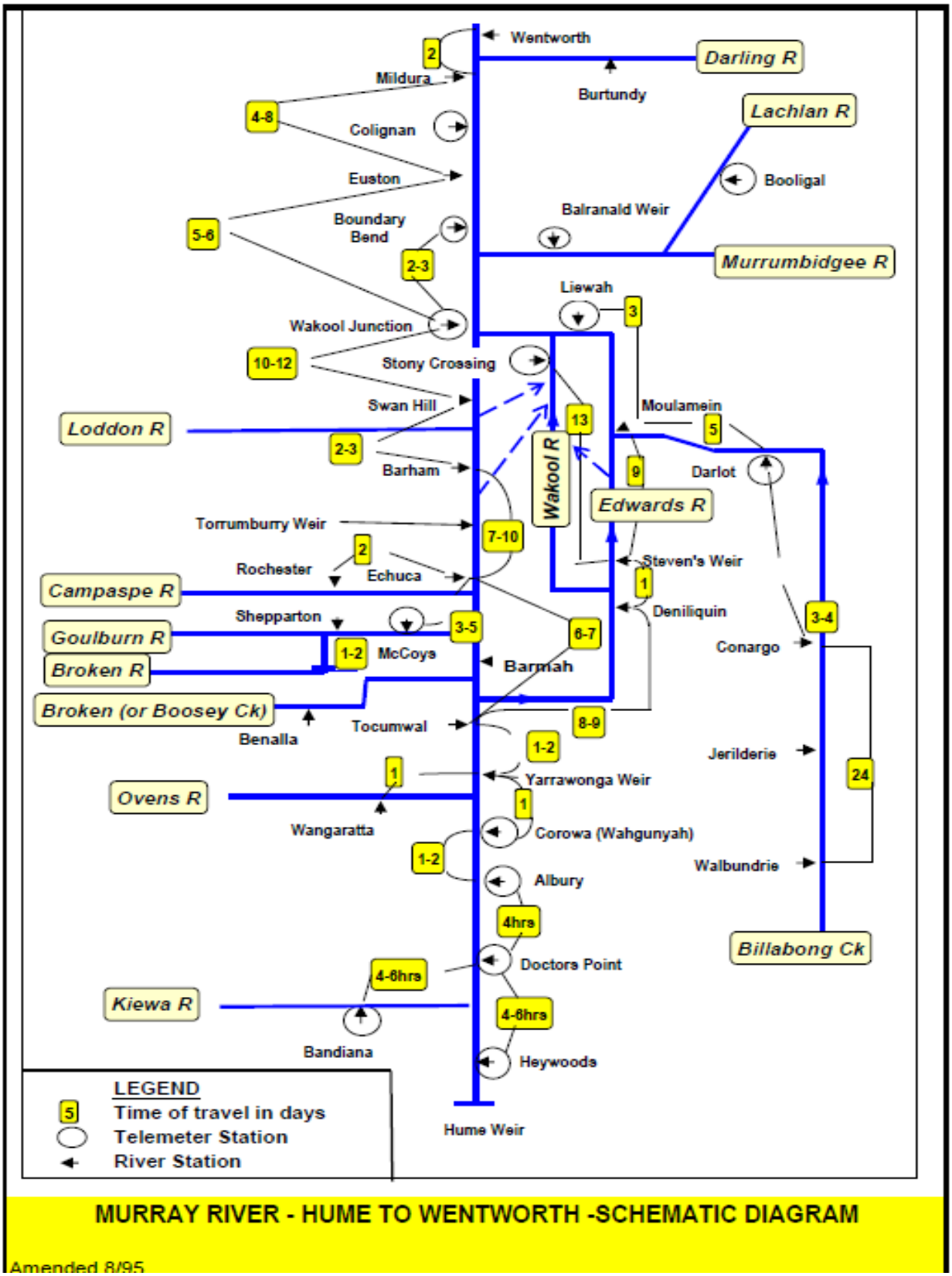


Figure G9 - Murray River Schematic



Contents of this schematic are maintained by NSW BoM

Figure G10 – 1% AEP flood extend map for Kerang

Note: The Kerang electricity terminal station is not shown on this map. While threatened in January 2011 it did remain dry but was isolated. A permanent levee has now been constructed around the facility and will provide protection to 600mm above the 1% AEP

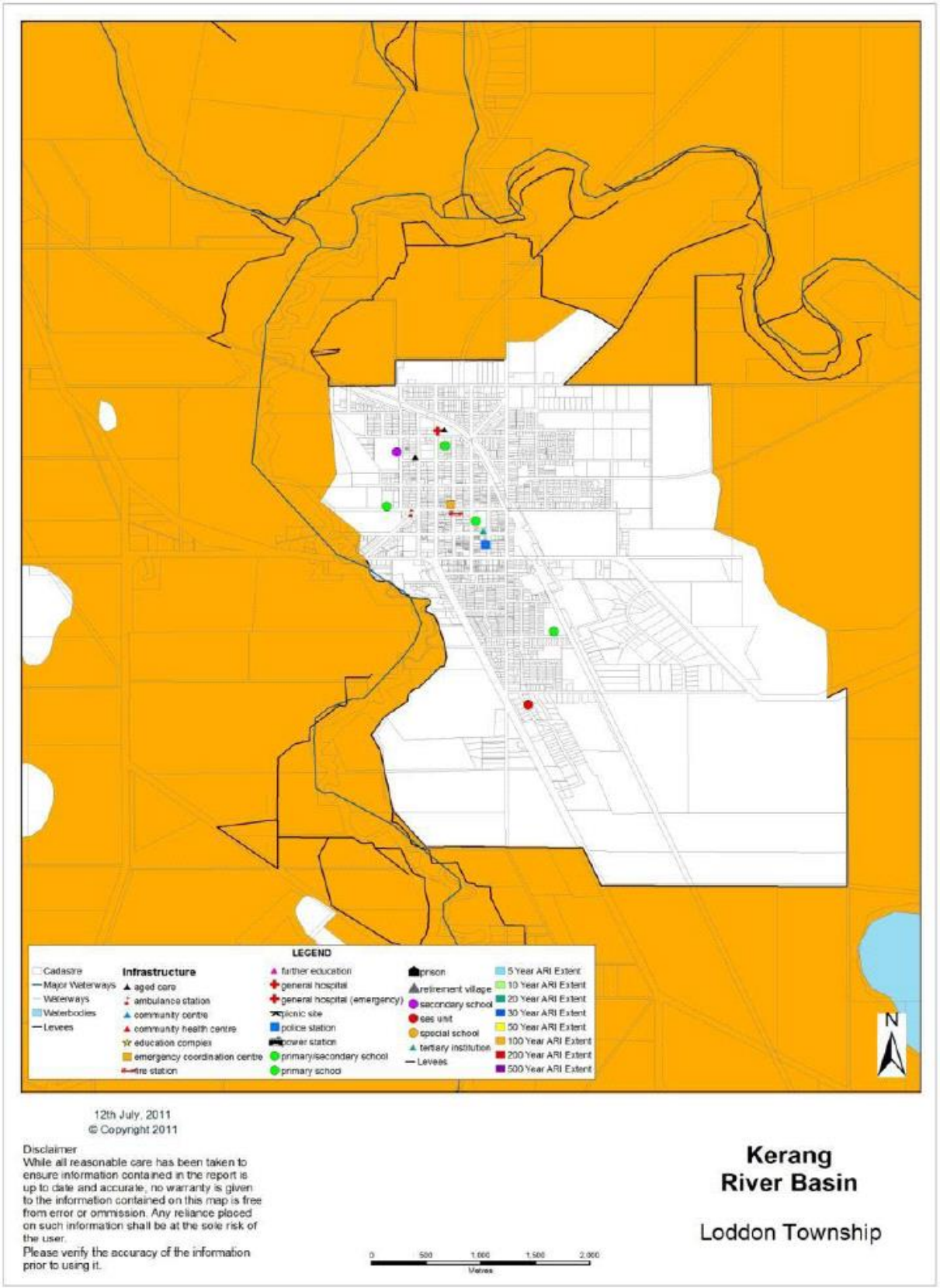


Figure G11 – Kerang Township Protection Levee

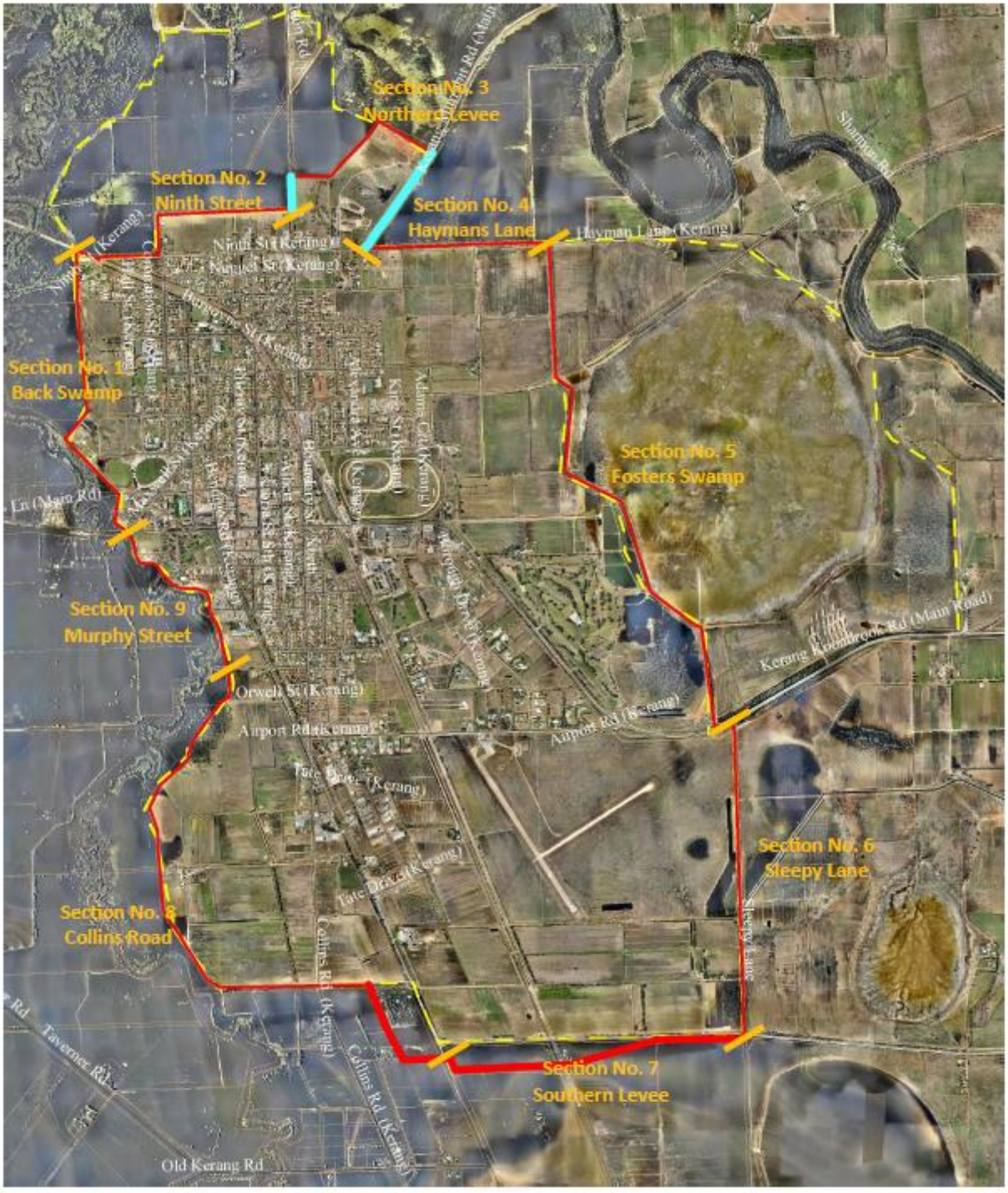


Figure G12 – Kerang Drainage Systems

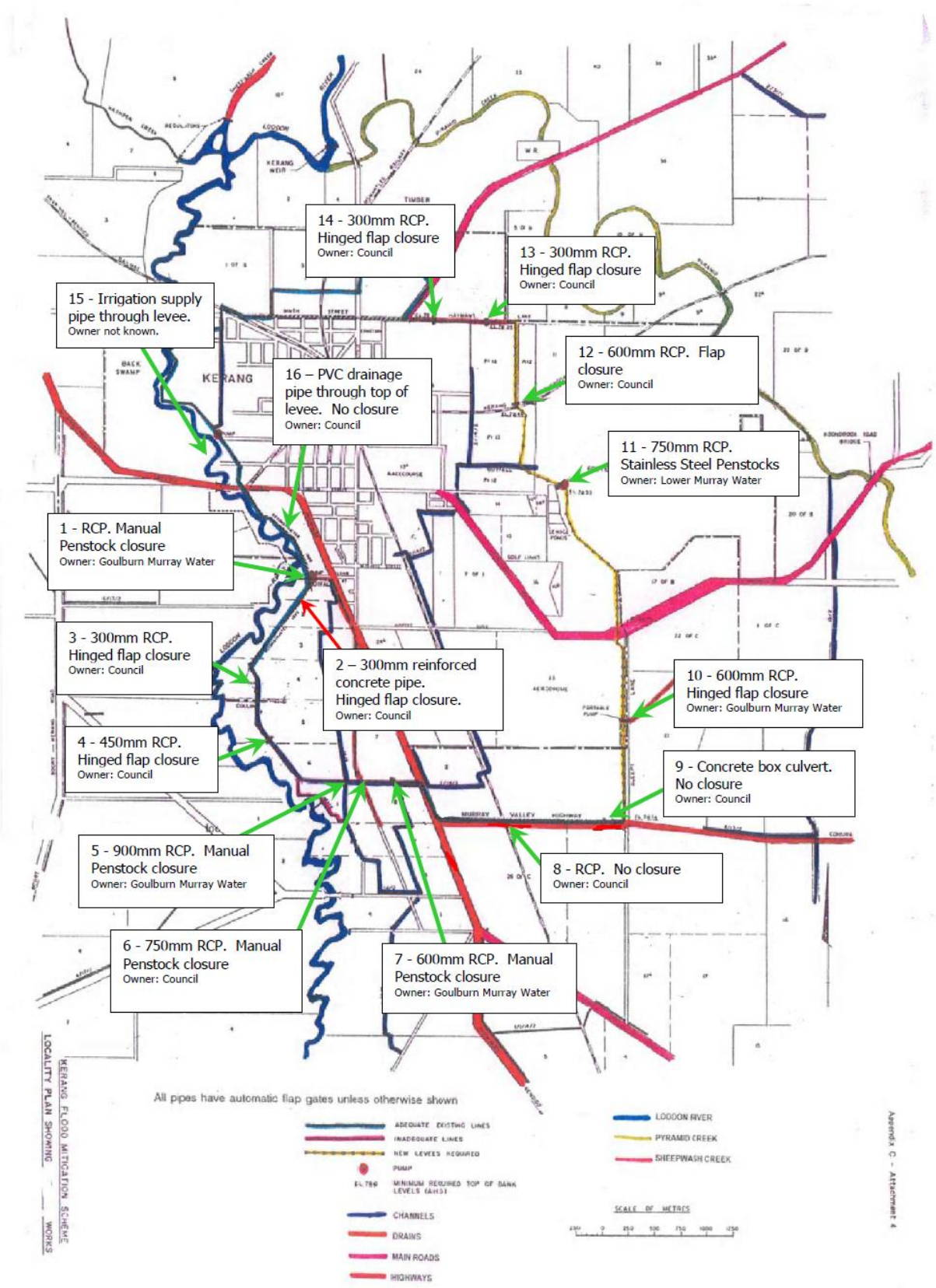


Figure G13 – Kerang Drainage Hotspots

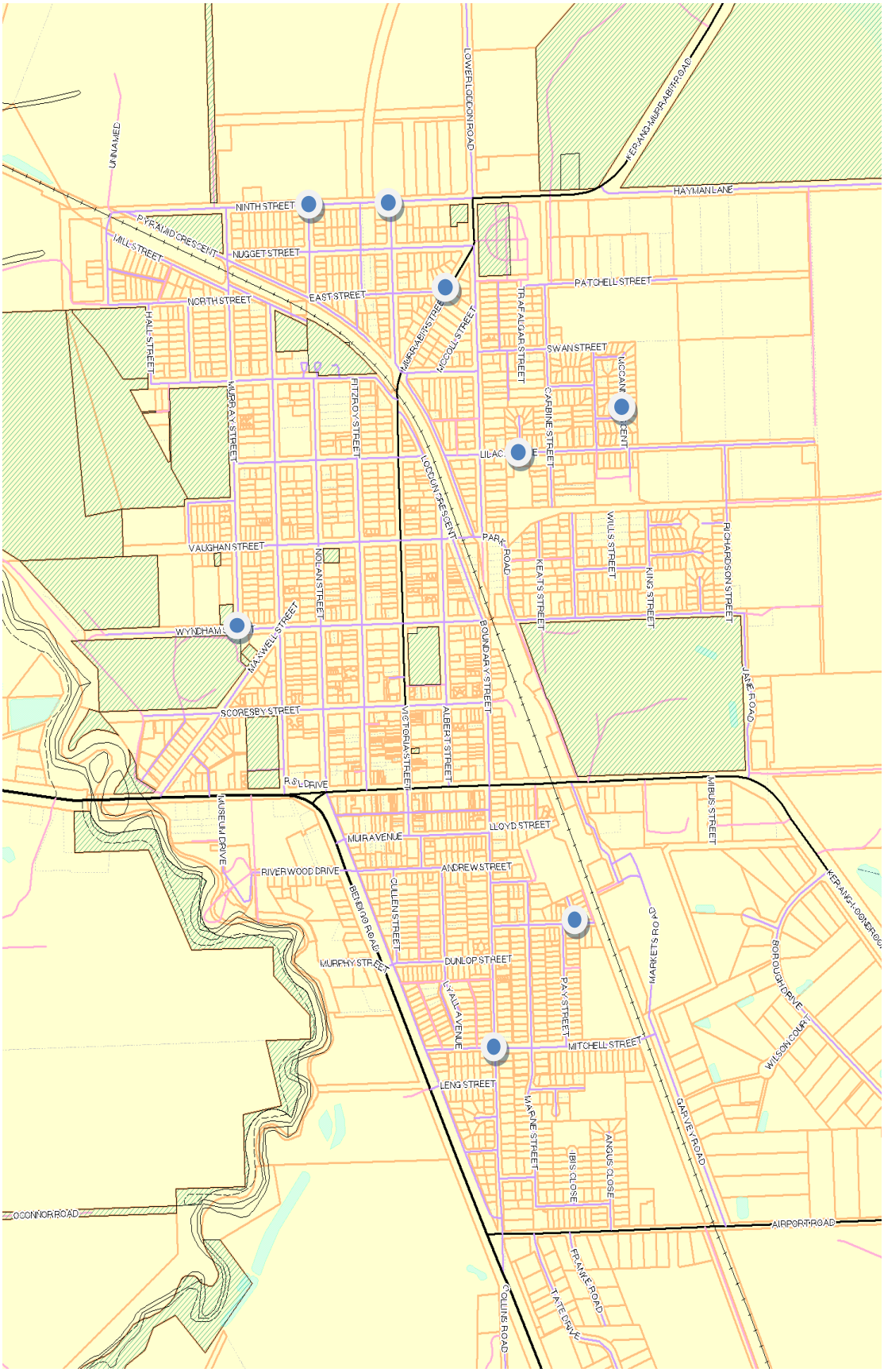


Figure G14 – Gannawarra Lakes and Waterways

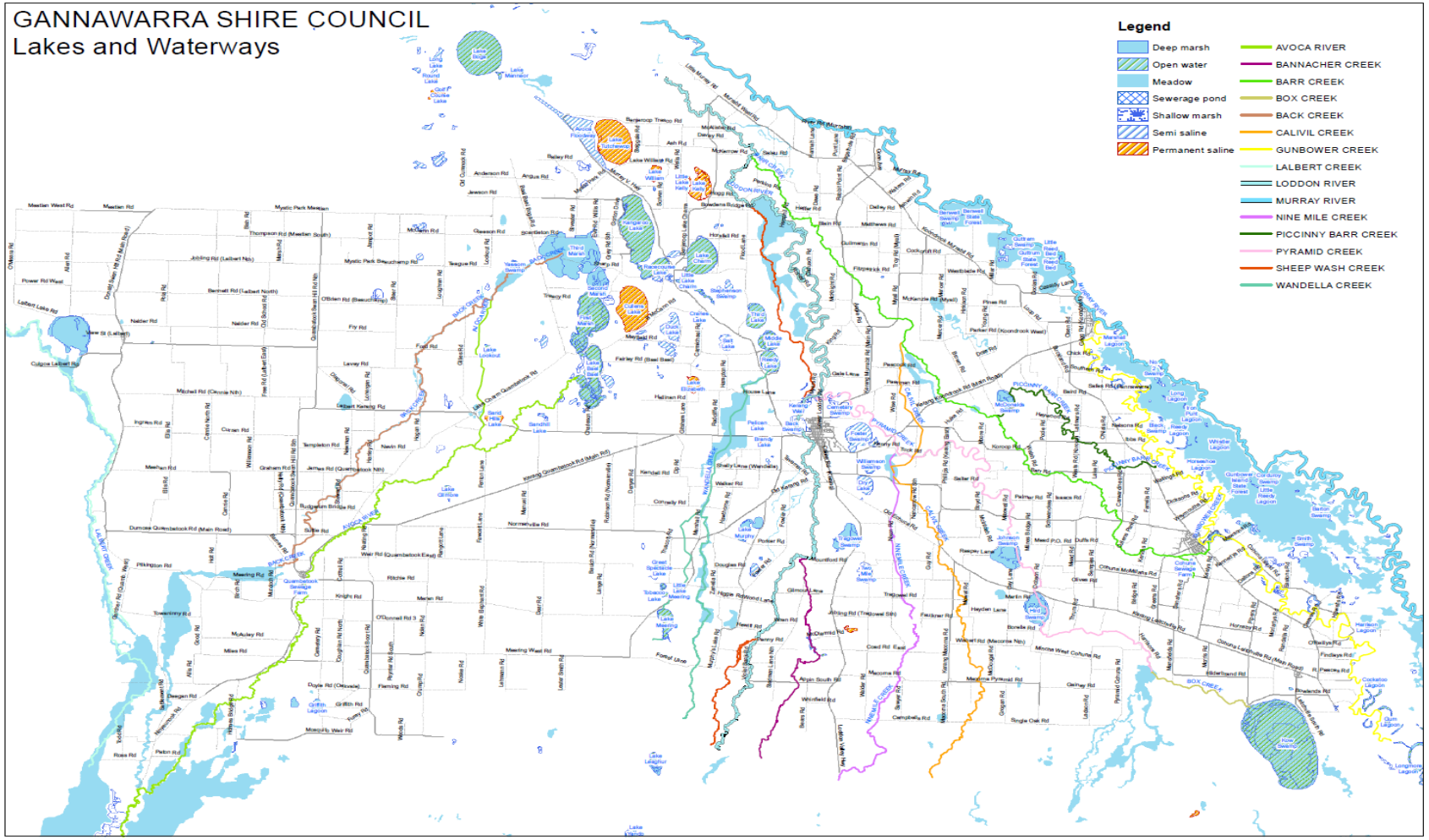


Figure G15 - Extent of Flood Inundation – Glenloth to Quambatook

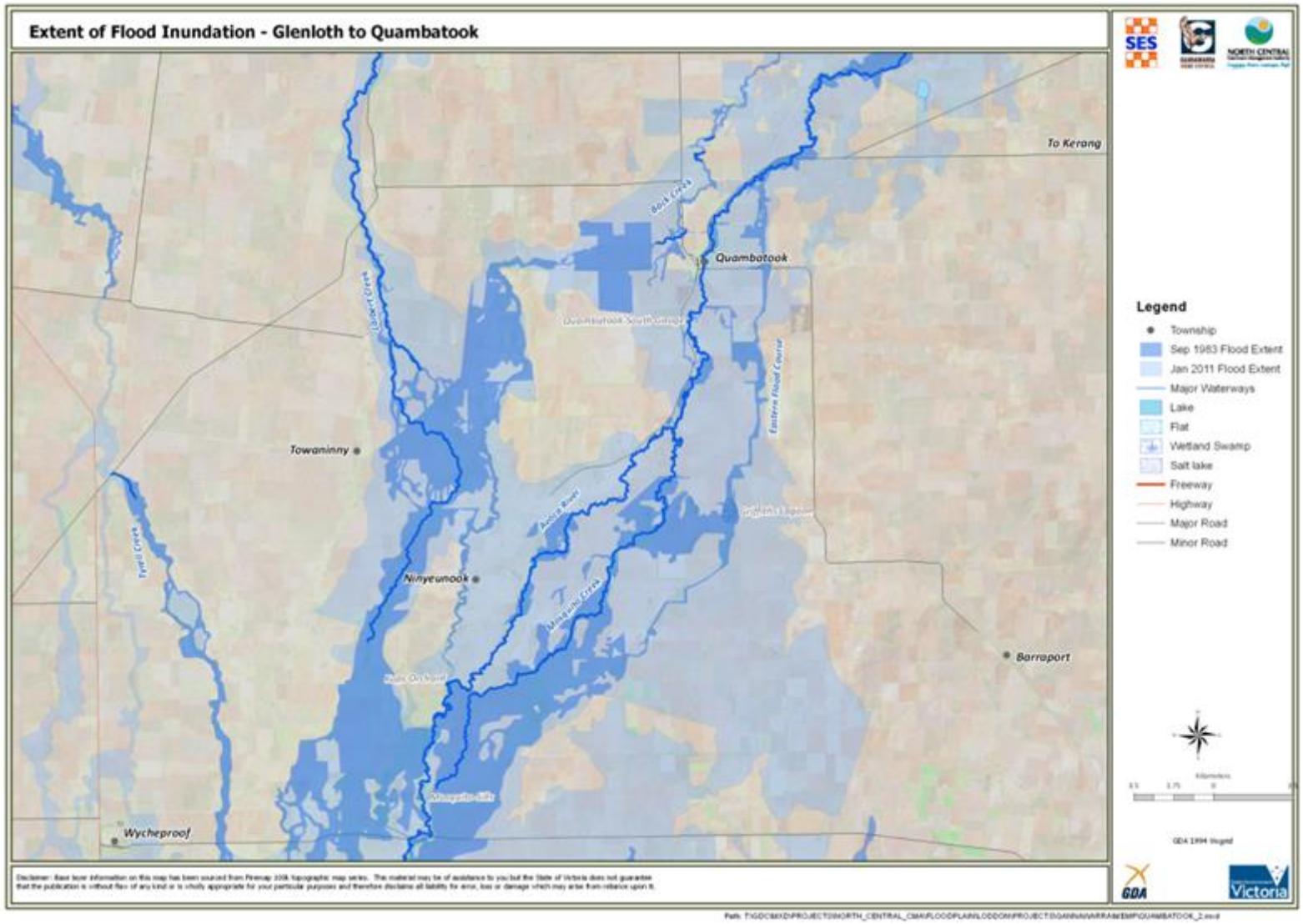


Figure G16 – Quambatook strategic levee constructed 2019

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, Local Information Officers (LIOs) and other agency networks identified in this plan will help support this process.

LIOs provide a key communication interface to community observers and other sources of local knowledge.

The formal flood warning system is complemented by an effective network of Local Information Officers who reside in seven (7) of the more vulnerable areas of the municipality (see list below), and are capable of providing or disseminating information as the case may be:

- Avoca River (south) / Lalbert Creek (all) / Back Creek (south)
- Avoca River (north) / Sandhill Lake / Back Creek (north) / Lakes system Avoca Outfall / Marshes / Wandell Creek (north)
- Wandella Creek / Loddon River (south) / Bannacher Creek / Nine Mile Creek / Calivil Creek
- Kow Swamp / Pyramid Creek / Box Creek / Barr Creek (south) / Murray River (south) / Calivil Creek / Gunbower Creek / Piccininny Barr Creek (south)
- Murray River (mid) / Gunbower Creek (north) / Piccininny Barr Creek (north) / Barr Creek (mid) / Pyramid Creek (mid)
- Murray River (north) / Barr Creek (north) / Loddon River (north) / Sheepwash Creek / Reedy Lakes
- Loddon River (mid) / Kerang Township

The seven (7) x Attachments to this Appendix contain structures and contact information for each of the Local Information Officer Groups listed above.

Leading up to and during a flood event, the municipality will liaise directly with these Local Information Officer groups and establish a two way flow of information to facilitate:

a) Issue of relevant warnings to the affected communities (landowners and occupants) where necessary;

b) Provision to those communities of other appropriate flood related information; and

c) Provision of local information from the Local Information groups to VICSES and other agencies regarding the progress of flood waters and of flood response activities intelligence and early advice to VICSES / Council of significant changes and/or developments in particular areas.

In each case, the first point of contact should be the nominated Local Information Officer Team Leader.

CONFIDENTIAL AVOCA RIVER (SOUTH) GROUP

Avoca River (south) ■ Lalbert Creek (all) ■ Back Creek (south)

CONFIDENTIAL AVOCA RIVER (NORTH) / LAKES GROUP

Avoca River (north) ■ Sandhill Lake ■ Back Creek (north) ■ Lakes System ■ Avoca Outfall ■ Marshes ■ Wandella Creek (north)

CONFIDENTIAL LODDON RIVER (SOUTH) GROUP

Wandella Creek ■ Loddon River (south) ■ Bannacher Creek ■ Nine Mile Creek ■ Calivil Creek

CONFIDENTIAL LODDON RIVER (NORTH) / MURRAY RIVER (NORTH) GROUP

Murray River (north) ■ Barr Creek (north) ■ Loddon River (north) ■ Sheepwash Creek ■ Reedy Lakes

CONFIDENTIAL MURRAY RIVER (SOUTH) / PYRAMID CREEK (SOUTH) GROUP

Kow Swamp ■ Pyramid Creek ■ Box Creek ■ Barr Creek (south) ■ Murray River (south) ■ Calivil Creek ■ Gunbower Creek ■ Piccininny Barr Creek (south)

CONFIDENTIAL MURRAY RIVER (MID) / PYRAMID CREEK (MID) GROUP

Murray River (mid) ■ Gunbower Creek (north) ■ Piccininny Barr Creek (north) ■ Barr Creek (mid) ■ Pyramid Creek (mid)

CONFIDENTIAL LODDON RIVER (MID) / KERANG TOWNSHIP GROUP

Loddon River (mid) ■ Kerang Township

Appendix I: - Local flood information

Under the Floodsafe Program, VICSES in consultation with Local Information Officers, Council and NCCMA produced Local Flood Guides for the townships of Kerang, Quambatook and Murrabit/Benjeroop.

The Flood Guides explain local flood risks for each of these communities. The guides also advise how to prepare for and respond to flood events. Theses flood guides can be found at https://www.ses.vic.gov.au/get-ready/your-local-flood-information