Flood Emergency Plan for the Campaspe Municipal District

A Sub-Plan of the Municipal Emergency Management Plan

Issue 7 - Feb 2019

Integrated Management Framework

FLOOD EMERGENCY PLAN

FOR THE CAMPASPE MUNICIPAL DISTRICT

PURPOSE:	This Flood Emergency Plan has been produced pursuant to Section 20(1) of the Emergency Management Act 1986 and the Emergency Management Act 2013 and assists in the organisation of emergency management in relation to floods.
SCOPE:	Floods have been identified in the Community Emergency Risk Register in the Municipal Emergency Management Plan as having a high risk. Consequently this plan has been developed. Emergency planning is undertaken at a state level, regional level and a local level. This plan is for the local level only. The plan outlines arrangements for the prevention of, preparedness for, and recovery from flood emergencies within the Campaspe municipal area but primarily covers the response to flood emergencies.
REFERENCES:	These are listed in Appendix "G".
AUDIT:	This Flood Emergency Plan is a sub-plan of the Northern Victorian Integrated Municipal Emergency Management Plan and therefore is subject to the audit provisions of Section 20A of the Emergency Management Act 1986.
DOCUMENT TRANSMITTAL:	**Hard copy holders**: Document Transmittal Forms will be forwarded to copy holders with any changes to hard copies mailed out. Copy holders are to replace pages according to the instructions, and return the signed Document Transmittal Form. **CD holders:** Copy holders are to replace the new issue and destroy the old issue, and return the signed Document Transmittal Form. **Electronic copy holders:** Copy holders are to replace the new issue and delete the old issue, and respond by return email that they have done so.
PUBLIC VERSIONS:	In the publicly available document (eg library, VICSES website, Council web site) any personal or confidential details will be removed.

This Plan has been produced as a cooperative effort from emergency service agencies and service organisations

Amendments

This Flood Emergency Plan will be amended, maintained and distributed as required by VICSES after consultation and in conjunction with the IMEMPC, and consideration by the Campaspe Shire Council

Suggestions for amendments to this Plan should be forwarded to VICSES Regional Office, 7 Rohs Road, Bendigo 3550.

Amendments listed below have been included in this Plan and promulgated to all registered copyholders.

Issue Number	Date approved by VICSES Regional Manager	Date considered by Council	Date distributed	Page No and details of amendment
1.0			23/4/1999	All
			20/3/2000	Same version re-issued
1.1			12/4/2000	Title Page, App D & H
1.2			24/4/2001	Title Page, Part 1 pg 3, App A pg 6, Entire sections of Part 5, App D, App F and App H
2.0			7/2/2003	All – re-issue
2.1			23/4/2004	Title Page and pg i, Pt 2 pg 9, App D pgs 5, 20 and 24, App H
3		18/11/2011	11/11/2011	All – Reissue, all sections reviewed, interim update only before the issue of a new standard template by the VICSES Adopted by Council 18 October 2011
4	1/12/2014	18/11/2014	28/11/2014	All – Reissue. All sections reviewed, additional information included throughout and to the standard template of VICSES.
5	15/9/2015	17/11/2015	18/11/2015	All – Reissue. Machinery of government changes made. Inclusion of Appendix H which covers sandbagging operations.
6		6/12/2016	9/12/2016	All – Reissue. Name changes, updating to include location of pits in Appendix C1.
7	25/7/2018	21/8/2018	21/8/2018	All – Reissue. Changes made to include removal of irrigation channels, installation of flood gauges and availability of FloodZoom. Rochester mapping updated.
7	27/2/2019			Minor update – List of Abbreviations & Acronyms.

This Plan will be maintained on the following websites:

Victoria State Emergency Service – www.ses.vic.gov.au

Campaspe Shire Council – www.campaspe.vic.gov.au

All confidential information will be removed prior to the document going on to the websites.

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List of Abbreviations & Acronyms

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

Part 1. INTRODUCTION

1.1 Municipal Endorsement

This Flood Emergency Plan for the Campaspe Municipal District (FEP) has been prepared by the Municipal Flood Emergency Planning Committee (MFEPC) and with the authority of the Northern Victorian Integrated Municipal Emergency Management Planning Committee (IMEMPC) pursuant to Section 20 of the Emergency Management Act 1986 (as amended).

When reading this Plan, any reference to Flood Emergency Plan should be read as "Flood Emergency Plan for the Campaspe Municipal District".

This FEP is a sub plan to the Northern Victorian Integrated Municipal Emergency Management Plan: Campaspe ShireIMEMP), is consistent with the Emergency Management Manual Victoria (EMMV) and the Victoria Flood Management Strategy (DNRE, 1998a), and takes into account the outcomes of the Community Emergency Risk Assessment (CERA) process undertaken by the IMEMPC.

The FEP is also consistent with the Regional Flood Emergency Plan and the State Flood Emergency Plan.

The FEP is a result of the cooperative efforts of the Flood Emergency Planning Committee (FEPC) and its member agencies.

The FEP will be circulated to FEPC members seeking acceptance of the draft plan. The Plan is also to be agreed to, in writing, by the Victorian State Emergency Service Regional Manager

Upon acceptance, the plan is forwarded to the IMEMPC for recommending to Council for consideration as a sub-plan of the IMEMP If approved by the IMEMPC, Council staff will prepare a report to Council for consideration of the FEP, pursuant to Section 21 of Part 4 the Emergency Management Act 1986.

The Amendment page listing at the beginning of this Plan indicates the history of consideration and acceptance of the document.

1.2 The Municipality

An outline of Campaspe municipal district in terms of its location, demography and other general matters is provided in the IMEMP. An outline of the flood threat is provided in Appendix A of this Plan.

1.3 Purpose and Scope of this Flood Emergency Plan

The purpose of this FEP is to detail arrangements agreed for the planning, preparedness / prevention of the community and agencies, response and recovery from flood incidents within the Campaspe municipal district.

As such, the scope of the Plan is to:

- Identify the Flood Risk to the Campaspe municipal district;
- Support the implementation of measures to minimise the causes and impacts of flood incidents within the Campaspe municipal district;
- Detail preparedness, response and recovery arrangements including, Incident Management, Command and Control;
- Identify linkages with Local, Regional and State emergency and wider planning arrangements with specific emphasis on those relevant to flood.

1.4 Flood Emergency Planning Committee (FEPC)

Membership of the Flood Emergency Planning Committee (FEPC) comprises the following representatives from the following agencies and organisations:

- Victoria State Emergency Service (Region) - Chair
- Victoria State Emergency Service Units (Rochester, Echuca, Kyabram and Rushworth).
- Campaspe Shire Council
- Victoria Police
- Echuca/Moama Search & Rescue Squad
- North Central Catchment Management Authority
- Department of Environment, Land, Water and Planning.

Subject Matter Experts (non-voting members):

The following agencies can be called upon whenever their expertise is required:

- Goulburn Valley Water
- Goulburn Murray Water
- Coliban Water
- Goulburn Broken Catchment Management Authority
- Bureau of Meteorology.

1.5 Responsibility for Planning, Review and Maintenance of this Plan

This Municipal Flood Emergency Plan must be maintained in order to remain effective.

VICSES, through the Flood Emergency Plan Committee and the IMEMPC, has responsibility for preparing, reviewing, maintaining and distributing this plan.

The plan will be reviewed on an annual basis in line with the Municipal Emergency Management Plan. This will be done by the FEPC.

The plans should be reviewed:

- Following any new flood study;
- Change in non-structural and/or structural flood mitigation measures;
- After the occurrence of a significant flood event within the Municipality to review and where necessary amend arrangements and information contained in this Plan.

Note: Reissue of the Plan, with minor changes such as updating contact details and procedural matters, can be undertaken by VICSES or Council Officers at any time (this includes the period between the recommendation for adoption of the Plan by the IMEMPC and a report being considered by the Campaspe Shire Council). However, once a year the Plan should be considered by Council.

The Campaspe Shire Council holds the master copy of the document and it is expected that central receivers of the various agencies who hold copies of the Plan, will have internal processes in place to ensure distribution of the Plan within their organisation.

Part 2. PREVENTION / PREPAREDNESS ARRANGEMENTS

2.1 Community Awareness for all Types of Flooding

Details of this FEP will be released to the community through local media, the FloodSafe program, websites (VICSES and the Municipality) upon consideration by the Campaspe Shire Council.

VICSES, with the support of Goulburn Broken Region Catchment Management Authority, North Central Catchment Management Authority and Campaspe Shire Council will coordinate community education programs for flooding within the municipal area. Eg. FloodSafe / StormSafe and through the distribution of local flood guides to the communities of Echuca and Rochester

2.2 Structural Flood Mitigation Measures

Refer to Appendices A and C for detailed information on structural mitigation measures.

2.3 Non-structural Flood Mitigation Measures

2.3.1 Exercising the Plan

Arrangements for exercising this Plan will be at the discretion of the IMEMPC. This Plan should be regularly exercised, preferably on an annual basis. Refer to section 4.7 of the EMMV for guidance.

2.3.2 Flood Warning

Arrangements for flood warning are contained within the State Flood Emergency Plan and the EMMV (Part 3.7) and on the BoM website.

Specific details of local flood warning system arrangements are provided in Appendix E.

2.3.3 Flood Observers

There is currently no formal flood warden network, however, local intelligence during flood events is paramount and will be sourced from local agencies and community members.

Part 3. 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 Incident Controller.

The Incident Controller/RDO VICSES will activate agencies as required and documented in the State Flood Emergency Plan.

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 Campaspe municipal district. These agencies will be engaged through the Incident EMT.

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

3.1.3 Municipal Operations Centre (MOC)

Liaison with the MOC will be through the established Division/Sector Command and through municipal involvement in the Incident EMT, in particular the Municipal Emergency Response Coordinator (MERC). The VICSES RDO / IC will liaise with the MOC directly if no Division/Sector Command is established.

The function, location, establishment and operation of the MOC will be as detailed in the MEMP.

3.1.4 Escalation

Most 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 areas (on a regional basis) and then on a State-wide basis.

Resourcing and event escalation arrangements are described in the EMMV ('State Emergency Response Plan' – section 3.5).

3.2 Strategic Control Priorities

To provide guidance to the Incident Management Team (IMT), the following strategic control priorities shall form the basis of incident action planning processes:

1. Protection and preservation of life is paramount - this includes:

    a. Safety of emergency services personnel, and;

    b. Safety of community members including vulnerable community members and visitors/tourist located within the incident area.

2. Issuing of community information and community warnings detailing incident information that is timely, relevant and tailored to assist community members make informed decisions about their safety;

3. Protection of critical infrastructure and community assets that supports community resilience;

4. Protection of residential property as a place of primary residence;

5. Protection of assets supporting individual livelihoods and economic production that supports individual and community financial sustainability;

6. Protection of environmental and conservation values that considers the cultural, biodiversity, and social values of the environment.

Circumstances may arise where the Incident Controller is required to vary these priorities, with the exception being that the protection of life should remain the highest. This shall be done in consultation with the State Controller and relevant stakeholders based on sound incident predictions and risk assessments.

3.3 Command, Control & Coordination

The Command, Control and Coordination arrangements in this Flood Emergency Plan are consistent with those detailed in State and Regional Flood Emergency Plans. For further information, refer to sections 3.4, 3.5 & 3.6 of the EMMV.

The specific details of the Command, Control and Coordination arrangements for this plan are to be provided in Appendix C.

3.3.1 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 7.1 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

All flood response activities within the Campaspe municipal district including those arising from a dam failure or retarding basin / levee bank failure incident will therefore be under the control of the appointed Incident Controller, or his / her delegated representative.

3.3.2 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 Incident Controller responsibilities are as defined in Part 3.5 of the EMMV.

3.3.3 Incident Control Centre (ICC)

As required, the Incident Controller 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 Incident Control Centre locations are:

- Bendigo, Department of Environment, Land, Water and Planning (DELWP), Taylor Rd Epsom (L3)
- All Level 2 and 3 ICC's are listed in the Loddon Mallee Regional Flood Plan.

3.3.4 Divisions and Sectors

To ensure that effective Command and Control are in place, the Incident Controller may establish Divisions and Sectors depending upon the complexity of the event and resource capacities.

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

* Additional Divisions/Sectors may be defined by the Incident Controller if required

Division	Sector
Echuca (CFA)	Elmore (CFA)
	Rochester (SES)
	Echuca Village (CFA)
	Echuca (SES)
	Torrumbarry (CFA)
	Stanhope (CFA)
	Colbinabbin (CFA)
	Rushworth (SES)
	Kyabram (SES)
	Lockington (CFA)

3.3.5 Incident Management Team (IMT)

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

Refer to 3.5 of the EMMV for guidance on IMTs and Incident Management Systems (IMSs).

3.3.6 Emergency Management Team (EMT)

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

Organisations, including Campaspe Shire Council, required within the EMT 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 3.5 of the EMMV for guidance on EMTs.

3.3.7 On Receipt of a Flood Watch / Severe Weather Warning

Incident Controller or VICSES RDO (until an incident controller is appointed) will undertake actions as defined within the flood intelligence cards (appendix C). General considerations by the Incident Controller/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, Catchment Management Authorities, Department of Environment and Primary Industries, Goulburn Murray Water, Coliban Water and Goulburn Valley Water, other emergency services and flood wardens through the EMT;
- Assess ICC readiness (including staffing of IMT and EMT) and open if required;
- Ensure flood bulletins and community information are prepared and issued to the community and advise Campaspe Shire Council and other agencies;
- Monitor watercourses and undertake reconnaissance of low-lying areas;
- Develop media and community information management strategy;
- Ensure flood mitigation works are being checked by owners;
- Develop and issue incident action plan, if required;
- Develop and issue situation report, if required.

3.3.8 On Receipt of the First and Subsequent Flood Warnings

Incident Controller/VICSES RDO (until an incident controller is appointed) will undertake actions as defined within the flood intelligence cards (appendix C). General considerations by the Incident Controller/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 – flood wardens
  - 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.

3.4 Community Information and Warnings

Guidelines for the distribution of community information and warnings are contained in the State Flood Emergency Plan.

Community information and warnings communication methods available include:

- Emergency Alert;
- Phone messages (including SMS);
- Radio and Television;
- Two-way radio;
- Mobile and fixed public address systems;
- Sirens;

- Verbal Messages (i.e. Doorknocking);
- Agency Websites;
- VICSES Flood Storm Information Line;
- Variable Message Signs (i.e. road signs);
- Community meetings;
- Newspapers;
- Email;
- Telephone trees;
- Community Flood Wardens;
- Fax Stream;
- Newsletters;
- Letter drops;
- Social media and/or social networking sites (i.e. twitter and/or facebook).

Refer to Appendix C and E for the specific details of how community information and warnings are to be provided.

The release of flood bulletins and information with regard to response activities at the time of a flood event is the responsibility of VICSES, as the Control Agency.

Council has the responsibility to assist VICSES to warn individuals within the community. Responsibility for public information, including media briefings, rests with VICSES as the Control Agency.

Other agencies such as CFA, DELWP and VicPol may be requested to assist VICSES with the communication of community flood warnings.

In cases where severe flash flooding is predicted, dam failure is likely or flooding necessitating evacuation of communities is predicted, the Incident Controller may consider the use of the Emergency Alert System and Standard Emergency Warning System (SEWS).

The Department of Health and Human Services will coordinate information regarding public health and safety precautions.

3.5 Media Communication

The Incident Controller through the Information Unit established at the ICC will manage Media communication. If the ICC is not established the RDO will manage all media communication.

3.6 Initial impact assessment

An initial impact assessment can be conducted in accordance with part 3 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.

3.7 Preliminary Deployments

When flooding is expected to be severe enough to cut access to towns, suburbs and/or communities the Incident Controller 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, sandbags etc.

3.8 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 Flood Emergency Plan.

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 advising them not to attempt to flee by entering floodwater if they become trapped, and that it may be safer to seek the highest point within the building and to telephone 000 if they require rescue. This advice needs to be provided even when evacuation may be possible, due the likelihood that not all community members will evacuate;

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.

During a flash flood it will often be difficult, due the rapid development of flooding, to establish evacuation (relief) centres ahead of actually triggering the evacuation as is normal practice but this is insufficient justification for not adopting evacuation.

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

3.9 Evacuation

The decision to recommend or warn people to prepare to evacuate or to evacuate immediately rests with the Incident Controller.

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 section 3.8 of the EMMV and the Evacuation Guidelines for guidance of evacuations for flood emergencies.

3.10 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.

3.11 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 Incident Controller.

The Incident Controller may request aircraft support through the State Air Desk located at the State Control Centre will establish priorities.

Suitable airbase facilities are located at Echuca Airport.

3.12 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.

3.13 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.

Campaspe Shire Council maintains a small stock of sandbags for Council infrastructure only. Supplies of sandbags are available through the VICSES Regional Headquarters. The Incident Controller will determine the priorities requiring 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 Incident Controller will ensure that owners of essential community infrastructure are kept advised of the flood situation. Essential community infrastructure providers must keep the Incident Controller informed of their status and ongoing ability to provide services.

Refer to Appendix C for further specific details of essential infrastructure requiring disruption to services.

3.14 Disruption to Service

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

3.15 Road Closures

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

VicRoads and Campaspe Shire Council will communicate community information regarding road closures.

3.16 Dam 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 occur. Major dams with potential to cause structural and community damage within or adjacent to the Municipality are contained in Appendix A. Lake Eppalock is the major dam effecting Campaspe and is operated by Goulburn Murray Water (GMW). GMW holds and maintains plans for dam failure. The Incident Controller will liaise with DELWP & Dam operators (GMW) in the event of possible failure to determine possible consequences and actions required.

3.17 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 responsible 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.

The responsible agency for reticulated sewage systems is the relevant Water Authority who will provide advice to the Campaspe Shire Council Environmental Health Officer (EHO) on the expected volumes of sewage contamination entering the flood to enable an assessment of the risk to be made. The risk to reticulated drinking water systems from floodwaters is the responsibility of the local Water Authority to assess and manage under the direction of the Department of Health and Human Services, Environmental Health unit, and to report to the ICC and Campaspe Shire Council EHO.

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

3.18 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. EMERGENCY RELIEF AND RECOVERY ARRANGEMENTS

4.1 General

Arrangements for recovery from a flood incident within the Campaspe municipal district are detailed in the Integrated MEMP: Campaspe Shire.

4.2 Emergency Relief

The decision to recommend the opening of an emergency relief centre rests with the Incident Controller in consultation with, or on advice from, the Municipal Recovery Manager of DHHS. Incident Controllers are 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 4.4 of the EMMV for details of the range of emergency relief services that may be provided.

Suitable relief facilities identified for use during emergencies are detailed in Appendix D of the Integrated MEMP: Campaspe Shire.

Details of the relief arrangements are available in the Integrated MEMP: Campaspe Shire.

4.3 Animal Welfare

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

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

Refer to the Emergency Animal Welfare, Stock Management and Disposal Plan for additional detail.

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 Section 3.10 of the EMMV.

APPENDIX A - FLOOD THREATS FOR CAMPASPE SHIRE

1. General

The Shire covers an area of 4,500 square kilometres and is predominantly flat but with forested hills in the south. The Rushworth hills, in the southeast part of the Shire, are drained by the Wanalta Creek and tributaries. The Mount Camel range divides the southern part of the Shire and is located to the east of the Campaspe River. The range runs northward from the southern boundary of the Municipality and flattens out into the plains to the east of Rochester.

The stream and catchment network is complex given that a number of independent waterways and catchments come together within the Shire. The main watercourses and water bodies include the:

- Lower Goulburn River;
- Campaspe River (tributaries include Axe, Sweenies, Forest and Mount Pleasant creeks);
- Murray River;
- Gunbower Creek;
- Yambuna Creek and the Kanyapella Basin (picks up drainage from the area around Kyabram and Tongala);
- Bendigo Creek (including the Tang Wetlands and the Winghee Swamps);
- Kow Swamp (Bendigo Creek terminates in the swamp; Taylors Creek also connects to the swamp);
- Waranga Basin (an off-stream water storage basin operated by GMW);
- Deakin Main Drain (also known as Southern Cross Drain) which discharges to the Murray near Echuca and picks up water from:
  - Cornella Creek (including Lake Cooper and the overflow system of Gaynor Swamp, Horseshoe Lake and Greens Lake);
  - Wanalta Creek and the Wallenjoe Wetlands (including Nine Mile and Moora creeks as well as Two Tree Swamp and Mansfield Swamp);
  - The Corop Lakes;
  - Woolwash, Stanhope, Timmering and Nanneella Depressions; and
  - Mosquito Depression (starts north of Murchison and passes through Tatura);
- Many irrigation and drainage channels.

2. Riverine Flooding

Large severe floods within the Municipality generally occur as a result of 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. The period of general rainfall "wets up" the catchments and (partially) fills 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.

Water level rises through the Municipality tend to be relatively delayed with rural flooding in the Deakin Basin and flooding along the Campaspe River occurring 24 hours or more after the start of heavy rainfall. Rises in the Murray River tend to be more delayed and are affected by flows from the Campaspe and Goulburn rivers.

3. Flash Flooding and Overland Flows

Short duration, high intensity rainfall (usually associated with thunderstorms) can also cause localised flooding within the urbanised areas and 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 where flow exceeds design capacity 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 records may provide some guidance in such cases.

4. Overview of Flooding

The towns most at risk of riverine flooding within the Municipality are Echuca, Rochester and Gunbower with Kyabram (in particular), Tongala, Rushworth, Stanhope, Nanneella having some risk during localised heavy storms. Large areas of rural land to the west of the Campaspe River including in the Torrumbarry / Gunbower area and particularly in the eastern part of the Municipality in the Deakin Basin (eg. including Kanyapella, Wyuna, Yambuna, Colbinabbin and Wanalta), can flood following locally heavy rain or periods of prolonged rainfall.

From a flooding perspective, the Goulburn, Murray and Campaspe rivers dominate. In Echuca flooding can result from rain falling over a single catchment or over several catchments. The timing, distribution and amount of rainfall determine the magnitude and duration of flooding at Echuca. The western side of Echuca can be flooded from the Campaspe while the northern and eastern side can be flooded from the Murray.

More than minor flooding in the Campaspe at Echuca is unlikely unless Lake Eppalock is spilling.

It should be noted that just as the Murray River influences the Campaspe, the Campaspe River can cause back-up effects in the Murray River (as happened in January 2011).

Note that a large Murray flood upstream from Barmah is not indicative of future flooding at Echuca. This is because the Barmah Choke restricts Murray River flows past Barmah to around 35,000ML/d with the balance being forced northwards into NSW along the Edwards River. Flooding at Echuca 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. Note also that if Goulburn River flows are high and Murray flows are low, some backflow can occur through the Barmah Choke (ie. in effect the Murray flows upstream).

The urban area of Echuca has been predominantly protected by levees from the end of 1992. They provide protection up to a 3% AEP event in the Murray River with about 600mm freeboard and up to a 1% AEP event in the Campaspe River with no freeboard. Some areas in Echuca East (eg. Bynan Street and the north side of Goulburn Road – up to 300 properties) are not protected by the levees: Landowners are expected to implement individual protective measures. The Echuca levees are described in greater detail in Appendix C1.

Echuca Village is located on the eastern outskirts of Echuca and consists of relatively small rural allotments containing many farmlets. While the area is protected by levees of unknown structural integrity along the Beattie Floodway (and lower Goulburn), flooding can occur from floodwaters backing up the Southern Cross Drain or flows from breakouts from the east side of the Campaspe River downstream from Rochester. If a flood event did overtop the levees, access to the area would be difficult and protection of residences that do not have floor levels above flood level would be difficult to achieve.

In Echuca the area immediately to the west of the Campaspe River is located on the natural floodway and is not protected by formal levees. The area is susceptible to flooding from both the Campaspe and Murray Rivers. In 1975, floodwaters up to 1m deep inundated the area south of Warren Street for a considerable time.

A history of notable flood events within the Municipality is provided below and in Appendix C of this Plan.

5. Drainage Hot Spots within the Shire

Areas that have a high risk of flooding during heavy rain events (as at January 2012):

Town & Street Name	Map Reference Spatial Vision Map Book	Notes
Gamble Court, Colbinabbin	8223 J2	Localised flooding in Gamble Court could result in one property being inundated. If the Cornella Creek breaks its banks this can also cause flooding in Gamble Court.
Sturt Street, Echuca	8228 K3	Localised flooding along the length of road, particularly at the roundabout with Pakenham Street. Can enter properties e.g. flooding one cellar at the intersection of Pakenham Street and Sturt Street.
Service Road east side of Northern Highway between Murray Valley Northern Highway Roundabout and Rose Street, and south of Rose Street, Echuca	8228 E8	Localised flooding of road. Access to properties an issue for residents north of Rose Street, and in the service road south of Rose Street and access to businesses fronting this service road is restricted.
High Street / Darling Street, Echuca	8228 J4	Localised flooding closes one lane to traffic in High Street.
Darling / Hare Street, Echuca	8228 J4	Localised flooding at the intersection of Darling and Hare Streets can come close to entering shop on this intersection. It prevents access to shop in such events.
Pakenham / Hare Street, Echuca and eastward on Pakenham Street frontage	8228 J4	Localised flooding to past the Post Office. Access for vehicles an issue.
Anstruther Street / High Street, Echuca	8228 J3	Localised flooding on the south east corner. No underground pipe along east side of High Street.
High Street south of Ogilvie Avenue, Echuca	8228 K7	Subject to localised flooding by storm water run off from the east. Ash Street is a particular issue. Flooding could also occur if the Campaspe River is high and flows in the underground pipes to the outlet are impeded.
Matong Road, Echuca	8229 B9	Localised flooding in Matong Road.
Mundarra Road, Echuca	8229 B7	Localised flooding of Mundarra Road.
316 High Street and intersection of High / Service Streets, Echuca	8228 J7	Localised flooding of property with water under the house at 316 High Street and flooding of the High / Service Streets intersection.

Town & Street Name	Map Reference Spatial Vision Map Book	Notes
Ogilvie Avenue service road near Crossen Street, Echuca	8228 F7	Localised flooding of service lane restricting access to properties.
Area around Brenton Avenue, Jamieson Drive, Park Avenue, Westwood Place, Echuca		Localised flooding sufficient to restrict access to properties.
Emu Court, Kyabram	8246 G9	Localised flooding sufficient to restrict access to properties.
Koala Court, Kyabram	8249 G9	Localised flooding sufficient to restrict access to properties and flowing through one garage.
Tisdall Road and Frederick Street, Kyabram	8247 G4	Localised flooding sufficient to restrict access to properties.
Cassia Court, Kyabram	8246 D8	Localised flooding of the court bowl. Water rises part way up the nature strip before it heads eastward out of the court bowl. It is sufficient to restrict access to properties.
Cowan Court, Kyabram	8246 D7	Localised flooding of the court bowl sufficient to restrict access to properties.
Mitchell Street, Chaston Street, Pettifer Street area, Kyabram	8247 F7	Low lying streets upstream of Lake Road sump. Localised flooding in the streets sufficient to restrict access to properties. On occasion water enters garages in Pettifer Street.
Park Street, Kyabram	8246 G8	Localised flooding. Road has been closed on occasions.
Richards Street, Kyabram	8246 G7	Localised flooding. Road has been closed on occasions.
Fischer / Lake Road, Kyabram	8246 F7	Localised flooding.
End of Markham Street, Kyabram	8246 E6	Localised flooding.
Gillespie Street, Kyabram	8246 E5	Localised flooding.
Fenaughty Street / Goddard Street, Kyabram	8246 E7	Localised flooding.
Allan Street, Kyabram	2846 F7	Localised flooding at the rear of Retravision and Hurley's Hotel. This is a private drainage issue, not a result of a Council drain.
McCormick Road, Kyabram	8246 C5	Localised flooding along McCormick Road (i.e. Engineering works at intersection of McEwen Road and McCormick Road, Caltex Service Station and adjoining transport depot.)
Breen Avenue / Oorilim Avenue, Kyabram	8246 H8	Localised flooding from Pullar Street to Fischer

Town & Street Name	Map Reference Spatial Vision Map Book	Notes
near school		Street. Localised flooding with water up to 400mm deep.
Kyabram Caravan Park east of railway line – Anderson St	8246 H7	Localised flooding within park
McEwan Roads from Wood Road to McCormick Road and surrounding streets, Kyabram		Localised flooding. Two businesses can be inundated.
Roger Street, Kyabram		Localised flooding sufficient to restrict access to properties.
South Boundary Road and Gardadale Road, Kyabram		Localised flooding.
Union Street Kyabram, between Lake Road and Richard Street		Localised flooding. One property becomes inundated, including garage.
Alfred Crescent, Lockington		Localised flooding.
Elizabeth Street / Mackay Street, Rochester	8277 D8	Localised flooding of roads. Requires signage – Water Over Road. Clears after about 1 – 2 hours
Railway Road / McKenzie Street, Rochester	8277 A14	Localised flooding from south west over road. Properties can be flooded.
Bayne Street, Rochester		Localised flooding south of Kyabram Rochester Road.
Kyabram Rochester Road, Rochester		Localised flooding.
Near Rochester cemetery		Localised flooding through natural drainage depression.
Ramsay Street, between Mary and Elizabeth Streets, Rochester		Localised flooding through natural depression.
Kyabram – Rochester Road (Bridge Road)		Campaspe River first overtops the road to the east of the bridge from less than a 10-year ARI event (eg November 2011). Bridge is also overtopped in big floods.
High Street, Rushworth	8278 F11	Localised flooding in front of Bakery and Chemist.
Esmonde Street / Wigg Street intersection, Rushworth	8278 E11	Localised flooding of property can occur from flows down Moore Street overtopping drain and entering the property. Water can flow under the house.
Mary Ann Road Brecon Court Benson Road Nolan and Pianta Roads		

Town & Street Name	Map Reference Spatial Vision Map Book	Notes
Wharparilla Drive Restdown Road Hill Road Singer Road Anderson Road Simmie Road Benson Road near Northern Highway Tehan Road Graham Road Strathallan Road O'Dea Road Tasman Court Winter Road Doherty Road Echuca Nanneella Road / Webb Road intersection		

6. Overview of Catchments and Flood Behaviours

The **Goulburn River** rises upstream of Lake Eildon, flows through Seymour and Shepparton, enters the Shire at McCoys Bridge at the Murray Valley Highway and joins the Murray River about 15km upstream of Echuca. While the majority of effluent flows from the Goulburn River spill northwards into Moira Shire, breaching of levees during major flooding can cause inundation of the Goulburn River floodplain in Campaspe Shire. The flood height and timing at which levees are breached or effluent flows begin (ie. into the Deep, Wakiti, Sheepwash and Skeleton Creeks), has a significant bearing on flood behaviour across the Goulburn River floodplain. **Note that flooding above the September 2010 level (11.1m at Shepparton and 10.2m at McCoys Bridge) is likely to breach some levees along the lower Goulburn River, probably on both the northern and southern side of the river.**

The **Campaspe River** basin (see Figure A1) extends from the Dividing Range near Mt Macedon, 64 km northwest of Melbourne, to the Murray River at Echuca. The main tributaries are the Coliban River, Axe Creek and Mt Pleasant Creek. The floodplain is fairly narrow until just upstream of Rochester at which point it widens. As it approaches Echuca the floodplain narrows and becomes more defined. At Rochester a number of effluent flow paths allow floodwaters to spill:

- To the east:
  - From around Rochester into the Nanneella Depression and thus into the Timmering Depression and the Deakin Main Drain;
  - From just downstream of Rochester to the east side of Rochester Channel No 11 and into the Deakin Drainage system;
  - Across a broad area in-between Rochester Channel No 11 and the Bendigo-Echuca railway line and, closer to Echuca, either to the Deakin Main Drain across the Murray Valley Highway near Lady Augusta Road or back into the Campaspe River.
- To the west upstream and downstream of Rochester:
  - Into the Lockington and Bamawm Drainage area to the northwest which in turn outfall into Murphy Swamp in the Murray River floodplain.

The Campaspe River downstream from Rochester is bordered by the Northern Highway to the west and the Bendigo-Echuca railway line to the east. The highway appears to be on slightly higher ground than the railway. The area between these two features is widely flooded during major floods with the raised formations restricting the lateral movement of floodwaters to road and railway culverts. Land to the east of the railway is subject to shallow overland flooding and flooding along natural drainage lines. Land to the west of the Highway is also affected by shallow flooding.

Lake Eppalock is situated on the Campaspe River just south of the Shire and around 60km upstream from Rochester. It has a fixed crest and is operated by GMW. It was constructed between 1960 and 1964 and the main embankment was upgraded in 1999 and 2003. As it controls around half the catchment, the downstream flow regime has therefore changed since 1964. The Lake is used to impound water for irrigation and town use (Bendigo and Ballarat) and has a capacity of around 304,000ML. Although not intended as a flood mitigation storage, Lake Eppalock does, depending on storage levels prior to an event and because of its capacity, have considerable potential to mitigate floods in the Campaspe River. It also provides some degree of mitigation when full as indicated in the SKM report for the Victorian Flood Review (SKM, 2011, pages 22 & 23, section 5.1). The Rochester Flood Management Plan (Water Technology, 2013) demonstrated that if Lake Eppalock was at 70% full instead of 100% full at the start of the January 2011 flood event, the flows at Rochester would have been reduced significantly, producing a flood roughly equivalent to the November 2010 event.

Axe Creek, Sweenies Creek and **Forest Creek** all enter the Campaspe within a short distance downstream from Lake Eppalock. They can have a significant impact on the Campaspe River if there is localised heavy rain in their catchments

Mount Pleasant Creek enters the Campaspe River upstream of Elmore at Runnymede (well downstream from Lake Eppalock) and can also have a significant effect on the Campaspe River. The creek passes through the township of Toolleen. In the early 1990s, a storm resulted in severe localised flooding through the township. Velocities and depths were sufficient to wash a house off its foundations.

A section of **Gunbower Creek,** an anabranch of the Murray River and used by GMW as part of the Torrumbarry Irrigation System, is located in the Shire's northwest extremity. There is a connection between the creek and Kow Swamp.

Bendigo Creek drains the foothills around Bendigo, flows northward along the western boundary of the Shire and discharges into Kow Swamp near Gunbower in the Shire's northwest. A significant tributary creek (Myers Creek) enters just north of Dingee. From this point north to Kow Swamp the creek has also been known as both Mt Hope Creek and Piccaninny Creek, the creek outfalls into Kow Swamp.

About 6km east of Dingee and to the north of the Dingee-Rochester Road there is significant wetlands (Tang Tang) and about 10km east is the Winghee Swamps. Both are on the Bendigo Creek floodplain.
Pyramid Creek flows out of Kow Swamp to the northwest and joins the Loddon River just to the north of Kerang.

Flows that commence near the southern boundary of the Shire and flow northward through the Moora Creek, Nine Mile Creek, Wanalta Creek, Gobarup Creek, Two Tree Swamp, Wallenjoe Swamp, Mansfield Swamp and Timmering Depression, discharge into the Murray River through the **Deakin Main Drain** near Echuca (see Figure A2). This area which includes the Corop Lakes system, which is complex, and made up of a number of drainage features as follows.

- **Cornella Creek** rises in the hills to the north of Heathcote and flows to Lake Cooper where, in most years, it terminates. The Cornella Creek system includes Cornella Creek, Lake Cooper and the overflow system of Gaynor Swamp, Horseshoe Lake and Greens Lake.
- **Wanalta Creek** has a number of tributaries including Nine Mile Creek and Moora Creek and flows to Wallenjoe Swamp east of Colbinabbin. The creek has a well defined course as far north as Old Corop Road where it enters the One Tree Swamp. The terrain then becomes flatter. Water spills north through the Two Tree Swamp and into Wallenjoe Swamp. Flow from the creek into Wallenjoe Swamp cannot be controlled: the release through the regulator is the same as that entering the channel from the open creek. Wallenjoe Swamp has two outlets, one northwest to Greens Lake and the other northeast to Mansfield Swamp.
- The **Woolwash Depression** flows generally northwest from west of Rushworth via Mansfield Swamp into the Stanhope and Timmering Depression. A short section of GMW drain was built to connect to a community drainage scheme. This channel crossing acts as a throttle so that drainage waters can pass through to Greens Lake while ensuring that flood flows are directed into the Timmering Depression at Mansfield Swamp approximately 5km upstream of the Stanhope Depression.
- The **Stanhope Depression** is effectively blocked at both ends preventing flooding into the Timmering Depression. The embankment at the downstream end also prevents backup flows from the Timmering Depression.
- The **Nanneella Depression** which flows eastward from east of Rochester, discharges into the Deakin Main Drain. The Depression is an effluent flood course of the Campaspe River. During large floods, water can leave the river near Rochester and flow east to enter the Timmering Depression just upstream of the confluence with the Deakin Main Drain. It is well defined upstream of Thornton Road but downstream storm runoff spreads out over low lying country. Water spreads out and ponds in low lying areas as well as upstream of obstructions such as road formations, levees, channels and other works.
- The **Timmering Depression** also flows into the Deakin Main Drain. The Depression is a continuation to the north of the prior stream system that forms the Stanhope Depression. It is the main outfall for drainage from a large area to the south. Near Hadfield Road, runoff from the upper catchment of the Stanhope Depression has been diverted north through Mullins Cut to the Deakin Main Drain. The upper reaches of the Deakin Main Drain follow the former Stanhope Depression.
- The **Mosquito Depression** normally conveys local runoff from heavy rain. The Depression runs to the north from near Murchison. It flows past Tatura where it is joined by the East Arm Depression which flows through Tatura from the southeast. It then turns to the northwest and is fed by tributaries from the south as it passes Merrigum, Kyabram and Tongala. It enters Campaspe Shire 3.5km south of Kyabram and proceeds through the Municipality in a formed drain. It connects to the Deakin Main Drain west of Koyuga and discharges into the Murray River upstream of Echuca. These lakes and swamps provide significant flood attenuation as they progressively fill and overflow into the next. Infrastructure also acts to significantly attenuate peak flows. Because of the substantial attenuation and the retardation of flow along the Timmering Depression, flooding can last weeks to months and peak outflows to the Deakin Main Drain occur typically several weeks after flood producing storms. Accordingly, discharges at the Deakin Main Drain outfall are inordinately low for a catchment of this size, and rarely exceed some hundreds of megalitres per day.

  Note that the Tatura Flood Study (WBM, January 2006) dismissed the proposition that during major floods, effluent floodwaters can occur from the Goulburn River into the Mosquito Depression between Murchison and Shepparton.

Normally, the Deakin Main Drain flows along its constructed course to its outfall near Echuca. However, at the intersection with the Murray Valley Highway, a regulator can divert flows from the drain along the Beattie Depression (a freehold floodway) directly to the Murray River. The regulator is used when the Drain downstream from the Highway is influenced by high floodwaters in the Murray.

It should be noted that the Deakin Basin is undergoing almost constant change. For example, changes in agricultural management practices have seen a significant amount of land-forming over the last 20 or so years, regional drainage has been a focus, and obstruction removal programs have been implemented along major depressions following their Declaration as Drainage Courses. This work will impact on future flood behaviours.

7. Overview of Levees within the Shire

Urban Levees

At Echuca, levees and the associated stormwater drainage outlets that are managed and routinely maintained by Council, were constructed between 1989 and 1992 as part of a formal Flood Mitigation Scheme constituted under the Water Act 1958 and the Local Government Act 1958 and gazetted on 1 June 1988 (Council has a copy of the formal scheme on record if required). They are located on Crown land, road reserves or in easements on private property. The levees protecting the water treatment plant and raw water pump station are located on land managed by Coliban Water and are also maintained by Coliban Water. All of these levees are described in greater detail in Appendix C1.

Operations and Maintenance Manuals for use by Council were prepared for the Echuca levees in 1994 and outline appropriate triggers for closing gate valves, laying sand bags at the Radcliffe Street end of Collier Street, and operating and maintaining stormwater pumps, amongst other things. Copies of the manuals are available in Council's electronic document management system. Work Instructions, summarising the key points, have been prepared for use by Council field staff in managing Council controlled facilities such as pumps, gate valves, street furniture, pedestrian bridges, etc.

Note that the immediate area to the west of the Campaspe River in Echuca is located on the natural floodway. This area includes Anstruther Street, Warren Street through to Campaspe Esplanade. This area is not protected by levees and much of the area is zoned as Urban Floodway Zone (UFZ) within the Campaspe Planning Scheme. There is an island within this area that is not subject to flooding, this includes the cemetery and a number of residential properties to its east.

Rural Levees

Levees have been constructed adjacent to the Goulburn and Campaspe rivers in rural areas within the Shire to mitigate riverine flooding. These levees are not to 1% AEP standard and are generally neither well constructed nor maintained: their structural integrity, the date of construction, the extent of maintenance and the protection provided by many is unknown. There is also doubt as to whether they were all constructed with appropriate approvals. Some are situated on private land and some on public land.

In 2013, a project was undertaken to assess the condition of rural levees along the Lower Goulburn and Murray rivers as well as the level of protection they provide. This project was funded by the Department of Environment, Land, Water and Planning (DELWP) and was managed by the NCCMA and GBCMA for their respective regions.

Many of the levees along the lower Goulburn River were constructed as part of Government sponsored unemployment relief schemes following the depression of the 1890s and have no identifiable owner. Flooding above the September 2010 level (11.1m at Shepparton and 10.2m at McCoys Bridge) is likely to breach some of these levees along both sides of the lower Goulburn. Flooding of mostly rural properties may occur as a result however there is no specific details of the properties that may be impacted.

A significant levee system forms the Beattie Floodway north of the Murray Valley Highway at the Bay of Biscay to the east of Echuca. This floodway carries excess flows from the Deakin Main Drain northward directly to the Murray River.

For some distance downstream from Echuca, the Murray River is confined by constructed levees. On the NSW side, a number of effluent flow paths convey floodwaters into NSW when the levees breach or overtop. The Murray levees are strategically important as they protect tracts of agricultural land from minor and moderate floods. The condition of these levees is generally poor. Although they contained the 1993 and 2011 floods, they 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.

Other private levees have been constructed to mitigate overland sheet flow. This group of levees can be found in a number of areas within the Shire including:

- Around Runnymede and Muskerry (south of Elmore) in the southern central part of the Shire;
- Along the Woolwash Depression and through the Corop Lakes area in order to maintain minor and moderate floods within floodways;
- To the east of Rochester; and
- In the Wanalta / Colbinabbin / Corop area in the south eastern part of the Shire.

The locations of levees within the Shire are shown in Council's GIS in a layer titled "levees". While the data has been sourced through the NCCMA from DELWP, care should be exercised in using this data as it may not be complete or precise.

It should be noted that irrigation channels can form barriers to the overland flow of floodwaters including offering protection to property or re-directing flows from their natural course. A number of channels were decommissioned through the Goulburn Murray Water Connection Project (formerly Northern Victoria Irrigation Renewal Project – NVIRP). This work may affect future flows and should be considered in any planning or flood predictions. The flood modelling for the Rochester township has been updated to reflect current conditions; that is the removal of a number of channels in and around the township. The maps for Rochester in Appendix F reflect this updated modelling.

8. Infrastructure

8.1 Overview

The network of roads, irrigation channels and levees that cross the Campaspe and Deakin Basin floodplains intersect many of the natural flow paths and therefore have some impact on flood extents and the period of inundation.

The Murray Valley Highway passes from east to west as does the Midland Highway while the Northern Highway passes from north to south. The Tatura-Echuca railway line generally follows the boundary between the Deakin and Goulburn basins while the Bendigo-Echuca railway line extends north to south through the Campaspe Basin.

The Waranga Western Irrigation Channel, which supplies water to properties and towns between Waranga Basin and the Mallee in western Victoria, generally runs along the toe of the Rushworth Hills and the Mt Camel Range but crosses the floodplains of the Wanalta and Cornella creeks and the Campaspe River. Subways and regulating structures allow the passage of floodwaters across or into the channel. There is a perception that the Waranga Channel or as termed locally, the Siphon, has a significant impact on flooding in Rochester. The flood modelling undertaken for Rochester clearly showed that the siphon is far enough downstream as to not have any significant impacts on flood levels in Rochester township.

The old abandoned railway line may have some localised impact, but this is largely negated by the Waranga Western Irrigation Channel. Colbinabbin Primary School is impacted by flooding. For Wanalta Creek, localised impact (if any) would be of rural properties.

The Rochester telephone exchange pit (Telstra), adjacent to the Post Office, was threatened with inundation during the 2011 floods and needed to be protected by sandbags and continuous pumping of water in order to maintain services.

The Bendigo pipeline pump commences in Colbinabbin and the pump house could potentially be flooded in heavy rain fall or a breach of the channel. This pump station is only operated during extended dry periods so is unlikely to be operating during a flood event and temporary loss of this facility will not have any impact on water supply due to large storage reservoirs upstream of the pumps. Water treatment plant in Rochester was affected by floodwaters in 2011 however a concrete flood wall has been constructed around the plant to the 0.5% flood level.

Floodwater is allowed to pass GMW channels via one or more of the following means:

- the creek, natural depression, water course, floodway or river is passed under the channel via a "subway" usually a pipe structure under the channel;
- the irrigation channel is passed under the creek, natural depression, water course, floodway or river via a "siphon" the channel is passed under the waterway by piping the channel flow;
- in some locations the floodwater enters the channel system and in these cases the floodwater is passed out of the channel to allow floodwater to continue along the natural drainage lines;
- where the passing of floodwater is undertaken as part of bullet point 3, there are specific operating rules for each site.

8.2 Major Roads

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

- Barnadown - Knowsley Road – Muskerry
- Burnewang Road – Near Three Chain Road
- Northern Highway – At Rochester (both north to Echuca and south to Elmore / Bendigo)
- Northern Highway - Between Elmore to Echuca-Mitiamo Road (South of Echuca)
- Echuca - Kyabram Road - Between Echuca and Tongala Road
- Elmore - Raywood Road - Between Elmore and Kamarooka East
- Heathcote - Rochester Road - From the Midland Highway to Kyabram - Rochester Road
- Kyabram - Rochester Road - Between Rochester and Timmering and at Rochester to the east of the bridge
- Rochester - Strathallan Road.

9. Historic Floods

Significant floods have occurred within the Municipality as follows:

Murray River	Goulburn River	Campaspe River	Deakin Drainage Basin
1867		1867	
1870	1870	1870	
		1906	
September 1916	September 1916	October 1916	
1917		September 1917	
		Aug / Sep 1920	
		September 1921	
		July 1923	
		Aug / Oct 1924	
		1930	
1931			
		August 1932	
	1939	June 1939	
			1950 (Also between Goulburn and Deakin Basin (Generally the entire Rodney County)
		June 1951	
		1954	
1956	1956	July 1956	
		August 1973	August 1973
May 1974	May 1974	May 1974	May 1974
		October 1974	October 1974
November 1975		November 1975	November 1975
July 1981	July 1981		
	September 1983	August 1983	
October 1993	October 1993	October 1993	
		November 2010	
January 2011 (GBCMA- September 2010		January 2011	January 2011
		February 2011	
October 2016			

November 1870 flood

The largest flood along the Murray since European settlement occurred in 1870. A large flood also occurred along the Goulburn River: approximately 2% AEP event at Shepparton. At Echuca, the gauge reached 96.20 mAHD which is about 0.6m higher than the 1% AEP flood level (95.63 mAHD at Echuca Wharf). South of Rochester the river scoured the railway embankment and washed away the railway bridge at Black Culvert Road.

1916 and 1917 floods

The 1916 flood is the flood of record along the Goulburn River (about a 1% AEP event at Shepparton) while it was a significant event along the Murray (3-5% AEP at Echuca). It is likely that the levee system would have been overtopped on both sides of the Goulburn River upstream of McCoys Bridge. The 1916 event was followed in 1917 by another large flood (4% AEP at Echuca and Shepparton).

1950 flood

The 1950 flood was an extremely large flood in the Deakin drainage area. It is comparable to the 1% AEP event for this area.

July / August 1956 flood

This event was the fourth largest along the Murray at Echuca since 1870 (4% AEP) and about the seventh largest along the Goulburn River (5% AEP at Shepparton). This was also a significant event along the Campaspe River and resulted in a peak at the Rochester town gauge of 115.19 mAHD, at that time the highest on record.

August 1973 flood

While this was only a moderate flood along the lower reaches of the Campaspe River (25% AEP at Rochester), it was a significant event west of the Campaspe and in the Corop Lakes area.

May and October 1974 floods

Widespread flooding occurred in May and October 1974. The May flood was more significant along the Murray (~6% AEP at Echuca), Goulburn (1.5% AEP at Shepparton) and Campaspe rivers (5% AEP at Rochester). Numerous levee breaches occurred along the lower Goulburn. Major flooding occurred in October 1974 in the Corop Lakes area.

November 1975 flood

The 1975 flood was the third largest in the Murray at Echuca since 1870 (~3% AEP). It was also a significant event along the Campaspe River (5% AEP at Rochester).

July 1981 flood

This was a major but less severe flood along the Goulburn River (12% AEP at Shepparton) and Murray (AEP not determined for Echuca).

August 1983 flood

This was a significant flood along the Campaspe and was assessed at the time to be around a 2-3% AEP event at Rochester.

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. Levees on both sides of the Goulburn River breached at numerous locations between Loch Garry and McCoys Bridge.

September 2010 to February 2011 flooding

The January 2011 flood followed an extended period of wet weather with major flooding along the lower Goulburn River in September 2010 and moderate flooding in December. Heavy rain over the Campaspe and more western catchments in January 2011 caused Lake Eppalock to spill with severe record flooding at Rochester reaching 115.4 mAHD at the Town gauge immediately upstream of the Kyabram – Rochester Road bridge. While minor flood flows occurred along the lower Goulburn and higher than normal flows were experienced in the Murray, it was the substantial flow in the Campaspe that increased levels at Echuca. The gauge at the Echuca Wharf did not exceed minor flood level. The Deakin Basin, particularly the Corop Lakes area, experienced significant flooding.

Comparison between floods of record and 1% AEP events

Gauge Station	Flood of Record				1% AEP Event	
	Peak Discharge (ML/d)	Stage (m AHD)	Date	AEP (%)	Peak Discharge (ML/d)	Stage (m AHD)
Wanalta Creek @ Wanalta (405229)	13,700	117.52 (3.64m)	February 1973	>< 1	12,600	n/a
Cornella Creek @ Colbinabbin (405230)	8,570	115.92 (4.45m)	December 1992	3	11,200	n/a
Goulburn River @ McCoys Bridge (405232)	167,500	103.143 (11.71m)	June1974	<~1	181,000	n/a
Campaspe River @ Rochester	75,300 (Campaspe Weir)	115.4 (town gauge)	January 2011	1	74,300 (Campaspe Weir)	115.33 (town gauge)
Murray River @ Echuca (409200)	170,000	96.20	1870	< 1	146,000	95.63

Summary of flood levels at Echuca Wharf (Murray River)

Flood Event	Flow (ML/d)	AEP (%)	Level (m AHD)	Difference between level and 1% AEP event (m)
1% AEP	146,000	1	95.63	-
November 1870	170,000	< 1	96.20	approx -0.57
1867	134,000	1.4	95.35	0.28
October 1993	100,000	~4	94.77	0.86
September 1916	108,800	~3	94.75	0.88
October 1975	108,300	~3	94.75	0.88
August 1956	99,500	~4	94.58	1.05
1917	98,800	~5	94.55	1.08
May 1974	98,000	~5	94.52	1.11
October 2016	~60,000 (no flow data)	No AEP	93.42	2.21
January 2011	54,025		92.84	2.78

Note: The peak level at the Campaspe River Echuca gauge (upstream of the Murray Valley Highway Bridge) on 16 January 2011 was 95.75 mAHD at ~ 9pm. The Echuca Wharf gauge peaked at ~11:45am on 18 January, some 39 hours later.

Summary of flood levels at Rochester (Campaspe River)

	Town gauge at Bridge Road			Syphon gauge		
Flood Event	**Flow (ML/d)**	**AEP (%)**	**Level (m AHD)**	**Flow (ML/d)**	**AEP (%)**	**Level (m AHD)**
1% AEP u/s of town / breakouts (Campaspe Weir)	74,300			-		
1% AEP at gauge		1	115.33	-		
January 2011		1	115.4			9.17
September 1916			115.28			
July 1956			115.19			
1920			115.15			
June 1939			115.14			
June 1951			115.14			
August 1932			115.09			
October 1916			115.04			
July 1923			114.99			
May 1974			114.97			9.11
September 1921			114.91			
August 1924			114.90			
August 1920			114.85			
September 1920			114.83			
September 1917			114.75			
October 1924			114.72			
Aug / Sep 1983		2.5	114.70			9.15
October 1974			114.62			9.02
November 2010		10	114.43			9.00
February 2011			114.30			8.94
August 1973			114.09			8.78
Oct / Nov 1975						8.09
October 1992			114.42			9.05
Sep / Oct 1993			114.01			8.86
September 2010			113.30			8.00

10. Dam Failure

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

A number of significant water storages are located with the Campaspe catchment, most upstream of Lake Eppalock and thus outside the Shire. (eg. the Upper Coliban Storages: the Upper Coliban, Lauriston and Malmsbury reservoirs).

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

Large dams are designed to withstand 1 in 100,000 or greater flood events which means that failure during flood events is extremely unlikely. All large dams have Dam Safety Emergency Plans which determine how floods are managed by the dam operators, outline the risks that the dam structure presents and controls for these and consequence assessments for catastrophic failure of dam structures during normal operation (Sunny day failure) including inundation mapping for the areas immediately below the structure. These plans are held by the dam operator and DELWP who are the control agency for large dam failures. The behaviour of dams during flood events (including the impact of dam operating rules) is considered as part of flood plain modelling performed by Catchment Management Authorities and reflected in the flood extent maps attached.

Location	Owner and Operator	Primary Embankment Height (m)	Dam Capacity at FSL (ML)	FSL (m AHD)	Comments
Lake Eppalock	GMW	47	~304,000	193.910	Fixed crest thus at FSL inflow =outflow There is some significant attenuation when the levels are not at FSL but also above too
Waranga Basin	GMW	12.2	~432,000	121.360	The major outlet releases to the Waranga Western Main Channel while the minor outlet releases to the irrigation district around Kyabram.
Campaspe Weir					In 2011 the water level was almost the same both sides on the weir. The weir is about level with the top of the river bank, therefore it is unlikely that significant damage would occur downstream if it broke. The lower level in the caravan park in Rochester would probably get flooded. (GMW – Fixed crest weir with drop bar openings and one gate for passing irrigation flows downstream in the Campaspe River)

Flood Inundation Mapping and Floor Levels

NCCMA have prepared approximate flood inundation maps for Echuca using an outer enveloping approach to capture the extents associated with a Goulburn River driven flood and with a Campaspe River driven flood. Those maps are available from the CMA and are included in this CMAFEP at Appendix F. Detailed floor level information is not widely available for Echuca. There is some floor level information for older properties constructed pre1981, which is available from NCCMA.

Water Technology (April 2013) delivered a Flood Management Study for Rochester. In addition to other deliverables, the study provided detailed floor level information and flood inundation maps for the town for a range of design flood events. The flood inundation extents are also available digitally through FloodZoom.

For areas of the Municipality not covered by detailed flood maps, the Campaspe Planning Scheme shows areas along the waterways within the Shire likely to be inundated by a 1% AEP (100-year ARI) flood event as LSIO (Land Subject to Inundation Overlay). While it is not practical to reproduce the overlay as an attachment to this Plan, hard copies are available at the Campaspe Shire offices. They are also available in digital form at http://planningschemes.dpcd.vic.gov.au the website for the Department of Transport Planning and Local Infrastructure.

Course flood extent maps were also developed for the whole of the Campaspe Municipality in 2000 as part of a state-wide Flood Data Transfer Project (FDTP) (DNRE, 2000). Although this flood extent mapping has a low level of accuracy the maps can be a useful guide to highlight areas subject to flooding where detailed mapping is not yet available. The associated reports provide guidance on likely accuracies and associated confidence in delineations. These data are available through FloodZoom.

A Flood Atlas showing 1% AEP flood contours overlaid on flood overlays is available for the Goulburn River and its surrounds on the GBCMA website - www.gbcma.vic.gov.au

11. Aerial Flood Photography

Aerial flood photography is available from the NCCMA and GBCMA as follows:

Echuca	Murray River	Lower Goulburn River	Rochester (Campaspe River)	Deakin Drainage Basin and Corop Lakes area	West of Campaspe River
		August 1956			
				February 1973	
May 1974	May 1974	May 1974	May 1974	May 1974	May 1974
				1975	
November 1975	November 1975		November 1975	November 1975	
July 1981	July 1981	1981			
September 1983			September 1983		
October 1992	October 1992			1992 (GMW)	
October 1993	October 1993	October 1993			October 1993
			January 2011 *		
	October 2016				

Note: * The 2011 datasets comprise infrared and normal photography as well as linescans.

Other Flood Related Information

Additional information is held by NCCMA as follows:

- Numerous flood photographs for the November 2010 and January 2011 flooding at Rochester;
- Video footage of the 2010 and 2011 flooding and of post-flood flights;
- Surveyed flood levels for the November 2010 and January 2011 floods in Rochester;
- Other historical flood information and photographs.

Additional information is held by GBCMA as follows:

- Numerous surveyed flood levels 1916 to 2010;
- Flood animation of lower Goulburn;
- Flood inundation mapping for the lower Goulburn.

12. Flood Intelligence Cards – see Appendix C

All flood intelligence records are approximations only. 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 at http://www.ema.gov.au and in particular in Manual 20 "Flood Preparedness"

APPENDIX B - TYPICAL FLOOD PEAK TRAVEL TIMES

In using the information contained in this Appendix, 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.

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 approx Travel Time	Comments
MURRAY RIVER			
Tocumwal	Echuca Wharf	3 to 4 days	**Note** - requires large flows in Goulburn and / or Campaspe to flood at Echuca. Will not flood from Murray flows alone due to Barmah Choke.
Echuca Wharf	Pianta Road	~ 8 hours	
	Torrumbarry Weir	~24 hours	
GOULBURN RIVER			
Shepparton	McCoys Bridge	~36 hours	
	Echuca Wharf	~ 4-5 days	
CAMPASPE RIVER			
Redesdale	Lake Eppalock	~5 hours	
	Barnadown	12 hours	
	Rochester	36 hours	
Lake Eppalock	Barnadown	8 hours	**Note** -Axe Creek flows can mask actual travel times

<table>
<tr><td></td><td>Rochester</td><td>21 to 40 hours</td><td></td><td>Note -Mt Pleasant Ck flows can mask travel times</td></tr>
<tr><td rowspan="2">Barnadown</td><td>Rochester Town gauge</td><td>16 to 22 hours</td><td>January 2011</td><td rowspan="2">Note -Mt Pleasant Ck flows can mask travel times</td></tr>
<tr><td>Rochester Syphon</td><td>19 hours to 24 hours</td><td></td></tr>
<tr><td>Runnymede</td><td>Rochester</td><td>~25 hours</td><td colspan="2">January 2011</td></tr>
<tr><td>Campaspe Weir
Is 7.5km u/s of Rochester</td><td>Rochester Town gauge</td><td>8 hours</td><td colspan="2">
<table>
<tr><th>Event</th><th>Travel time</th><th>Source</th></tr>
<tr><td>May 1974</td><td>6 days</td><td>All three rivers but Goulburn largest</td></tr>
<tr><td>August 1981</td><td>7 days</td><td>Mainly Campaspe</td></tr>
<tr><td>September 1983</td><td>9 days</td><td>Large Campaspe flood</td></tr>
<tr><td>October 1992</td><td>9 days</td><td>Mainly Murray</td></tr>
<tr><td>October 1993</td><td>8 days</td><td>All three rivers but Goulburn and Murray larger</td></tr>
</table>
</td></tr>
<tr><td>Rochester (town gauge)</td><td>MVH Bridge at Echuca</td><td>~24 hours</td><td colspan="2"></td></tr>
</table>

APPENDIX C1 – ECHUCA FLOOD EMERGENCY PLAN

1. Overview

The western side of Echuca is flooded from the Campaspe River while the eastern side is flooded from the Murray River. Flood levels are driven by the complex interaction of floods from the Campaspe, Murray and Goulburn Rivers.

Note that:

- **A large Murray flood upstream from Barmah is not indicative of future flooding at Echuca**. This is because the Barmah Sandhills (sometimes referred to as the Barmah Choke – the actual choke is further upstream) restricts Murray River flows past Barmah to around 35,000ML/d with the balance being forced northwards into NSW along the Edwards River. Flooding at Echuca is therefore very much dependent on the magnitude of flows coming from the Goulburn River and Campaspe Rivers. Note also that if Goulburn River flows are high and Murray flows are low, some backflow can occur through Barmah (ie. in effect the Murray flows upstream).
- **More than minor flooding in the Campaspe at either Rochester or Echuca is unlikely unless Lake Eppalock is spilling.**
- Just as the Murray River influences the Campaspe, the Campaspe River can cause back-up effects in the Murray River (as happened in January 2011).

Since prior to the 1993 flood, the urban area of Echuca has been predominantly protected by levees that provide protection up to a 3% AEP event in the Murray River with 600mm freeboard and up to a 1% AEP event in the Campaspe River with no freeboard (see Section 3 below). Areas of Echuca East are not protected by the levees: landowners are expected to implement individual protective measures (eg. Bynan Street and the north side of Goulburn Road – up to 300 properties).

Echuca Village is located on the eastern outskirts of Echuca and consists of relatively small allotments containing many farmlets. While the area is protected by informal levees of unknown structural integrity along the Beattie Floodway and the Murray (and lower Goulburn), flooding can occur from floodwaters backing up the Southern Cross Drain from the Murray or flows from breakouts from the east side of the Campaspe River downstream from Rochester. If a flood event did overtop the levees, the Kanyapella Basin would fill to significant depth, access to the area would be difficult and protection of residences that do not have floor levels above flood level would be difficult to achieve.

The area to the west of the Campaspe River in Echuca is located on the natural floodway and is not protected by formal levees. The area is susceptible to flooding from both the Campaspe and Murray Rivers.

Levels at Echuca Wharf for various combinations of floods in the Campaspe River and Murray River.

(Sourced from SKM's May 1997 Moama-Echuca Flood Study undertaken for the Shire of Murray and Campaspe Shire Council).

Campaspe event	Murray event (includes Goulburn River flows)				
%AEP	10	5	2	1	0.5
100	93.86	94.11	94.39	94.65	94.92
10	94.16	94.39	94.65	94.91	95.18
5	94.41	94.62	94.87	95.13	95.39
2	94.78	94.96	95.20	95.40	95.68
1	95.02	95.21	95.43	95.66	95.85
0.5	95.42	95.60	95.80	95.96	96.14

2. Overview of Flooding Consequences

2.1 Warning times

Flood warning times for Echuca vary depending on whether the main driver is the Campaspe River or the Murray (Goulburn) River.

- Campaspe River: Expect warning lead time of between 24 and 48 hours. Initial impact on Echuca west of the Campaspe River.
- Murray River with minimal contribution from the Goulburn River: Unlikely to cause flooding concerns. Even with flooding in the Campaspe River, unlikely to cause any additional flooding concerns in the town outside Echuca west of the Campaspe River.
- Murray with strong contribution from the Goulburn River: Expect warning lead time of between 3 and 5 days. Initial impact on Echuca East and Echuca Village.

2.2 Areas affected

During the 1975 and 1993 floods, lower lying areas of Echuca were flooded and some roads were closed including Goulburn Road, Warren Street and Homan Street. Some residences were also sandbagged. Areas east of Southern Cross Drain, north of Goulburn Road, east of Bowen Street and to the end of the seal in Campaspe Esplanade also flooded. The Echuca Holiday Park (caravan park) was also affected.

In 1975 floodwaters up to 1m deep inundated Echuca, west of the Campaspe River, for a considerable time.

In January 2011 (flood of record in the Campaspe River at Rochester), the best estimate is that less than 10 houses were inundated at Echuca.

Floodwaters remain for an extended period – weeks rather than days.

2.3 Properties affected

Detailed information not currently available. The 1993 floods did not in general significantly affect the town as the levees held the water back. The area to the north of Goulburn Road was flooded. Council has some aerial photos of this area.

2.4 Isolation

An island, centred on Hansen Street, is formed in Echuca west of the Campaspe River, as it rises. Modelling indicates that this island remains dry beyond the 1870 flood level (ie. 96.20 mAHD at Echuca Wharf). Note however that a very large Campaspe flood (ie. >1% AEP) may wet this island.

A shrinking island centred on Crescent Street and Bynan Street near the outfall of Southern Cross Drain begins to form when the Echuca Wharf gauge approaches 94.30 mAHD. The island disappears at around 94.80 mAHD on the Echuca Wharf gauge.

Major isolation will occur if the Murray Valley Highway and the Northern Highway are closed. Neither Highway is likely to be impacted within Echuca but they could be affected by flooding outside the town. However during the January 2011 flood the Murray Valley Highway (Ogilvie Avenue) at the Campaspe River was protected by sand bags and down to one lane in either direction under Police control. Warren Street was unaffected.

2.5 Essential Infrastructure

The water treatment plant and raw water pumping station are protected by levees designed to the 1870 flood level (ie. 96.20 mAHD) (see next section). A survey conducted in 2007 by Coliban Water determined that the top of the water treatment plant levee was 96.4 mAHD and the top of the raw water pump levee was 96.50 mAHD (seems low). The levees are now considered to provide protection to the 1870 flood level but with limited freeboard. Stop logs need to be dropped across the access road through the levee to the water treatment plant by Coliban Water before a flood. See Flood Intelligence Card below.

The lowest point on the Echuca levees is 94.79m AHD (Watson Street levee – see next section). If the levees overtop, the Council offices (96.18AHD) and the Police Station (96.4m AHD) may be flooded (need to relocate) and much of the area in the port precinct and along the Campaspe River and caravan parks will need to be evacuated.

The railway line remains dry within Echuca until some time after the levees overtop at which time water gradually extends up the line from the river end.

The hospital remains dry up to the 1870 flood level although surrounding streets are wetted by floodwaters.

All other services remain dry although the fire station may need to be relocated in a repeat of the 1870 flood.

3. Flood Mitigation

3.1 Echuca Levees

The levees at Echuca were constructed between 1989 and 1992 as part of a formal Flood Mitigation Scheme and are managed and routinely maintained by Council. They provide protection for the main part of the town including the central business district, up to a 3% AEP Murray River event with 600 mm freeboard and up to a 1% AEP Campaspe River event without freeboard. This means that they will provide protection for larger floods but with reduced security. The levees are located on Crown land, road reserves or in easements on private property although the levee protecting the water treatment plant is located on land managed by Coliban Water. There is also a levee around the Coliban raw water pumping station. Both these levees are maintained by Coliban Water and provide protection to 1870 flood levels (exceeding 1%AEP), these levees are maintained and regularly inspected by Coliban Water's Dam Engineers.

The Scheme includes the high capacity permanent stormwater pumps installed near the corner of Heygarth and Landsborough Streets and at the end of Mitchell Street to deal with local drainage run-off from storms during periods of high river level. Portable pumps are also required to deal with local drainage run-off at other locations. All these pumps are managed and maintained by Council.

The Department of Environment and Primary Industries has undertaken a condition assessment of the urban levees in Echuca as part of a state wide project. The results of this condition assessment are available in FloodZoom.

Areas in Echuca East are not protected by the levees, landowners are expected to implement individual protective measures (eg. Bynan Street and the north side of Goulburn Road – up to 300 properties)

Echuca, west of the Campaspe River, is located on the natural floodway, is subject to deep flooding and is not protected by formal levees.

Operations and Maintenance Manuals were prepared in 1994 for the levees and drainage works. They outline appropriate triggers for closing gate valves on storm water drains, laying sand bags at the Radcliffe Street end of Collier Street, and operating and maintaining stormwater pumps, amongst other things. Copies of the manuals are available in Council's electronic document management system. Further, Work Instructions have been prepared for use by Council field staff and contain the Dataworks document numbers for ready retrieval of source documents.

Note: The 1% flood level is about 600mm higher than the design level on the Murray.

The levees comprise relatively short sections in seven locations (some linked by sealed roads) around Echuca and protect low areas and essential public works such as the water treatment plant. The levees protecting the water treatment plant and pump station were designed to the 1870 flood level plus 600mm freeboard while levees on the east side of Echuca were designed to protect against the 3% flood plus 600mm freeboard. The levee between Radcliffe and Heygarth Streets was designed to provide protection from the 1% AEP flood (ie. 95.40 mAHD) without any freeboard. Levees constructed under the Flood Mitigation Scheme are located as follows (see also maps in Appendix F).

Levee 1 – Raw Water Pumping Station. The ring levee protecting the pump station is typically 2m high and was originally designed to provide protection from the 1870 flood (ie. 96.200 mAHD) with limited freeboard (approximately 300mm)

Levee 2 – Water Treatment Plant. This ring levee is typically 3m high and was originally designed to provide protection from the 1870 flood (ie. 96.200 mAHD). There are two 6m wide entrances to the site which must be filled with concrete stop logs during a flood. The stop logs are stored on site and will be installed by Coliban Water in the event of a flood.

Levee 3 – Moama Street. This is a low levee constructed to link the water treatment plant levee back into high ground. This means that operators can still access the water treatment plant during a flood if required.

Levee 4 – Goulburn Road to Sturt Street. This earth levee is typically 2m high.

Levee 5 – Watson Street. This levee is adjacent to the Murray River and incorporates a concrete crib wall on the protected side. The levee runs into high ground to the east and south in Crofton Street.

Levee 6 – Radcliffe Street to Heygarth Street. Comprises crib walling as space is limited. Protects the central business district from the Campaspe River. During large floods, need to construct temporary levees between High Street and the river bank and at the Radcliffe Street . Sandbags should be used to construct the temporary levee from the earthen ramp at the north west corner of Beechworth Bakery, through the middle of the Beechworth Bakery car park, to the traffic lane in High Street.

Levee 7 – Anstruther Street to Collier Street. The first part of the levee crosses Anstruther Street, runs into land filled above flood level and then runs adjacent to the school oval. Protects the central business district from the Campaspe River.

In summary: Levees were constructed from Collier Street to Radcliffe Street, along Crofton Street and Watson Street, from Sturt to Pakenham Street and along Moama Street. Goulburn Road west of Moama Street was also raised as part of the scheme. Levees were constructed around the water treatment plant and the raw water pumping station.

The Echuca levees are based on different flood protection levels. The 1996 levee audit demonstrated that the levees have variable freeboard as summarised below:

Levee		Design level (mAHD)	Freeboard (as at 1996 levee audit)		Level of lowest point (mAHD)
			Minimum (m)	Maximum (m)	
1	Raw water pumping station	1870 flood + freeboard 96.20 + 0.60 96.800	0.43	0.71	96.63 96.4 in 2007
2	Water treatment plant	1870 flood + freeboard 96.20 + 0.60 96.800	0.19	0.73	96.39 96.5 in 2007
3	Moama Street	3% AEP + freeboard 94.50 + 0.60 95.10	0.32	2.09	94.82
4	Moama St along Goulburn Rd to Packenham St then earth to Hovell St, along Anstruther St and Sturt St to railway line	3% AEP + freeboard 94.50 + 0.60 95.10	0.33 for Goulburn Rd and 0.50 for earth section	1.23 for Goulburn Rd and 0.86 for earth section	95.83 for Goulburn Rd and 95.00 for earth section
5	Watson Street	3% AEP + freeboard 94.50 + 0.60 95.10	0.29	1.34	94.79
6	Radcliffe St to Heygarth St	1% AEP level no freeboard 95.40	-0.15	0.12	95.25
7	Anstruther St to Pakenham St to Collier St	1% AEP + freeboard 95.40 + 0.05 95.45	-0.15	1.06	95.25

A further levee to the west of Watson Street provides some protection to the Caravan Park but is of unknown structural integrity, although it held (ie. did not fail) during the 1993 flood.

4. Flood Impacts and Required Actions

Refer to following Flood Intelligence Card. Note that users of the Flood Intelligence Card should consider the AEP of flows in the Campaspe River and Murray River and refer to the "Levels at Echuca Wharf for various combinations of floods in the Campaspe River and Murray River" table in Section 1 above in order to better appreciate likely flood impacts. Failure to do this during a Campaspe River dominated flood may result in some impacts over and above those expected and / or detailed in the Flood Intelligence Card.

5. Command, Control and Coordination

The Command, Control and Coordination arrangements in this Municipal Area Flood Emergency Plan will be as detailed in the Emergency Management Manual Victoria.

All flood response activities within the Shire of Campaspe will be under the Control of the VICSES Regional Manager/ Incident Controller (appointed as per EMMV).

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

An Incident Control Centre (ICC) will be established by the Control Agency (ie. VICSES) for its command and control functions in response to any flood event within the municipality. It will be operate in accordance with VICSES arrangements.

The location of the ICC will be determined and advised to relevant stakeholders dependant on the extent and severity of the flood event.

Municipal Operations Centre (MOC)

The establishment and operation of the MOC will be in accordance with and as detailed within the IMEMP.

6. Gauge Location: Murray River at Echuca Wharf

Flood impacts described in the following Flood Intelligence Cards 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.

IMPORTANT NOTE – users of the following Flood Intelligence Card should consider the AEP of flows in the Campaspe River and Murray River and refer to the “Levels at Echuca Wharf for various combinations of floods in the Campaspe River and Murray River” table in Section 1 above in order to better appreciate likely flood impacts. Failure to do this during a Campaspe River dominated flood may result in some impacts over and above those expected and / or detailed in the table below.

Predicted River Height for Echuca Wharf (mAHD)	AEP	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
92.77		Invert of 800mm diameter pipe at the outside toe of the levee between Hovell St and Mitchell St.	➢ Council to close flood control gate in pit #4 located in the levee bank at the end of Heygarth Street.
92.78			➢ Council to close flood control gate in pit #9 located in the levee bank between Hovell St and Mitchell St.
92.84	January 2011 flood	This was a predominantly Campaspe River flood. Caused flooding in Echuca west and east side of the Campaspe south of MVH and backed-up the Murray a bit.	➢ Council to sand bag centre of Campaspe Esplanade north of the Murray Valley Highway if flooding on the Campaspe River
93.100		Flooding from Campaspe becoming evident in Echuca west of the Campaspe River. Cohuna – Echuca Road (Warren Street) beginning to get wet. Campaspe Esplanade d/s Cohuna–Echuca Road getting wet.	➢ Council to deploy signs and begin closing roads as appropriate.
93.240		Top of open drain in Heygarth St:	
93.40		Water Treatment Plant: lowest kerb invert within internal road system.	➢ Flood control gate in pit #17 in the Water Treatment Plant needs to be closed by Council. Coliban Water to be advised.
93.50		Top of grated pit on the east side at the end of Mitchell St.	➢ Council to close flood control gate in pit #10 located in the levee bank at the end of Mitchell Street.

Predicted River Height for Echuca Wharf (mAHD)	AEP	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
93.50	Minor Flood Level 20% AEP (5 year ARI)		➢ VICSES to advise organisations that flood warnings have been issued. ➢ VICSES to commence community information and warning program. ➢ Council staff to commence ad hoc inspections of Echuca levees. ➢ Council to prepare information for website, recorded telephone message and Customer Service Centres (based on SES data / information) ➢ Council staff to progressively close gate valves according to Work Instruction and set up mobile pumps if rain possible – see Council document management system for reports and manuals. ➢ SES to ensure sand and sand bags are available. ➢ MERC, MERO & MRM to consider setting up MOC in consultation with VICSES.
93.60		Flooding becoming established in Echuca west of the Campaspe River. Langford, Nolan, Homan, Redman, Payne, Hansen, Jarman, Heygarth and Anstruther Streets all getting wet. Cohuna – Echuca Road also wet. Lower end of Campaspe Esplanade impassable. Dry island forming centred on Hansen Street.	➢ Council to deploy further signs and close roads as appropriate. ➢ Incident Controller and VicPol to consider developing and implementing evacuation strategy for Echuca west of the Campaspe River.
93.70		Anstruther St: top of grated pit in school oval.	➢ Council to close flood control gate in pit #3 in Anstruther Street opposite the levee bank located in the school oval.

Predicted River Height for Echuca Wharf (mAHD)	AEP	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
93.78		Watson Rd / Crofton St: top of grated pit on the east side of Watson St adjacent to flood control pit.	➢ Council to close flood control gate in pit #18 located in the levee bank at the intersection of Watson Road and Crofton Street.
93.80		Pakenham St / Goulburn Rd: obvert of 250mm diameter pipe at the end of open drain near the pit in median.	➢ Council to close flood control gate in pit #12 in the levee bank just east of intersection of Pakenham St and Goulburn Rd.
93.81		Anstruther St: invert of kerb at side entry pit on southwest corner of Anstruther St / Landsborough St.	
93.82		Pakenham St: top of grated pit adjacent to flood control pit in school oval.	➢ Council to close flood control gate in pit #2 located in the levee bank just north of intersection of Pakenham Street and Murray Street.
93.90	Moderate Flood Level 15% AEP (8 year ARI)		➢ Council to begin regular patrols of Echuca levees. ➢ SES notify people in Echuca East outside levee system (up to 300 properties). These properties are located north of Goulburn Road and east of Sutton Street.
93.98		Top of grated pit in open drain in Anstruther St near Hovell St.	➢ Council to close flood control gate in pit #8 in Hovell Street at the intersection with Anstruther Street.
94.00			➢ Council to close flood control gate in pit #1 located in the levee bank at the end of Collier Street.

Predicted River Height for Echuca Wharf (mAHD)	AEP	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
94.00		Collier St: top of second grated pit in the property north of flats at 24 Collier St.	➢ SES Incident Controller to consider convening an Emergency Management Team (EMT) if not already done. ➢ Council to patrol Echuca levees 24 hours a day. Some fences may need to be cut to gain access to yards. ➢ Council to close Watson Road north of Glanville Road. ➢ With Coliban Water, discuss need to and timing for dropping the concrete stop logs into the opening in the levee around the Water Treatment Plant - isolation risk.
94.02	October 1992 flood		
94.08		Invert of kerb at side entry pit on east side of Sutton St at Goulburn Road.	➢ Council to close flood control gate in pit #11 in the levee bank opposite the end of Sutton Street.
94.16		Invert of kerb at side entry pit at southwest corner of Moama St / Goulburn Rd intersection.	➢ Council to close flood control gate in pit #14 located on the south east corner of the intersection of Moama Street and Goulburn Road.
94.19		Hume St: invert of kerb at side entry pit on the east side near Anstruther St.	➢ Council to close flood control gate in pit #7 in Hume Street at the intersection with Anstruther Street.
94.20	10% AEP (10 year ARI)		➢ Incident Controller, in consultation with the MRM, to consider opening Relief Centres, if not already done. ➢ Incident Controller to brief Regional Emergency Response Coordinator.

Predicted River Height for Echuca Wharf (mAHD)	AEP	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
94.21		Moore St inside Water Treatment Plant fence line: top of grated pit east side of Moama St opposite Donchi residence.	➢ Council to close flood control gate in pit #15 within the Water Treatment Plant fence line, east of Moama Street.
94.30		Areas of deep flooding in Echuca west of the Campaspe River. Shrinking island centred on Hansen Street and river end of Jarman Street. All other streets in Echuca West flooded. Campaspe River end of Martin Street flooded. Southern Cross Drain flooding near the Pakenham – Bynan Street intersection and Mary Anne Road getting wet. Start of shrinking island centred on Crescent St and Bynan St.	➢ Incident Controller to consider evacuation of the Crescent Street / Bynan Street area. ➢ Incident Controller to consider developing strategy for Echuca East. ➢ Incident Controller to consider developing strategy for Echuca Village.
94.40	Major Flood Level 7% AEP (16 year ARI)	Campaspe River encroaching on rear of properties along Haverfield, Eyre and McKenzie Streets, Tangey Lane and Chatsworth Drive. Area to the east of Southern Cross Drain getting progressively wetter.	➢ Incident Controller and Council to discuss need to and timing for constructing temporary levees (or sandbagging two bags high min) - between High Street centre line at Radcliffe Street and the river bank across car park and - at the end of Collier Street.
94.53		Snowden St: top of grated pit in McIntosh St south of Moore St.	➢ Council to close flood control gate in pit #16 located in the levee bank at the intersection of Snowden St and Moama Street.
94.60		Bowen St: invert of kerb at side entry pit at the southwest corner of the Goulburn Rd / Bowen St intersection.	➢ Council to close flood control gate in pit #13 located at the in Bowen Street north of the intersection with Pakenham Street.

Predicted River Height for Echuca Wharf (mAHD)	AEP	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
94.60		Flooding into McBride Place from Campaspe River. Water over Etona Avenue. Mary Anne Road likely to be impassable from Ogilvie Avenue to the Murray River.	➢ Incident Controller and SES to consider sandbagging low points in levees.
94.70		Campaspe: some flooding into Haverfield St and Eyre St and water encroaching on rear of properties in Rutley Crescent. Water also encroaching into properties at the river end of streets in the area to the west of Dickson Street and north of Cohuna - Echuca Road.	➢ Incident Controller and SES to consider the need to sandbag houses.
94.71		Sturt St: invert of kerb at side entry pit on the west side near Anstruther St.	➢ Check pit at Sturt St east of railway crossing for backflow from River– Council to consider sandbagging. ➢ Council to observe pit #19 at Echuca Caravan Park outlet. This located north of Crofton Street about halfway along Caravan Park boundary. Close flood gate if backflow is about to occur. ➢ Council to observe pit #20 at Bateman Drive outlet into retardation basin. Close flood gate if backflow is about to occur. ➢ Council to observe pit #21 located on the east side of the intersection of McBride Place and Campaspe Esplanade. Close flood gate if backflow is about to occur. ➢

Predicted River Height for Echuca Wharf (mAHD)	AEP	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
94.75	October 1975 flood ~3% AEP (33 year ARI)	Records exist for flood extent and good flood intelligence is available. This is available through the NCCMA.	
94.77	October 1993 flood ~4% AEP (25 year ARI) Note that this flood was higher than the October 1975 event but flow was lower and thus the AEP is also lower.		➢ Levees need to be patrolled between Baillieu Road and the municipal boundary at Deep Creek as at this level, water will be near to or overtopping the levees. (SES)
94.79		Lowest point in Echuca levees (in Watson St) – as per 1996 levee audit report.	
94.80		Almost all of shrinking island centred on Crescent St and Bynan St inundated. Water also beginning to wet properties at river end of Snowden Street.	➢ Incident Controller and SES to consider need to sandbag houses.
94.90		Properties at river end of Martin Street starting to get wet. Water also starting to wet properties on the west side of the Ogilvie Avenue bridge.	➢ Incident Controller & SES to consider need to sandbag houses.
95.00		Water beginning to wet properties in the area bounded by Ogilvie Avenue, Bowen Street and Snowden Street.	➢ Incident Controller and SES to consider need to sandbag and / or evacuate houses.

Predicted River Height for Echuca Wharf (mAHD)	AEP	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
95.04	2% AEP (50 year ARI)		➢ Council to check that low points in township levees have (or are being) sandbagged. ➢ Incident Controller and Council to consider need to relocate Shire Offices / MOC (floor level about 96.37 mAHD) and Police Station.
95.10		General design crest (min) of Echuca flood mitigation scheme levees	
95.35		General top of bank (ie. maximum level) of Echuca levee system (ie. 1975 flood level plus 600mm).	
95.63	1% AEP (100 year ARI)		➢ Incident Controller and Council to consider relocating Shire Offices / MOC, Police and Fire Stations. ➢ Observe pit #5 at Annesley St. If backflow is likely to occur sandbag the drain.

Predicted River Height for Echuca Wharf (mAHD)	AEP	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
96.20	1870 flood Flood of record	Extensive flooding of the area to the south of Mitchell Road and to the east and north of the Murray Valley Highway. Substantial flooding to the east of Bowen Street. Most of the area to the north of McKinlay Street between Bowen Street and the Campaspe River flooded. Area around Crofton Street and Dickson Street, including parts of the Caravan Park, dry but isolated. Eyre, North, Leichardt and High Streets and Hospital Avenue flooded from the Campaspe River. Flooding of properties on both sides of Ogilvie Avenue to the west of the bridge over the Campaspe. Substantial flooding of the estate centred on Fehring Lane.	
96.40	0.5% AEP (200 year ARI)		
96.60		Lowest point in levees around raw water pumping station and water treatment plant – as per 1996 levee audit report.	
96.80		Design height of levees around raw water pumping station and water treatment plant (ie. 1870 flood level plus 600mm).	➢ Coliban Water to arrange for alternative water supply for Echuca.
	Probable Maximum Flood (PMF)	Yet to be determined	

1. **NOTES:** Flood intelligence records (ie. the above card) 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 at http://www.ema.gov.au and in particular in Manual 20 "Flood Preparedness".

APPENDIX C2
WYUNA, YAMBUNA, KANYAPELLA & ECHUCA VILLAGE FLOOD EMERGENCY PLAN

Predicted River Height (m) for Shepparton Gauge	Annual Exceedance Probability	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
9.50	Minor Flood Level		
10.70	Moderate Flood Level		
11.00	Major Flood Level	➢ Houses outside the levee system are at risk including at the northern end of Tehan Rd, to the north west from the western end of Eisele Rd, to the north of Bangerang Rd at Mc Donald Rd, the northern end of Oliver Rd, the eastern end of River Ave on the north side, and the western end of River Ave amongst others.	➢ SES to ensure sand and sand bags are available for Wyuna, Yambuna and Kanyapella areas to raise low points in levees such as vehicle tracks. ➢ Incident Controller & SES to notify landowners to begin patrolling levees in Wyuna, Yambuna and Kanyapella. ➢ Incident Controller & SES to notify landowners to begin patrolling levees in Echuca Village if Murray River level is high. ➢ Incident Controller to arrange Public meeting with residents of Wyuna and Yambuna to advise of situation. ➢ Council to prepare information for web site, recorded telephone message and Customer Service Centres (based on information from SES)
11.20		Properties outside, or unprotected by, the levee system are at risk including at the northern end of Emily Jane Road and the northern end of Agnes Road	

Predicted River Height (m) for Shepparton Gauge	Annual Exceedance Probability	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
11.60			➢ SES to ensure sand and sand bags are available for Echuca Village (depending on Murray River level) to raise low points in levees.
11.72	1993 flood level		

Predicted River Height (m) for McCoys Bridge Gauge	Annual Exceedance Probability	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
9.00	Minor Flood Level		
9.70			➢ Council to prepare information for web site, recorded telephone message and Customer Service Centres (based on SES information)
10.00	Moderate Flood Level		➢ SES to ensure sand and sand bags are available for their use.
10.23	September 2010 flood level		➢ Incident Controller & SES to notify landowners to begin patrolling levees in Wyuna, Yambuna & Kanyapella ➢ Incident Controller to arrange Public meeting with residents of Wyuna to advise of situation ➢ Incident Controller & SES to notify landowners to begin patrolling levees in Echuca Village (depends on Murray River level) ➢ SES to undertake information and warning program for landowners at risk
11.02	October 1993 flood level		
11.20	Major Flood Level		➢ SES to ensure sand and sand bags are available for their use ➢ SES to ensure sand and sand bags are available in Echuca Village to raise low points in levees

APPENDIX C3 – ROCHESTER FLOOD EMERGENCY PLAN

1. Overview

Rochester is located 180km north of Melbourne in Central Victoria. It is situated on the Campaspe River floodplain and has an upstream catchment of around 3,345 km^2 that extends to the south of Daylesford, Kyneton and Woodend. The steep gradient of the Great Dividing Range contracts with the flat northern plains which are traversed by irrigation channels managed by GMW.

The area around Rochester has little topographical relief and the river channel at Rochester has limited capacity. Widespread flooding occurs adjacent to the river and along a number of effluent flow paths when channel capacity is exceeded.

Historically, floods tend to occur at Rochester between June and October, although not exclusively. The flood record also indicates that when large floods do occur, two often occur in the same year (see flood history in Appendix A).

Three floods occurred in a short time following the end of the prolonged drought in 2010: in November 2010, January 2011 and February 2011. The January event was the largest recorded at Rochester: 115.4 mAHD at the town gauge at Bridge Road. Around 80% of the town was flooded (~1,000 properties) This was 200 mm higher than the 1956 flood, the previous highest recorded. The January 2011 event has been assessed as being a ~1% AEP event while the November 2010 event was assessed being a ~10% AEP event (Water Technology 2013).

There are two river gauges at Rochester. The Town gauge is located just upstream of Bridge Road while the Syphon gauge is located around 3km downstream from town where the Waranga Western Irrigation Channel passes under the Campaspe River. The Town gauge is set to AHD while the Syphon gauge is set to local datum. While the Syphon gauge is rated (the Town gauge is not rated), because of site characteristics and flood behaviour driven by breakouts, it does not capture all flow and there is a lack of consistency between levels in town and at the Syphon

Lake Eppalock is situated some 60 km upstream (to the south) of Rochester. It spilled in November 2010, the first time since 1996. During the January 2011 event, both the primary and secondary spillways passed flows. The last time both spillways operated was in 1974.

Barnadown is around 36 km upstream of Rochester while Campaspe Weir is approximately 7.5 km upstream. The river is well confined at the Weir even under very high flow conditions and thus flows / levels / trends at the site provide a good indication of likely impacts at Rochester.

2. Flood Behaviour

2.1 Overview

Flooding at Rochester is triggered by persistent heavy rain (eg. 100 mm or more in 24 hours or so) across the catchment upstream of Lake Eppalock, with Eppalock at or near full supply level (FSL) and / or by heavy rain across the catchment below Lake Eppalock, in the Axe Creek, Sweeney Creek, Forest Creek and / or Mount Pleasant Creek catchments.

The Campaspe River is the primary cause of flooding in Rochester. In the past, some minor inundation in the south and west of the town has been attributed to local runoff and stormwater systems being overwhelmed but this is not a common occurrence.

Up to around the 20%AEP event, flooding is confined to the low lying areas of the floodplain in the immediate vicinity of the Campaspe River (the wetlands, lagoons and low depressions) although there is some shallow inundation north (downstream) of the town along the railway line to the Waranga Western Irrigation Channel. Flow also passes along the floodways under the railway line.

Upstream of Rochester (to Campaspe Weir), the 5 and 2% AEP events produce similar inundation extents but within town each of these events produce an incrementally larger extent.

Aerial imagery showing flows bypassing the Rochester Syphon gauge during the January 2011 event

As flood severity increases from the 20% AEP event, the old anabranch area (low depression) in the vicinity of Reserve Street begins to flood and depths increase along the railway line and through the crossings.

At the 10% AEP event (similar to the November 2010 event):

- Flooding is largely confined to the eastern side of the railway line.
- The first 3 houses are flooded over-floor: in Campaspe Street, Tasker Road and Zegelin Road.
- There is a breakout flow to the east of the river near the sporting ground that is likely to inundate the Club Rooms, the Rochester Caravan and Camping Park, and properties along Church Street, Reserve Street, Hood Street and the Kyabram - Rochester Road (between the river and Hood Street).
- Breakout flow to the west of the river inundates properties in Pascoe Street, Fraser Street and Campaspe Street and threatens the water treatment plant (although this is protected to the 0.5% AEP flood level by a concrete levee).
- Other breakout flows to the west inundate properties along McKay Street and Hart Street, flow under the railway line along the floodways and also flow alongside the railway line to the north along Ramsey Street.
- A major breakout upstream of the railway bridge flows north towards the Waranga Western Irrigation Channel where water begins to back-up and inundates the area between the railway line and Cohen Road, including the Rochester - Strathallan Road.
- Minor breakouts begin to occur adjacent to the river upstream of Rochester.

At the 5% AEP event:

- Water spreads through the central township area and causes shallow inundation within a large part of Rochester east of the railway line: most properties between the river and High Street are inundated.
- East of High Street, a block of properties bounded by High Street, Baynes Street and the Kyabram - Rochester Road are inundated along with a significant proportion of the properties north of the Kyabram - Rochester Road between the river and Cohen Street.
- The hospital grounds and a number of care facilities around the hospital may be affected by shallow inundation. There will also be access difficulties with Pascoe Street and the Northern Highway inundated.
- The area between the railway line and the Northern Highway is also inundated with a significant number of properties inundated north of George Street.

- Water also starts to accumulate in the "Rochester south drainage line" west of the railway line along Ramsay Street, Echuca Road, and Railway Road, threatening low lying properties adjacent to the drainage line.
- North (downstream) of town, water backs-up behind the Waranga Western Irrigation Channel and overtops it. In addition, inundation depths increase in this area and extend to the west along the Channel.
- 32 houses are likely to be flooded over-floor with another 50 within 100mm of being flooded over-floor.
- Flooding upstream of Rochester is similar to that of the 10% AEP event.

Widespread inundation and an increase in the number of properties flooded over-floor occurs from about the **3% AEP event.**

At the 2% AEP event, there is significant shallow inundation across a large proportion of the town and inundation of properties through the central part of town. In addition:

- Almost the entire area east of the river and north of the Kyabram - Rochester Road is inundated.
- East of the railway line there is only a small pocket of properties bounded by Lindsay Street, High Street and Aitken Road that are not inundated.
- The floodway to the east of town (south / upstream of Pascoe Street) begins to flow but stays largely within the floodway.
- Further inundation at the hospital and care facilities with water completely surrounding the hospital and exacerbating access issues.
- Floodwaters rise between the Northern Highway and the railway line and also break out west of the Highway inundating the golf course and number of properties between Diggora Road and McKenzie Street.
- Low-lying properties adjacent to the "Rochester south drainage line" are under threat.
- 157 properties are flooded over-floor and a further 128 are within 100mm of being affected.
- Flooding upstream of Rochester is similar to that of the 5% AEP event.

The number of properties affected increases significantly for the **1% AEP event**. While the extent of flooding is not much different from the 2% AEP event apart from along the eastern floodway, depths increase. In particular during a 1% AEP event:

- There is significant inundation of properties through the central part of town and on both sides of the railway line with large quantities of water flowing through the railway crossing floodways.
- The grounds of the hospital and care facilities are completely inundated.
- The "Rochester south drainage line" flows strongly as does the eastern floodway from upstream of town.
- Two significant breakouts become well established as levels rise:
  - Initially just upstream of the railway bridge with widespread breakouts to properties on both sides of the river as well as significant flows to the north and north-east as water flows along the eastern side of the railway line. Breakouts occur when the water at the road bridge (immediately upstream) reaches 114.55mAHD.
  - As the river level continues to rise widespread breakouts then occur downstream of the railway line inundating the western part of the town.
- Further breakouts occur immediately upstream of Rochester across farming land although the channel embankment does restrict floodplain flows.

During a 0.5% AEP event, there is widespread inundation through town with only properties in the south-east of Rochester not directly impacted. In addition:

- The break out through the eastern floodway is considerably deeper than in the 1% event causing more inundation in the west and north of the central township.
- The floodway west of the railway line drives water further south (upstream) along the railway line where it crosses the line again at the Black Culvert Bridge.
- Flooding to the west of the Northern Highway is significantly increased in extent with only small pockets of properties not inundated.
- 440 properties are flooded over-floor and an additional 294 are within 100mm of being affected.
- The breakouts upstream of town to the east across farming land increases with some flowing into town along the "Rochester South drainage line".

2.2 November 2010 Flood

Following up to 76 mm of rain over the Campaspe catchment from around 9am Saturday 27th through to early Sunday 28th November 2010, the Campaspe peaked at Rochester on Monday 29th November at 8am at 114.43 mAHD at the Town gauge on Bridge Road and at 9.00m at the Syphon at 9:30am. Axe Creek, Sweenies Creek, Forrest Creek and Mount Pleasant Creek also flooded. Around Rochester, flooding was largely restricted to the low-lying areas adjacent to the river with the floodplain inundated for around 200m on either side of the main stream.

The November 2010 flood has been assessed as a 10% AEP event.

Within Rochester, the river began to overtop its banks somewhere between 6pm and midnight on the 28th. The main breakout occurred north-east of the railway bridge over the Campaspe River on the eastern side of the railway line towards the Waranga Western Irrigation Channel. The town was largely unaffected on the western side of the railway line. A number of streets were inundated and closed to traffic including the main VicRoads bridge over the Campaspe River on the Kyabram – Rochester Road (Bridge Road). The bridge was not overtopped (water came within 200mm of the road deck) but the approach to the east was inundated. The approach road remained closed for a number of hours. Some low-lying houses were sandbagged and although a number of properties were inundated, there was no over-floor flooding. The Caravan Park was flooded.

2.3 January 2011 Flood

The flood in January was the largest on record for Rochester. It exceeded the previous highest recorded flood (July 1956) by 200 mm and has been assessed as being a ~1% AEP event. It was nearly 1 m higher at the Town gauge and around 200 mm higher at the Syphon than the November 2010 event and took around 24 hours to rise from November 2010 levels to the peak.

In Rochester, the river peaked at around 115.4 mAHD at the Town gauge immediately upstream of Bridge Road at around 5:45pm on Saturday 15th January 2011 and at 9.17 m at the Syphon at 8:30pm.

Large breakouts occurred across the floodplain and water was deep through parts of the town. The floodway upstream of town, on the right bank of the river near Aitken Road, was engaged and flowed strongly. Floodwaters flowed to the western side of the railway line through the crossing located either side of the Campaspe railway bridge (600 m south at Ramsey and Charles Streets and 200 m north).

Approximately 80% of the town was inundated. 1,002 properties were flooded. More than 250 of these properties experienced over-floor flooding. All 136 shops, 3 churches, 12 public buildings including the Library and Service Centre, Community Centre, Shire Hall, Courthouse and Chambers, 3 recreational facilities including the Racecourse, Rotunda and Golf Course, the ambulance, police and fire stations, the Caravan Park, the aged-care facility, and the pre, primary and secondary schools were flooded. The hospital and Murray Goulburn Dairy Plant were isolated and SP AusNet infrastructure as well as the sewerage and water treatment plants were affected. The Northern Highway and the Kyabram – Rochester Road along with many other roads were closed. The railway line was overtopped between Elizabeth Street and south of the railway station.

Further downstream, the Waranga Western Irrigation Channel was overtopped.

The culverts from Ramsey Street to Railway Road form a floodway that was designed to drain local runoff from the catchment to the west back to the river. Water began to flow backwards through these culverts in the early hours of 15th January.

It took about 24 hours for the river to rise from the November 2010 peak height (114.43 mAHD) to the January 2011 peak height (115.4 mAHD).

2.4 Effect of Lake Eppalock and Rainfall Distribution

Peak flood flows and levels at Rochester are influenced by:

- The initial drawdown in Lake Eppalock;
- The spatial distribution of rainfall and the relative flow contribution from Mount Pleasant Creek;. and
- The antecedent conditions leading up to the flood event, ie how wet the catchment is prior to the flood. More runoff will occur if the catchment is saturated prior to the flood event as occurred in January 2011.

All flood modelling undertaken as part of the Rochester Flood Management Plan assumes Lake Eppalock is at 100% capacity at the start of the flood event. All flood levels and mapping for Rochester incorporated in this Plan includes this assumption.

Even if Lake Eppalock is at 100% capacity, it still plays an important role during a flood event, with attenuation of floodwaters still occurring. As outline in the table below, figures from January 2011 indicate that despite the dam being at capacity at the start of this event, without the dam, flooding would have been much worse for Rochester. The peak flow of water would have exceeded that of a 0.5% AEP flood event or 1 in 200 year flood event.

Scenario	Peak Flow (ML/d) at Rochester
January 2011 – dam 100% full	75,300
January 2011 – No dam	113,400

Lake Eppalock is not designed or intended to be operated as a flood mitigation structure. It is designed and operated to harvest, store and release bulk water for downstream entitlement holders. The water held in storage is owned by irrigators, urban water corporations and environmental water holders.

When possible, Goulburn Murray Water storages are operated to provide a limited mitigation benefit by delaying the onset of a flood and reducing its peak. The degree of mitigation is affected by the size of the flood and the volume in the storage prior to the event. However, Lake Eppalock only has a fixed crest spillway with a relatively small outlet pipe. Therefore, due to these infrastructure constraints, the maximum flow that can be released from Lake Eppalock is in the order of 2000ML/d.

Flows at Runnymede (Mount Pleasant Creek), the storage level in Lake Eppalock and Eppalock outflows are important inputs to the determination of flood impacts at Rochester.

It is important to note that there is sufficient catchment downstream of Lake Eppalock to cause flooding in Rochester as evidenced by the November 2010 flood event, where the Rochester town gauge level reached 114.41mAHD (equivalent to a 10% flood event)

3. Overview of Flooding Consequences

3.1 Warning Times

The flood warning time for Rochester is typically around 24 hours but this could be expected to be increased by the use of a rainfall - runoff model to 30 hours or more.

Forecast lead times are likely to be perhaps a little shorter for big floods and longer for smaller floods.

3.2 Areas Affected

Maps at Appendix F1 provide guidance on where flooding is likely to occur within and around Rochester for flood events ranging from the 20% AEP event up to the 0.5% AEP event.

3.3 Roads Affected

Most roads around and in Rochester are affected during large (greater than 2% AEP) floods. These include:

- Northern Highway – At Rochester to north (Elmore / Bendigo) and south (to Echuca) from about the 5% AEP event.
- Heathcote - Rochester Road - From the Midland Highway to Kyabram - Rochester Road.
- Kyabram - Rochester Road - Between Rochester and Timmering and at Rochester to the east of the bridge from about the 5% AEP event.
- Rochester - Strathallan Road.

Other roads further up and down the catchment are likely to be impassable for a couple of days or more.

Most of the roads within Rochester will be affected in big floods – see the flood inundation maps at Appendix F.

3.4 Properties Affected

3.4.1 Summary

In January 2011, 1,002 properties were flooded. More than 250 of these properties experienced over-floor flooding.

3.4.2 Detailed List

A list of properties likely to be flooded for a range of floods along with the expected depth of over-ground flooding and the likely depth of over-floor inundation is maintained by the NCCMA. Properties within 100mm of over-floor flooding are also identified. **It is strongly recommended that the list is used in conjunction with the flood inundation maps (see Appendix F) and flood forecasts provided for Rochester.**

3.4.3 Update of List of Properties Likely to be Flooded

The list of properties likely to be flooded (with corresponding levels and indication of over-floor flood depth) should be updated as soon as practicable. Update should occur with information collected as part of post-flood information recording activities and as may be collected as a consequence of the event debrief. Information on the collective experience of the IMT should also be gathered and utilised.

3.5 Isolation

The main access roads for Rochester are the:

- Northern Highway (north and south);
    - Is wetted from around the 5% AEP event between Pascoe and Fraser Streets. In a 2% AEP event water is around 150-200mm deep while in a 1% AEP event it is up to 400mm deep.
    - Overtops near the corner of Victoria Street adjacent to the swimming pool in 2% AEP events as a result of floodwater flowing down a natural drainage line and is up to 300mm deep. In a 1% AEP event the water is 450-500mm deep.
    - Overtops to the north on the outskirts of town in several places on the outskirts from around the 2% AEP event. Depths are 100-150mm in a 2% AEP event and 1200mm or so in a 1% AEP event.
- Kyabram - Rochester Road (east) – wetted from around the 5% AEP event;
- Rochester - Strathallan Road (south) - wetted from around the 10% AEP event.

The Melbourne - Murray River (Deniliquin) railway line is also overtopped at Rochester somewhere around the 1% AEP flood event.

Figure C1-1: Rochester township on 15th January 2011 around 3pm
(source: North Central CMA)

3.6 Essential Infrastructure

Access to and the grounds of the Hospital, ambulance centre and Care Facilities become wetted from about the 5% AEP event.

The Fire Station in McKay Street is affected from about the 5% AEP event and flooded over-floor from a little under the 2% AEP event.

The Police Station in Moore Street is also affected from around the 5% AEP event and is within 100mm of over-floor flooding at both the 1% and 0.5% AEP events.

The land on which the VICSES facility in Victoria Street may be affected from around the 5% AEP event but floors are expected to remain dry for events in excess of the 0.5% AEP event.

Many of the towns public buildings are flooded over-floor from the 5% AEP or 2% AEP events: Library and Service Centre, Community Centre, Shire Hall, Courthouse and Chambers, the Caravan Park, the aged-care facility, and the pre, primary and secondary schools.

The water treatment plant is protected by a levee - see below.

The waste water treatment ponds are above the 0.5% AEP flood level.

SP Ausnet infrastructure is affected by 1% AEP flooding (eg. January 2011).

The main access routes for the town and the railway line are all inundated beginning around the 5% AEP event.

4. Flood Mitigation

4.1 General

Flood intelligence MUST have regard for changes within the catchment that modify likely flood behaviour (e.g. mitigation works that reduce the severity of flood risk).

4.2 Flood Protection Levees

An earthen levee was constructed by Council upstream of Rochester to replicate the benefits of a decommissioned irrigation channel. This irrigation channel was present in January 2011 and prevented floodwaters from flowing underneath the railway line at Black Culvert Road. A significant number of additional properties would have experienced over floor inundation had this channel not been in place.

Coliban Water have also constructed a concrete flood barrier around the water treatment plan designed to protect against a 0.5% AEP flood (plus freeboard, top of wall is 116.45m AHD).

4.3 Drainage Works

None of significance to riverine flooding within Rochester.

5. Flood Impacts and Required Actions

Refer to the following Flood Intelligence Card.

6. Command, Control and Coordination

The Command, Control and Coordination arrangements in this Municipal Area Flood Emergency Plan will be as detailed in the Emergency Management Manual Victoria.

All flood response activities within the Shire of Campaspe will be under the Control of the VICSES Regional Officer / Incident Controller.

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

An **Incident Control Centre (ICC)** will be established by the Control Agency (ie. VICSES) for its command and control functions in response to any flood event within the municipality. It will be operate in accordance with VICSES arrangements.

The location of the ICC will be determined and advised to relevant stakeholders dependant on the extent and severity of the flood event.

The establishment and operation of a **Municipal Operations Centre (MOC)** will be in accordance with and as detailed within the IMEMP.

7. Flood Intelligence Card, Property Inundation List and Historic Flood Relationship

7.1 Introduction

BoM upgraded its flood prediction service in 2017 for Rochester and now provide a flood forecast for the Town gauge. The town gauge is attached to the upstream face of the bridge at Bridge Road, Rochester.

Notes:

1. While flood intelligence cards provide guidance on the relationship between flood magnitude and flood consequences, flood intelligence records are approximations. This is because no two floods at a location, even if they peak at the same height, will have identical impacts. Further, the hydrologic and hydraulic modelling that underpins much of the intelligence detailed below is informed by a number of assumptions and approximations that are unlikely to be replicated exactly during a flood event. Actual impacts under similar rainfall conditions are therefore expected to be similar but may not be exactly the same: there are likely to be some differences. More details about flood intelligence and its use can be found in the Australian Emergency Management Manuals flood series at http://www.ema.gov.au and in particular in Manual 20 "Flood Preparedness".
2. All levels, impacts and actions listed in the following flood intelligence card may need to be adjusted to better reflect experience.

7.2 Flood Intelligence Card

AEP of flood	Forecast level at Rochester (mAHD)	Forecast level at Syphon (m)	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 9.6. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is made early and that, in general, sandbagging is reserved for non-weatherboard buildings.				
	113.30			◦ Caravan Park to be advised that BBQ area floods by SES
Minor flood level	113.00	8.00		◦ SES advise organisations that warnings have been issued. ◦ Rochester SES Unit alerted. ◦ SES to Commence patrols of Ayson Reserve ◦ Council to: ➢ Close gate at pit No 1 on Northern Highway at Elizabeth Street. ➢ Close gate at pit 2 on Northern Highway at Diggora Road - earlier if water starts flowing westwards in the pit. ◦ Coliban Water staff isolate stormwater pits at water treatment plant and activate stormwater pumps.
	113.10			◦ SES to advise Caravan Park to evacuate caravans from lower level.
September 2010	113.30			
	113.50			◦ SES to advise Caravan Park to evacuate caravans from second level.
	113.71	8.70		◦ Council to close Campaspe St between bridge and

AEP of flood	Forecast level at Rochester (mAHD)	Forecast level at Syphon (m)	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 9.6. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is made early and that, in general, sandbagging is reserved for non-weatherboard buildings.				
				Gillies St. ◦ Council to prepare information for web site, recorded telephone message and, Customer Service Centres based on information from SES
	113.80			◦ SES to advise Caravan Park to evacuate caravans from third level.
	113.86		Caravan Park amenities block floods.	
Moderate flood level	114.00	8.80	Flooding likely in parts of Bridge Road, Mackay Street, Ramsay Street, Victoria Street, Cromwell Street, High Street and the Northern Highway. Rural flooding becomes established	◦ SES to advise Caravan Park to disconnect services and remove relocatable units ◦ VicRoads/Council to close the following: - Bridge Road between the bridge and High Street - Mackay Street from north end to Elizabeth Street - Ramsay Street from north end to Gillies Street - Victoria Street from north end to George Street - Cromwell Street from Echuca Road to the east - Echuca Road from Dawson Street to Railway Road and McKenzie Street corner - High Street north of Lowrie Street and areas south need checking - Echuca-Nanneella / Webb Road intersection

AEP of flood	Forecast level at Rochester (mAHD)	Forecast level at Syphon (m)	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 9.6. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is made early and that, in general, sandbagging is reserved for non-weatherboard buildings.				
				- Rochester - Heathcote Road near the cemetery - Bonn / Burnewang Road at bridge just north of Aysons Reserve ◦ SES to ensure sand and sand bags are available for their use. ◦ Coliban Water to install removable panels in flood wall at water treatment plant.
Sept / Oct 1993	114.01			
20% AEP (5-yr ARI)	114.10		Flooding confined mainly to the low lying areas of the floodplain in the immediate vicinity of the Campaspe River (the wetlands, lagoons and low depressions). Some shallow inundation north (downstream) of the town along the railway line to the Waranga Western Irrigation Channel. Flow also passing along the floodways under the railway line.	◦ Refer to indicated maps and impacts. ◦ Implement appropriate response actions. This may include organising necessary resources, sandbagging at key locations (see maps), the removal of furniture etc from buildings likely to be flooded over-floor and / or sandbagging buildings.
	114.14			◦ VicPol/Incident Controller to advise Caravan Park to evacuate entire site
February 2011	114.30	8.93		◦ SES, through normal warnings, to advise rural property owners to be advised. ◦ Incident Controller, in consultation with the MRM,to consider giving to opening Relief Centres.
October	114.42	9.05		

AEP of flood	Forecast level at Rochester (mAHD)	Forecast level at Syphon (m)	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 9.6. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is made early and that, in general, sandbagging is reserved for non-weatherboard buildings.				
1992				
November 2010	114.43	9.00	Around Rochester, flooding was largely restricted to the low-lying areas adjacent to the river with the floodplain inundated for around 200m on either side of the main stream. Main breakout occurred north-east of the railway bridge over the Campaspe River on the eastern side of the railway line towards the Waranga Western Irrigation Channel. Town largely unaffected on the western side of the railway line. Number of streets inundated and closed to traffic including the main VicRoads bridge over the Campaspe River on the Kyabram – Rochester Road (Bridge Road). Bridge not overtopped (water came within 200mm of the road deck) but approach to the east was inundated. Some houses sand-bagged - no over-floor flooding. Caravan Park flooded.	
Major flood level	114.50	9.10	Old anabranch area (low depression) in the vicinity of Reserve Street begins to flood and depths increase along the railway line and through the crossings.	◦ VicPol/Incident Controller to advise Caravan Park again to evacuate entire site ◦ Incident Controller to consider opening Relief Centres ◦ SES to consider establishing public information point ◦ SES to ensure sand and sand bags are available for their use.

AEP of flood	Forecast level at Rochester (mAHD)	Forecast level at Syphon (m)	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 9.6. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is made early and that, in general, sandbagging is reserved for non-weatherboard buildings.				
10% AEP (10-yr ARI)	114.64		Flooding largely confined to the eastern side of the railway line. First 3 houses flooded over-floor: in Campaspe Street, Tasker Road and Zegelin Road. Breakout flow to the east of the river near the sporting ground - likely to inundate Club Rooms, Rochester Caravan & Camping Park, and properties along Church Street, Reserve Street, Hood Street and the Kyabram - Rochester Road (between river and Hood Street). Breakout flow to the west of the river inundates properties in Pascoe Street, Fraser Street and Campaspe Street. Other breakout flows to the west inundate properties along McKay Street and Hart Street, flow under the railway line along the floodways and flow alongside the railway line to the north along Ramsey Street. Major breakout upstream of railway bridge flows north towards Waranga Western Irrigation Channel where water begins to back-up and inundates the area between the railway line and Cohen Road, including the Rochester - Strathallan Road. Minor breakouts begin to occur adjacent to the river upstream of Rochester.	
September 1983	114.7			
5% AEP (20-yr ARI)	114.96		Water spreads through central township area - shallow inundation in large part of town east of the railway line: most properties between the river and High Street are inundated. East of High Street, a block of properties bounded by High Street, Baynes	◦ Council/VicRoads - If not already done, to consider closing Kyabram - Rochester Road (east) and the Northern Highway.

AEP of flood	Forecast level at Rochester (mAHD)	Forecast level at Syphon (m)	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 9.6. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is made early and that, in general, sandbagging is reserved for non-weatherboard buildings.				
			Street and the Kyabram - Rochester Road are inundated along with a significant proportion of the properties north of the Kyabram - Rochester Road between the river and Cohen Street. Kyabram - Rochester Road wetted. Northern Highway first wetted between Pascoe Street and Fraser Street. The hospital grounds, ambulance station and care facilities affected by shallow inundation. Access difficulties due to inundation of Pascoe Street and Northern Highway. Area between railway line and Northern Highway is also inundated with a significant number of properties inundated north of George Street. Water accumulating in "Rochester south drainage line" west of railway line along Ramsay Street, Echuca Road, and Railway Road, threat to low lying properties adjacent to the drainage line. North (downstream) of town, water backs-up behind the Waranga Western Irrigation Channel and overtops it. In addition, inundation depths increase in this area and extend to the west along the Channel. 32 houses are likely to be flooded over-floor with another 50 within 100mm of being flooded over-floor. Flooding upstream of Rochester is similar to that of the 10-year ARI event.	
July 1956	115.19			
2% AEP (50-yr ARI)	115.20		Significant shallow inundation across a large proportion of the town and inundation of properties through the central part of town.	

AEP of flood	Forecast level at Rochester (mAHD)	Forecast level at Syphon (m)	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 9.6. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is made early and that, in general, sandbagging is reserved for non-weatherboard buildings.				
			Almost entire area east of the river and north of the Kyabram - Rochester Road is inundated. East of the railway line there is only a small pocket of properties bounded by Lindsay Street, High Street and Aitken Road that are not inundated. The floodway to the east of town (south / upstream of Pascoe Street) flowing but stays largely within the floodway. Water surrounds the hospital / care facilities causing access issues. Floodwaters rise between the Northern Highway and the railway line and also break out west of the Highway inundating the golf course and number of properties between Diggora Road and McKenzie Street. Low-lying properties adjacent to the "Rochester south drainage line" are under threat. Northern Highway flooded. Around 150-200mm deep between Pascoe and Fraser Streets, around 300mm deep near the corner of Victoria Street adjacent to the swimming pool and 100-150mm deep to the north on the outskirts of town. 157 properties are flooded over-floor and a further 128 are within 100mm of being affected. Flooding upstream of Rochester is similar to that of the 20-year ARI event.	
1% AEP (100-yr ARI)	115.33		Number of properties affected increases significantly. Extent of flooding not much different from 50-year ARI event apart from along the eastern floodway but depths increase everywhere. Significant inundation of properties through the central part of town and on	

AEP of flood	Forecast level at Rochester (mAHD)	Forecast level at Syphon (m)	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 9.6. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is made early and that, in general, sandbagging is reserved for non-weatherboard buildings.				
			both sides of the railway line with large quantities of water flowing through the railway crossing floodways. The grounds of the hospital and care facilities are completely inundated. The "Rochester south drainage line" and eastern floodway flowing strongly. Northern Highway around 400mm deep between Pascoe and Fraser Streets, 450-500mm deep near the corner of Victoria Street adjacent to the swimming pool and 1200mm or so deep to the north on the outskirts of town. Further breakouts occur immediately upstream of Rochester across farming land although the channel embankment does restrict floodplain flows.	
0.5% AEP (200-yr ARI)	115.39		Widespread inundation through town with only properties in the south-east of Rochester not directly impacted. Break out through eastern floodway is considerably deeper than in the 100-year event causing more inundation in the west and north of the central township. The floodway west of the railway line drives water further south (upstream) along the railway line where it crosses the line again at the Black Culvert Bridge. Flooding to the west of the Northern Highway is significantly increased in extent with only small pockets of properties not inundated. 440 properties are flooded over-floor and an additional 294 are within 100mm of being affected. The breakouts upstream of town to the east across farming land increases with some flowing into town along the "Rochester South drainage line.	

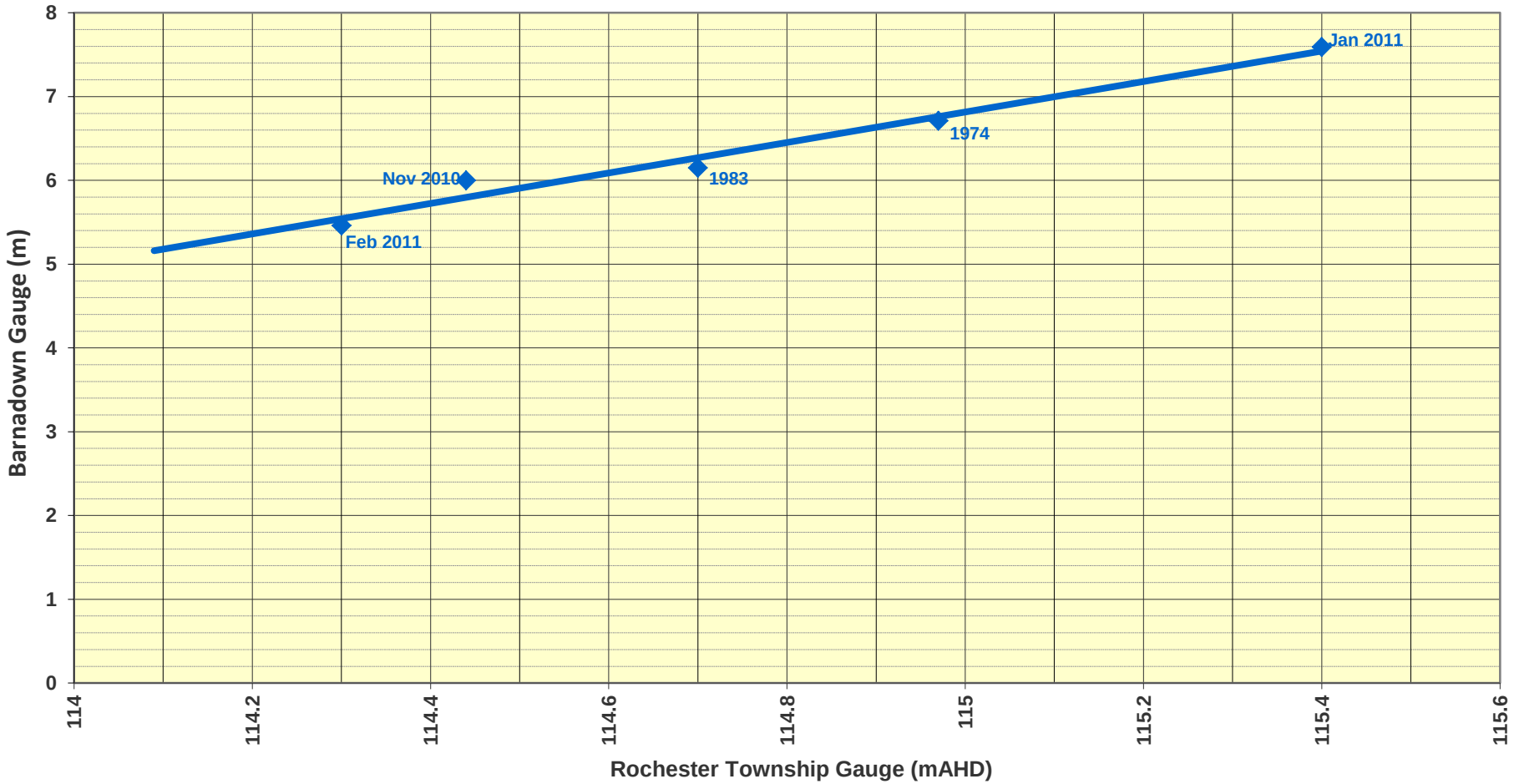
AEP of flood	Forecast level at Rochester (mAHD)	Forecast level at Syphon (m)	Consequence / Impact	Action Actions may include (but not limited to) evacuation, closure of roads, sandbagging, issue of warnings and who is responsible
USING THIS INTELLIGENCE CARD. Consider the flood inundation map deemed the most appropriate for the forecast flood level - either as provided by BoM or deduced from the tool at Section 9.6. Review all consequences and actions in this table, from the first row down to the approximate expected severity of flooding. Initiate all actions in a logical sequence. Note that that some actions may need to be initiated in an order that is different from their relative placement in this table.				
It is important that the decision to mobilise to remove furniture etc from buildings is made early and that, in general, sandbagging is reserved for non-weatherboard buildings.				
January 2011 Largest on record	115.4	9.17	Large breakouts across the floodplain and water deep through parts of the town. Floodway upstream of town, on right bank near Aitken Road, engaged and flowing strongly. Approximately 80% of the town likely to be inundated: ~1,000 properties with more than 250 flooded over-floor. Includes all 136 shops, 3 churches, 12 public buildings including the Library and Service Centre, Community Centre, Shire Hall, Courthouse and Chambers, 3 recreational facilities including the Racecourse, Rotunda and Golf Course, the ambulance, police and fire stations, the Caravan Park, the aged-care facility, and the pre, primary and secondary schools. Hospital and Murray Goulburn Dairy Plant isolated. Potential for damage to SP AusNet infrastructure as well as to sewerage plant. Northern Highway, Kyabram – Rochester Road and many others closed. Railway line overtopped between Elizabeth Street and south of the railway station.	

7.3 Summary of Properties Flooded

Summary of number of flood affected properties in Rochester (ref Water Technology, 2013) EXISTING CONDITIONS						
	Design Flood ARI					
	20%	10%	5%	2%	1%	0.5%
Level at the Town gauge upstream of Bridge Road (mAHD)	**114.10**	**114.64**	**114.96**	**115.20**	**115.33**	**115.39**
Level at the Syphon gauge, 3km downstream from town (m)	**7.30**	**7.65**	**8.37**	**8.76**	**9.17**	**9.23**
Number of properties flooded above floor	0	3	32	157	266	440
Number of properties flooded below floor only	1	13	224	485	626	713
Total number of flooded properties	**1**	**16**	**256**	**642**	**892**	**1153**
Number of properties within 100mm of over-floor flooding	0	1	50	128	205	294

A detailed list which shows properties that are flooded in Rochester at various flood heights is maintained by the North Central Catchment Management Authority (NCCMA). This information is not available to the general public, however individual property owners can contact the NCCMA for relevant information.

7.4 Historic Flood Relationship – Barnadown to Rochester Town Gauge



APPENDIX C4 – LOWER GOULBURN RIVER ACTION PLAN

Along the Goulburn River downstream from Shepparton an almost continuous system of parallel levees exist either side of the river. For a century, the levee system has played a role in enabling development on the adjoining floodplain outside the levees. It also played a role in preserving the forest corridor inside the levees.

Without the levees, much of the irrigation development on the left bank, or south side, of the river would not have taken place. The infrastructure has provided at least a modest standard of flood mitigation.

Records indicate that levee construction commenced on a significant scale during 1898 as an unemployment relief measure. Plans from 1908 already show levees in place adjacent to the Goulburn River. The main levee system which exists today was virtually complete before World War 1. There are now approximately 150km of levees flanking the Goulburn River downstream of Shepparton.

Sinclair Knight Mertz (Lower Goulburn Waterway and Floodplain Management Plan, 1989) states:

The engineering design standards of the levees were inadequate by contemporary standards. They were constructed too close to the river, generally reflecting the limits of Crown Land river frontage rather than hydraulic flow criteria. Consequently, for any flows exceeding the channel capacity but contained within the levees, water levels are increased and velocities of flow may be appreciably accelerated.

The probability of flows occurring which would exceed the capacity of the levee system was also unacceptably high, even for protection of rural land with low population density. Downstream of Loch Garry, and without a regulator to divert large flows such as exists today, the probability of the levees being overtopped was between 10% and 20%, and downstream of McCoys Bridge this standard declines to Annual Exceedence Probability AEP 50% or greater.

In addition to the levees flanking the Goulburn River, there are also approximately 40km of levees in the floodplain.

Levees extend approximately 7km on either side of the lowest reaches of Wells Creek. These are matched to the crest level of the Goulburn River levee, and their function is to prevent backwater from the Goulburn spreading out onto adjacent properties. However, when the Goulburn levees break or are overtopped on the south side of the river upstream, the Wells Creek levees can actually trap floodwater on the floodplain and obstruct the drainage back to the river via Wells Creek.

Floods not exceeding 10.36m (or 110.487 m AHD) on the Shepparton gauge are generally contained within the existing Goulburn River levees. However to prevent the river overtopping the levees if the river rises further, water is released into Bunbartha Creek at Loch Garry.

Twenty four hours after the river gauge at Shepparton exceeds 10.36 metres, GMW begins removing the bars at Loch Garry, with 25 bars removed for every 31mm of rise above 10.36 metres. Bars are progressively removed until the river reaches 10.96m at which point all the bars will have been removed. When the river returns to 10.96m, bars are progressively replaced at the same rate as they were removed.

When the bars are removed according to this process floodwaters may inundate properties on the north side of the river.

During the 1993 floods, (3/7% AEP), levee failures occurred causing substantial problems and resulted in the inundation of some rural houses.

In September 2010, (15% AEP), the levees were close to overtopping. It is therefore suggested that a flood higher than the September 2010 event (11.1m at Shepparton and 10.2m at McCoys Bridge) would be likely to breach some of the levees along both sides of the lower Goulburn.

APPENDIX C5 – KYABRAM ACTION PLAN

Kyabram is situated in a low lying area without a natural outfall and is located at the boundary of three major GMW drainage catchments: Mosquito Drain, Coram Drain and Wyuna Main Drain. GMW allows discharges to its drainage system, but only at specified rates which are very limited when dealing with urban stormwater runoff.

Kyabram is subject to flash flooding from stormwater runoff and depends on a series of stormwater retention basins and pumps for its protection.

In 1939 Kyabram received a deluge of 225mm of rain, but the extent of flooding was not more than an inconvenience to residents.

In 1950 significant rainfall occurred but did not result in significant flooding.

Significant street flooding occurred during storms in 1956.

In 1957, a 300mm pump was installed on the west side of Lake Road to cater for flood flows. However, with the increased development resulting in increased runoff, this pump was soon inadequate to cater for this runoff and in 1963 a second 300mm pump was installed.

In 1974 the headlines of the Free Press reported “Heavy Rain - Worst Flooding in History of Kyabram. Scores of homes under water.” The water took more than a week to pump away.

In 1975, 75mm of rain caused flooding in streets from Breen Avenue to Lake Road.

Further flooding occurred in 1983.

Significant flooding occurred when heavy rainfall fell in January 1993 (60mm in 18 hours) and October 1993 (105.9mm in 24 hours) with the Fauna Park Lake banks overflowing after only three quarters of the stormwater was pumped away. The pumps were closed down even though floodwaters extended from Fischer Street / Breen Avenue corner through to Lake Road and Chaston Street. The Caravan Park and Anderson Street remained flooded for 4 days after the rain had ceased. This storm was between a 1% and 2% AEP event.

Council employed consultants GHD to investigate appropriate mitigation measures and they delivered a report in September 1994 entitled “Surface Drainage Strategy”.

Council adopted the recommendations contained within the report and undertook significant works to reduce the impact of similar storm events.

There were 26 houses inundated in October 1993. Even with the works undertaken above 11 houses are still at risk of inundation.

Due to the nature of the Kyabram Drainage Network it is difficult to state a specific number of houses which will flood, or not. An example of this would be the operation of the Kyabram Fauna Park lakes could potentially impact at least 50 houses depending on the previous rainfall events and existing storage levels in the lakes, the golf course, local depressions, McEwen Road, South Boundary Road, Fenaughty Street and Allan Street.

Council's Operation Manual for the Kyabram Drainage will be followed until it is deemed unable to handle the rainfall event which would trigger the implementation of the Flood Emergency Plan.

Council maintains a Work Instruction for the operation and maintenance of pumps, associated drainage infrastructure and flood pumps across the Municipality. Council staff can access this documentation on the “Intranet”, the internal document management site.

APPENDIX C6 – WANALTA / COLBINABBIN ACTION PLAN

The main channel between Wanalta and Colbinabbin can impede the flow of floodwaters heading northward. To counter this there are syphons and opening at the channel to allow the passage of water. Concentrated water flowing under the channel near Kennedy Road should flow northward along the nature drainage courses. However it heads eastward towards the Wanalta Creek due to the nature of infrastructure that has been constructed over the years. Water flowing under the channel from further to the west tends to flow towards Cornella Creek and into Lake Cooper.

Heavy rain in the catchment of the Cornella Creek can result in the creek flooding at Colbinabbin. Floodwaters take about 6 hours to reach Colbinabbin from the upper catchment. The duration of the flood is generally 1 to 2 days, with the peak lasting less than 24 hours.

In these events, the Bendigo - Murchison Road can be inundated on the eastern approach to Colbinabbin and further east between Egans Bridge and Weppners Road where the water flows under the channel and then northward along the road reserves. The depth of water at the highway centreline can be 30 centimetres, but the depth in the table drains is substantially more. The water flowing across the highway makes the situation for vehicles extremely hazardous. The highway should be closed to traffic during floods at this level and traffic diverted via Corop.

Problems caused by the flooding also include inundation of the Primary School playground, the cemetery, the waste transfer station area, and the recreation reserve. Water can also cross the highway at Channel Road to the west of the main channel. Floodwaters spreading from Cornella Creek can make their way through the syphons under the main channel and can affect Kennedy Road and Browns Road.

Dwellings outside Colbinabbin can be affected by floodwater but generally only to the extent that access is cut off. A few houses can have water under the floorboards, but a high flood could exceed floor level. Sheds and outbuildings would also be flooded.

Similar rainfall events can also cause flooding of the highway further east at Wanalta where it crosses the Wanalta Creek. The timing of any releases from Groves Weir can have an impact on water levels downstream. Houses on the north and south side of the highway near the creek can have above floor inundation. A house further to the north on the west side of the creek can also be flooded.

GMW maintains operating procedures for the operation of Groves Weir and other structures in the area.

Also, heavy rainfall from the Camel Ranges impacts on Colbinabbin as previously mentioned.

A flood study has been undertaken for the Corop Lakes and is available from GBCMA.

APPENDIX C7 – TONGALA ACTION PLAN

Tongala is situated in a natural depression and can be subject to flooding from stormwater runoff. The stormwater drainage system has been designed so that no houses would be inundated by a 1% AEP rainfall event. Flooding would occur in some streets, but would not cause flooding of residences.

Tongala is served by two retardation basins. One located at Centennial Park having storage for a 1% AEP event. It has been estimated that in such an event, this basin would take 5 days to drain.

The other basin is located on the railway reserve and waters discharge from Henderson Road to the west.

Stormwater then discharges into the Mosquito Depression at a controlled rate.

APPENDIX C8 – RUSHWORTH ACTION PLAN

Localised flash flooding occurs as a result of stormwater runoff. Due to the steep gradients of the catchment area, there is little reaction time between a rainfall event and a flash flood event, which predominantly occur after summer storms. The area north of Rushworth flattens out through to plains.

There are no specific indicators for this area except for total rainfall measurements, the length of the event and the condition of the catchment prior to the rainfall event. For example 75mm in 24 hours onto a wet catchment would result in moderate flooding of some agricultural land, whereas 100mm to 125mm in 24 hours would result in major flooding for a wet catchment. The result of the same rainfall event on a dry catchment would not be as severe.

APPENDIX C9 – TORRUMBARRY / GUNBOWER ACTION PLAN

Significant failure of the levee system in the Torrumbarry / Gunbower area could cause problems for Gunbower, Cohuna, and other downstream townships.

Downstream of Echuca the first significant flooding risk occurs at the subdivision at Moorabinda Road off Farley Road and then at Young Road which is the western boundary of Torrumbarry Estate. Heading further downstream from the point where Young Road meets Richardsons (Baillieu) Lagoon there is an almost continuous levee to the Torrumbarry Headworks, and another bank commencing at the Headworks and running downstream to high ground near the Torrumbarry Weir. These banks were initially constructed by the early settlers in the 1870's and have been built up and maintained in an ad-hoc manner by local farmers over the years. Both of the former Shires of Cohuna and Rochester assisted local farmers in their maintenance by the provision of heavy equipment at times of serious flood.

The bank around the Headworks weaves its way through private land and Crown land, over a distance of about 16kms. The depth of water held back by the bank 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. Although the Gunbower Creek is cut off from the river by the Headworks, 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. Richardsons Bank was repaired after the 1975 flood by the former Shire of Rochester, with some or all of the funding coming from the State Government.

Downstream of the Headworks channel, a small low level levee follows the freehold boundary around the perimeter of the Gunbower Forest. Previously landowners undertook work to build up the natural banks of the Murray River within the Gunbower Forest. The banks along the Murray River are in a poor state of repair and cannot be relied upon. In future flood events, works will not be allowed in the forest and works, both temporary and permanent, should be focussed on the perimeter levee.

In 2013, an assessment of the rural levees along the Murray River upstream of Torrumbarry and the perimeter levee along the Gunbower Forest was completed. A copy of this report can be obtained in FloodZoom. The height of the levee was surveyed and compared to the 1975 flood event. It was found that 7.8km of the 38km levee was below the 1975 flood event, with 208m greater than 1m below the 1975 flood event. In addition along the 38km length of levee 839 points of weakness were identified, this includes trees growing within the levee, ant nests, rabbit burrows, erosion, slumping. Of these, 56 points of weakness were identified to have an extreme or high risk of failure. These 56 points equate to 97m length of levee.

A flood study is currently being undertaken to understand the level at Echuca Wharf for when the Torrumbarry levee may become overtopped. This flood study is due for completion in 2020. However, it is known that at 93m AHD at the Echuca Wharf the levees are not overtopped (as evidenced in September 2010). General comment: the data related to the area around Farley Rd and Headworks Rd downstream of Echuca has been moved from the Echuca FIC and deposited below. These areas are about 12 and 20 km west of Echuca respectively

Predicted River Height for Echuca Wharf (mAHD)	AEP	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
93.900	Moderate Flood Level 15% AEP (6 year ARI)	Some flooding of the forest reserve area to the west (downstream) of Farley Road	➢ Levees downstream from Echuca to Gunbower to be patrolled. ➢ Low points in levees may start to become overtopped.
94.770	October 1993 flood ~4% AEP (25 year ARI) Note that this flood was higher than the October 1975 event but flow was lower and thus the AEP is also lower.	The area in the vicinity of Headworks Road and Bail Road is critical as a levee breach here would allow water to flow towards Gunbower and Cohuna.	➢ Levees need to be patrolled between Baillieu Road and the Municipal boundary at Deep Creek as at this level, water will be near to or overtopping the levees.

APPENDIX C10 - WESTERN BOUNDARY OF THE SHIRE ACTION PLAN

When Bendigo Creek floods, many of the east west roads crossing the creek can be cut. Generally floodwaters take many days to travel from the southern most border of the Shire to Kow Swamp in the north. 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.

Predicted River Height (m) for Mitiamo Gauge	Annual Exceedance Probability	Consequence / Impact	Action Actions may include (but not limited to): evacuation, road closures, sandbagging, issue warning and who is responsible
1.41	December 2010 flood level		➢ East west roads across the creek require signage due to water over the road including Dingee - Rochester Road, Elmore - Mitiamo Road and Elmore-Raywood Road.
2.08	January 2011 flood level		
2.39	August 1981 flood level		➢ East west roads across the creek require signage due to water over the road including Bendigo - Tennyson Road
2.86	May 1974 flood level – record		➢ East west roads across the creek require signage due to water over the road including Prairie - Rochester Road and Echuca - Mitiamo Road

APPENDIX C11 – NANNEELLA / OTHER AREAS ACTION PLAN

Flooding of the Stanhope Depression can occur but is a rare event. The main problem in this area is floodwaters that spread out of the recognised wetland areas onto more productive farm land. The uncoordinated natural drainage system and flat terrain means land can be inundated for months.

Nanneella Depression floodwaters will usually arrive at the confluence with the Timmering Depression near Everard Road well in advance of any runoff from the Wanalta and Woolwash. Except in unusual circumstances where runoff deriving from separate storms coincides at the confluence, runoff from Nanneella has little influence on peak Timmering outflows.

The problems at the lower end of the Nanneella Depression are similar to those in the Timmering Depression. Floodwaters spread out over extensive areas for long periods.

APPENDIX D – Flood Evacuation Arrangements

1 Phase 1 - Decision to Evacuate

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 to conduct the evacuation;
- Time 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;
- Resources required to conduct the evacuation;
- Resources available to conduct the evacuation;
- Shelter including Emergency Relief Centres, Assembly Areas etc.;
- Vulnerable people and facilities;
- Transportation;
- Registration
- People of CALD (Culturally and Linguistically Diverse) background and transient populations;
- Safety of emergency service personnel;
- Different stages of an evacuation process.

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

2 Phase 2 – Warning

Warnings may include a warning to prepare to evacuate and a warning to evacuate immediately. Once the decision to evacuate has been made, the at-risk community will be warned to evacuate. Evacuation warnings can be disseminated via methods listed in part 3 of this plan.

Evacuation warning messages will be developed and issued by VICSES in consultation with the Police, MERO, MERC, MRM, DHHS and other key agencies and expert advice (CMA's and Flood Intelligence specialists).

3 Phase 3 – Evacuation

Evacuation will be controlled by VicPol who will advise the most appropriate evacuation routes and locations for at-risk communities to evacuate to, in consultation with VICSES and MRM.

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 coordinated by VicPol.

4 Phase 4 – Shelter

Relief Centres and/or assembly areas which cater for people's basic needs may be established to meet the immediate needs of people affected by flooding. Full details of Relief Centres are contained within the IMEMP, these centres can be activated by contacting the MOC, the Municipal Emergency Response Coordinator or the Municipal Recovery Manager.

The Incident Controller will liaise with Local Government and DHHS (where regional coordination is required) to plan for the opening and operation of relief centres. This can best be achieved through the Emergency Management Team (EMT).

5 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.

The Council, MERO, MERC and MRM will also be advised of the return.

APPENDIX E - FLOOD WARNING SYSTEMS

1 Flood Warning Products

Flood Warning products and Flood Class Levels can be found on the Bureau of Meteorology (BoM) website. Flood Warning products include Severe Thunderstorm Warnings, Severe Weather Warnings, Flood Watches and Flood Warnings.

2 Flood Watches

Flood watches are issued by the Bureau of Meteorology (BoM) to notify communities and other stakeholders within broad areas (rather than specific catchments) of the potential flood threat from a developing weather situation. They provide a 'heads up' of likely flooding.

Flood watches are based on an assessment of the developing weather situation and indicators of current catchment wetness. They provide generalised statements about expected forecast rainfall totals, the current state of the catchments within the target area and the streams at risk from flooding. Instructions for obtaining rain and stream level observations and access to updated Watches and Warnings are also included.

Normally, the BoM would issue a Flood Watch 24 to 36 hours in advance of any likely flooding and issue updates as required. If at any time during that period there was an imminent threat of floods occurring, the Flood Watch would be upgraded to a Flood Warning.

3 Flood Warnings

Flood Warnings are firm predictions of flooding based on actual rainfall and river height information as well as the results of stream flow based models of catchment behaviour that take account of antecedent conditions (i.e. the 'wetness' of the catchment, storage levels within dams, etc) and likely future rainfall. Releases from dams are an essential input to such models.

Flood warnings are categorised as 'minor', 'moderate' or 'major' (see BoM website for an explanation of these terms and current flood class levels) and indicate the expected severity of the flood for agreed key locations along the river. Flood warnings usually include:

Rainfall amounts for selected locations within and adjacent to the catchment;

River heights and trends (rising, steady, falling) at key locations within the catchment;

Outflows (in ML/d) from major storages within the catchment;

Forecasts of the height and time of flood peaks at key locations;

A weather outlook and the likely impact of expected rainfall on flooding; and

A warning re-issue date and time.

Note 1:The term "local flooding" or "flash flooding" may be used for localised flooding resulting from intense rainfall over a small area.

Note 2:The term "significant rises" may be used in the early stages of an event when it is clear that river levels will rise but it is too early to say whether they will reach flood level.

4 Flood Bulletins

VICSES distributes flood emergency information to the media through "Flood Bulletins". Flood Bulletins provide BoM Flood Warning information as well as information regarding possible flood consequences and safety advice, not contained in BoM Flood Warning products. VICSES uses the title Flood Bulletin to ensure emphasis is placed upon BoM Flood Warning product titles.

The relevant VICSES Region Headquarters or the established ICC will normally be responsible for drafting, authorizing and issuing Flood Bulletins, using the One Source, One Message system.

Flood Bulletins should refer to the warning title within the Bulletin header, for example Flood Bulletin for Major Flood Warning on Campaspe River.

Flood Bulletins should follow the following structure:

- What is the current flood situation;
- What is the predicted flood situation;
- What are the likely flood consequences;
- What should the community do in response to flood warnings;
- Where to seek further information;
- Who to call if emergency assistance is required.

It is important that the description of the predicted flood situation is consistent with and reflects the relevant BoM Flood Warning.

Flood Bulletins should be focused on specific gauge (or in the absence of gauges, catchment) reference areas, that is the area in which flood consequences specifically relate to the relevant flood gauge.

Flood Bulletins should be prepared and issued after receipt of each Flood Watch and Flood Warning from the BoM, or after Severe Weather or Thunderstorm Warnings indicating potential for severe flash flooding.

To ensure Flood Bulletins are released in a timely manner, standardised Flood Bulletins may be drafted based on different scenarios, prior to events occurring. The standardised Flood Bulletins can then be adapted to the specifics of the event occurring or predicted to occur.

5 Local Flood Warning System Arrangements

No local arrangements are currently in place.

6 Details of relevant gauges

Station No	River / Creek	Station	Type		Gauge readings according to Flood Class Levels (m)			Zero point on gauge AHD (m)	Comments
			Rain	River	Minor	Moderate	Major		
405204	Goulburn	Shepparton		River	9.50	10.70	11.00	100.127	Directly upstream Midland Hwy (Dainton's) Bridge, Shepparton
405232	Goulburn	McCoys Bridge		River	9.00	10.00	10.20 (BOM)	91.422	Approx 600m u/s MVH Bridge, east of Wyuna
406262	Axe				-	-	-	-	
406213	Campaspe	Redesdale	Rain	River	2.00	4.00	6.00	213.053	d/s Heathcote Kyneton Road, east of Redesdale
406219	Campaspe	Lake Eppalock HG		River					
406207	Campaspe	Lake Eppalock DS		River	158.40 21,200 ML/d	160.40 47,300 ML/d	162.40 80,200 ML/d	0.00	
406201	Campaspe	Bardnadown		River	4.00	4.50	5.50	132.489	3km d/s Epsom-Barnadown Road
406224	Mt Pleasant	Runnymede	Rain	River	-	-	-	-	u/s Northern Highway, north of Runnymede
406218	Campaspe	Campaspe Weir HG	Rain	River	1.20	1.40	1.50	120.133	7.5km upstream of Rochester Flood class levels to be reset to AHD
406202B	Campaspe	Rochester (Town - at bridge)		Staff gauge	113.00	114.00	114.50	0.00	
406202C	Campaspe	Rochester (Syphon)	Rain	River	8.00	8.50	9.10	103.615	Gauge located where Waranga Western Irrigation Channel passes unde the Campaspe River
406265	Campaspe	Echuca – upstream of Murray Valley Highway Bridge		Staff gauge	-	-	-	-	Cnr Crossen St and Campaspe Esplanade
407236	Mt Hope	Mitiamo	-	River	-	-	-	94.324	
409216	Murray	Yarrawonga Weir		River	6.40	6.70	7.80	115.035	d/s Yarrawonga Weir

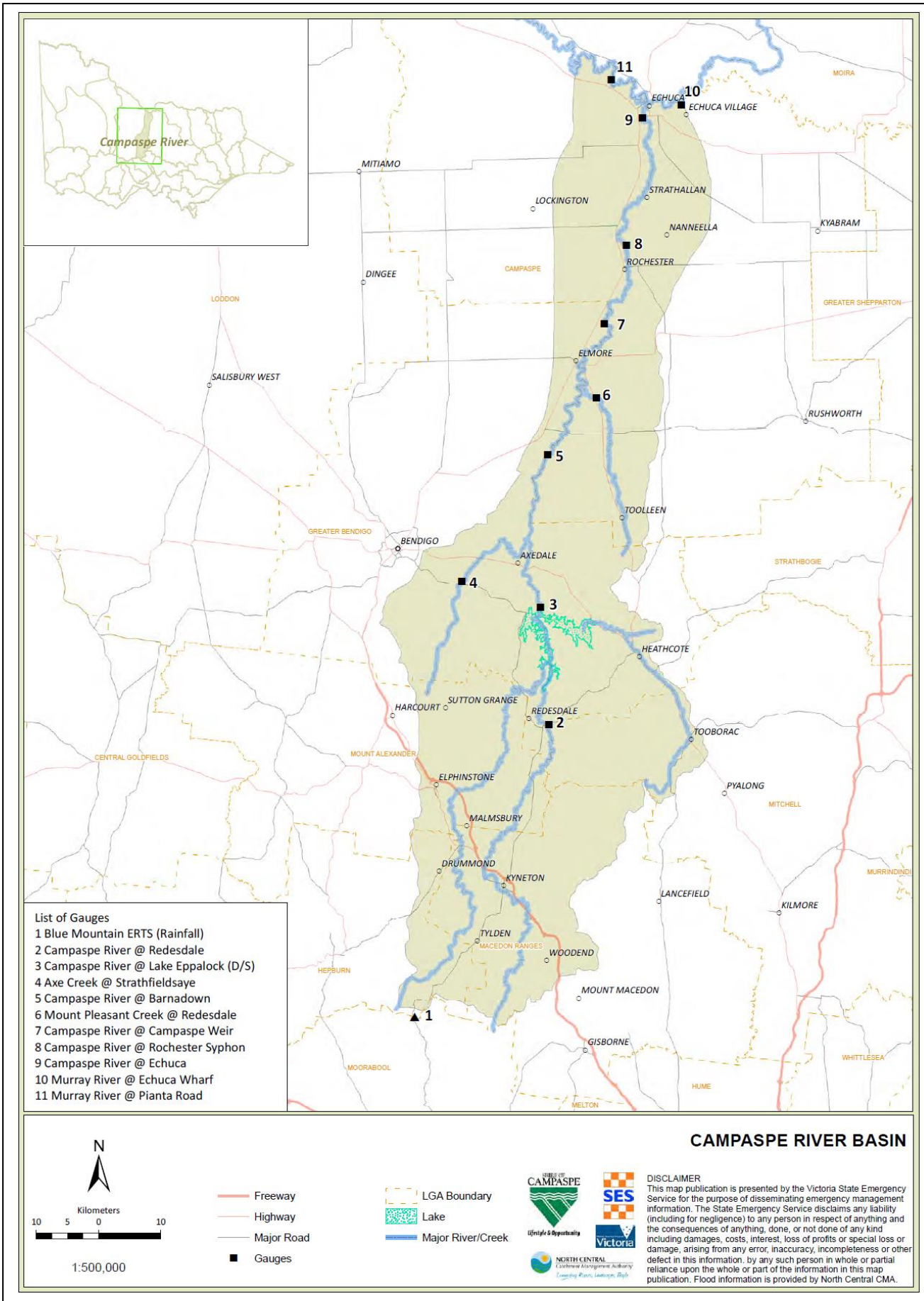
		DS			82,000 ML/d	98,000 ML/d	182,000 ML/d		
409202	Murray	Tocumwal		River	6.40	6.70	7.30	103.855	d/s Newell Hwy @ old bridge crossing
409215	Murray	Barmah		River	6.00	6.50	7.00	89.287	u/s Barmah Road
409200	Murray	Echuca Wharf (Vic) Moama (NSW)		Staff gauge	93.50 93.10	93.90 93.60	94.40 94.40	0.00	Located at Echuca Wharf
409222	Murray	Pianta Road		River	-	-	-	-	Pianta Road @ Riverlander Caravan Park
409207	Murray	Torrumbarry Weir DS		River	7.30 39,000 ML/d	7.50 48,300 ML/d	7.80 56,800 ML/d	78.545	d/s Torrumbarry Weir
409205	Murray	Barham		River	5.50	5.80	6.10	71.434	d/s Murray River bridge (NSW side)
409294	Murray	Swan Hill		River	4.50	4.60	4.70	62.921	Arnoldt Street, downsteam of Swan Hill

APPENDIX F – MAPS

1 Overview

Maps considered useful to flood response are included in this Appendix. They include:

- Campaspe River Basin
- Goulburn / Broken River Basin
- Loddon River Basin
- 1% AEP Flood Extent – Upper Campaspe
- 1% AEP Flood Extent – Lower Campaspe
- 1% AEP Flood Extent – Goulburn
- 93.5m AHD at Echuca Wharf (Minor Flood Level)
- 93.9m AHD at Echuca Wharf (Moderate Flood Level)
- 94.4m AHD at Echuca Wharf (Major Flood Level)
- 97.7m AHD at Echuca Wharf (1993 Flood Event)
- 95.6m AHD at Echuca Wharf (1% AEP Flood)
- 96.2m AHD at Echuca Wharf (1870 Flood Event)
- 1% AEP Flood Kyabram
- 20% AEP Flood Extent, Rochester
- 10% AEP Flood Extent, Rochester
- 5% AEP Flood Extent, Rochester
- 2% AEP Flood Extent, Rochester
- 1% AEP Flood Extent, Rochester
- 0.5% AEP Flood Extent, Rochester
- Flood Warning Zones, Rochester
- 1% AEP Flood, Strathallan
- 1% AEP Flood Extent, Torrumbarry


Campaspe River
11
10
9
8
7
6
5
4
3
2
1
ECHUCA
ECHUCA VILLAGE
MOIRA
MITIAMO
LOCKINGTON
STRATHALLAN
NANNEELLA
KYABRAM
ROCHESTER
CAMPASPE
DINGEE
LODDON
GREATER SHEPPARTON
ELMORE
SALISBURY WEST
RUSHWORTH
TOOLLEEN
GREATER BENDIGO
BENDIGO
AXEDALE
STRATHBOGIE
HEATHCOTE
HARCOURT
SUTTON GRANGE
REDESDALE
TOOBORAC
CENTRAL GOLDFIELDS
MOUNT ALEXANDER
ELPHINSTONE
PYALONG
MITCHELL
MALMSBURY
DRUMMOND
KYNETON
MURRINDINDI
LANCEFIELD
KILMORE
TYLDEN
MACEDON RANGES
WOODEND
HEPBURN
MOUNT MACEDON
GISBORNE
MOORABOOL
WHITTLESEA
HUME
MELTON
List of Gauges
1 Blue Mountain ERTS (Rainfall)
2 Campaspe River @ Redesdale
3 Campaspe River @ Lake Eppalock (D/S)
4 Axe Creek @ Strathfieldsaye
5 Campaspe River @ Barnadown
6 Mount Pleasant Creek @ Redesdale
7 Campaspe River @ Campaspe Weir
8 Campaspe River @ Rochester Syphon
9 Campaspe River @ Echuca
10 Murray River @ Echuca Wharf
11 Murray River @ Pianta Road
CAMPASPE RIVER BASIN
N
Kilometers
10 5 0 10
1:500,000
Freeway
Highway
Major Road
Gauges
LGA Boundary
Lake
Major River/Creek
SHIRE OF CAMPASPE
Lifestyle & Opportunity
SES
Victoria
NORTH CENTRAL Catchment Management Authority
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Broken River
Goulburn River
23
Tocumwal
7
10
9
8
Echuca
Echuca Village
5
Nathalia
Numurkah
MOIRA
Yarrawonga
6
Corowa
INDIGO
LODDON
CAMPASPE
4
GREATER SHEPPARTON
Wangaratta
Glenrowan
Benalla
BENALLA
WANGARATTA
Colbinabbin
Rushworth
Murchison
3
GREATER BENDIGO
Bendigo
Euroa
STRATHBOGIE
Nagambie
Avenel
Heathcote
Seymour
2
MOUNT ALEXANDER
MITCHELL
Mount Buller Alpine Village
MANSFIELD
Yea
Eildon
1
Kilmore
MURRINDINDI
Marysville
LAKE MOUNTAIN ALPINE RESORT (UNINC)
WELLINGTON
WHITTLESEA
Craigieburn
HUME
NILLUMBIK
YARRA RANGES
BAW BAW
BRIMBANK
MORELAND
DAREBIN
BANYULE
MANNINGHAM
List of Gauges
1 Goulburn River @ Lake Eildon D/S
2 Goulburn River @ Seymour
3 Goulburn River @ Murchison
4 Goulburn River @ Shepparton
5 Goulburn River @ McCoy Bridge
6 Murray River @ Yarrawonga
7 Murray River @ Tocumwal
8 Murray River @ Echuca Wharf
9 Murray River @ Pianta Road
10 Murray River @ Torrumbarry Weir
N
Kilometers
20 10 0 20
1:750,000
Freeway
Highway
Major Road
Gauges
LGA Boundary
Lake
Major River/Creek
GOULBURN/BROKEN RIVER BASIN
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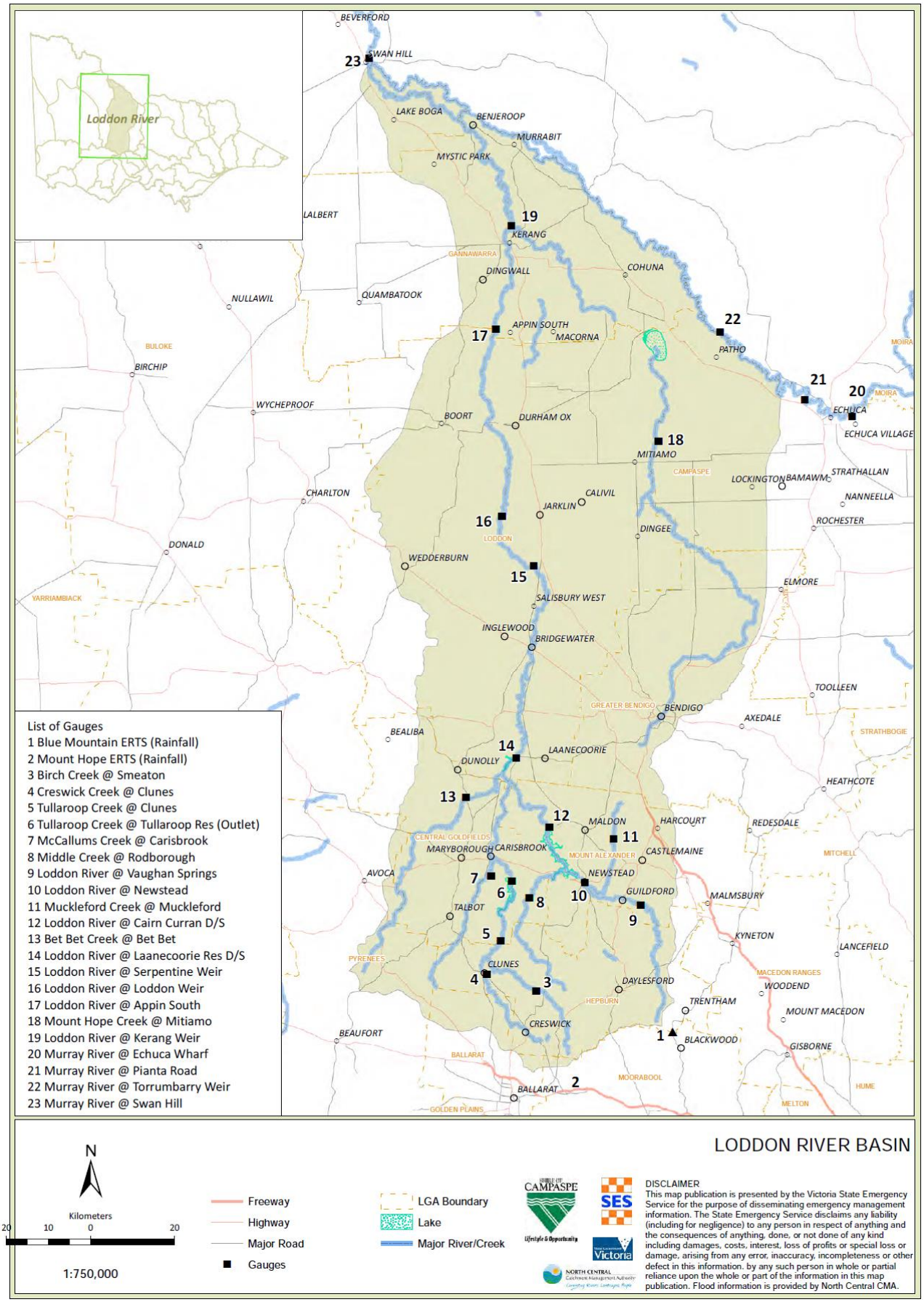
Loddon River
BEVERFORD
SWAN HILL
LAKE BOGA
BENJEROOP
MURRABIT
MYSTIC PARK
LALBERT
KERANG
GANNAWARRA
DINGWALL
COHUNA
NULLAWIL
QUAMBATOOK
APPIN SOUTH
MACORNA
PATHO
MOIRA
BULOKE
BIRCHIP
WYCHEPROOF
BOORT
DURHAM OX
ECHUCA
ECHUCA VILLAGE
MITIAMO
CAMPASPE
LOCKINGTON
BAMAWM
STRATHALLAN
NANNEELLA
CHARLTON
CALIVIL
JARKLIN
ROCHESTER
DINGEE
LODDON
DONALD
WEDDERBURN
ELMORE
YARRIAMBIACK
SALISBURY WEST
INGLEWOOD
BRIDGEWATER
TOOLLEEN
GREATER BENDIGO
BENDIGO
AXEDALE
STRATHBOGIE
BEALIBA
LAANECOORIE
DUNOLLY
HEATHCOTE
HARCOURT
REDESDALE
MALDON
CENTRAL GOLDFIELDS
MARYBOROUGH
CARISBROOK
MOUNT ALEXANDER
CASTLEMAINE
MITCHELL
AVOCA
NEWSTEAD
GUILDFORD
MALMSBURY
TALBOT
KYNETON
LANCEFIELD
PYRENEES
CLUNES
MACEDON RANGES
WOODEND
DAYLESFORD
HEPBURN
TRENTHAM
MOUNT MACEDON
CRESWICK
BEAUFORT
BLACKWOOD
GISBORNE
BALLARAT
MOORABOOL
HUME
MELTON
GOLDEN PLAINS
List of Gauges
1 Blue Mountain ERTS (Rainfall)
2 Mount Hope ERTS (Rainfall)
3 Birch Creek @ Smeaton
4 Creswick Creek @ Clunes
5 Tullaroop Creek @ Clunes
6 Tullaroop Creek @ Tullaroop Res (Outlet)
7 McCallums Creek @ Carisbrook
8 Middle Creek @ Rodborough
9 Loddon River @ Vaughan Springs
10 Loddon River @ Newstead
11 Muckleford Creek @ Muckleford
12 Loddon River @ Cairn Curran D/S
13 Bet Bet Creek @ Bet Bet
14 Loddon River @ Laanecoorie Res D/S
15 Loddon River @ Serpentine Weir
16 Loddon River @ Loddon Weir
17 Loddon River @ Appin South
18 Mount Hope Creek @ Mitiamo
19 Loddon River @ Kerang Weir
20 Murray River @ Echuca Wharf
21 Murray River @ Pianta Road
22 Murray River @ Torrumbarry Weir
23 Murray River @ Swan Hill
N
Kilometers
20 10 0 20
1:750,000
Freeway
Highway
Major Road
Gauges
LGA Boundary
Lake
Major River/Creek
LODDON RIVER BASIN
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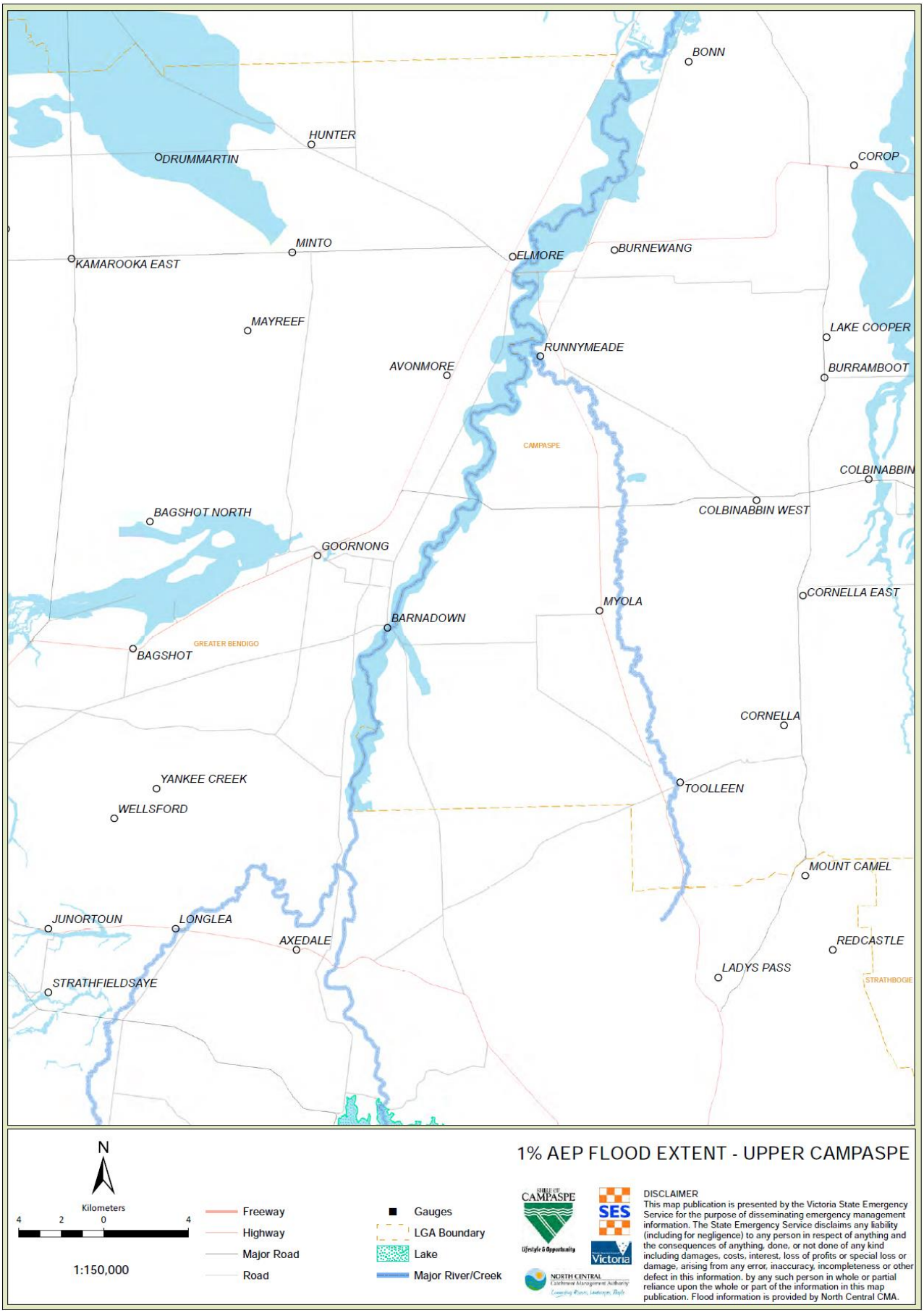
BONN
HUNTER
DRUMMARTIN
COROP
MINTO
KAMAROOKA EAST
ELMORE
BURNEWANG
MAYREEF
LAKE COOPER
RUNNYMEADE
AVONMORE
BURRAMBOOT
CAMPASPE
COLBINABBIN
BAGSHOT NORTH
COLBINABBIN WEST
GOORNONG
CORNELLA EAST
MYOLA
BARNADOWN
GREATER BENDIGO
BAGSHOT
CORNELLA
YANKEE CREEK
TOOLLEEN
WELLSFORD
MOUNT CAMEL
JUNORTOUN
LONGLEA
AXEDALE
REDCASTLE
LADYS PASS
STRATHFIELDSAYE
STRATHBOGIE
N
Kilometers
4 2 0 4
1:150,000
Freeway
Highway
Major Road
Road
Gauges
LGA Boundary
Lake
Major River/Creek
1% AEP FLOOD EXTENT - UPPER CAMPASPE
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TORRUMBARRY
WHARPARILLA NORTH
MOIRA
KANYAPELLA
ROSLYNMEAD
WHARPARILLA
KOTTA
BAMAWM EXTENSION
KANYAPELLA SOUTH
KOYUGA
BAMAWM
CAMPASPE
LOCKINGTON
MCCOLL
FAIRY DELL
DIGGORA
TIMMERING
BONN
HUNTER
GREATER BENDIGO
COROP
BURNEWANG
N
Kilometers
4 2 0 4
1:150,000
Freeway
Highway
Major Road
Road
Gauges
LGA Boundary
Lake
Major River/Creek
1% AEP FLOOD EXTENT - LOWER CAMPASPE
SHIRE OF CAMPASPE
Lifestyle & Opportunity
SES
Victoria
NORTH CENTRAL
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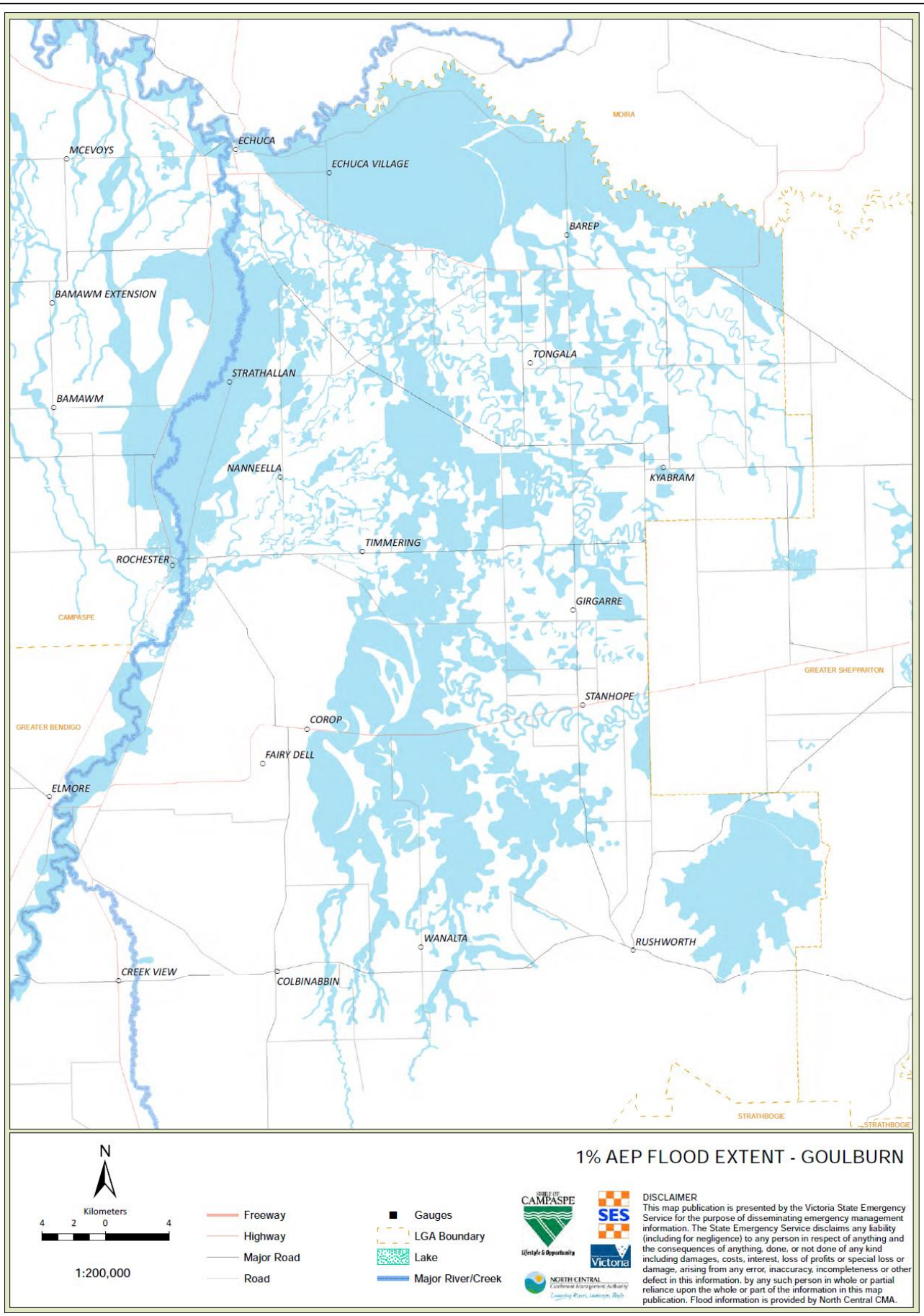
MOIRA
MCEVOYS
ECHUCA
ECHUCA VILLAGE
BAREP
BAMAWM EXTENSION
TONGALA
STRATHALLAN
BAMAWM
NANNEELLA
KYABRAM
TIMMERING
ROCHESTER
GIRGARRE
CAMPASPE
GREATER SHEPPARTON
STANHOPE
COROP
GREATER BENDIGO
FAIRY DELL
ELMORE
WANALTA
RUSHWORTH
CREEK VIEW
COLBINABBIN
STRATHBOGIE
STRATHBOGIE
N
Kilometers
4 2 0 4
1:200,000
Freeway
Highway
Major Road
Road
Gauges
LGA Boundary
Lake
Major River/Creek
1% AEP FLOOD EXTENT - GOULBURN
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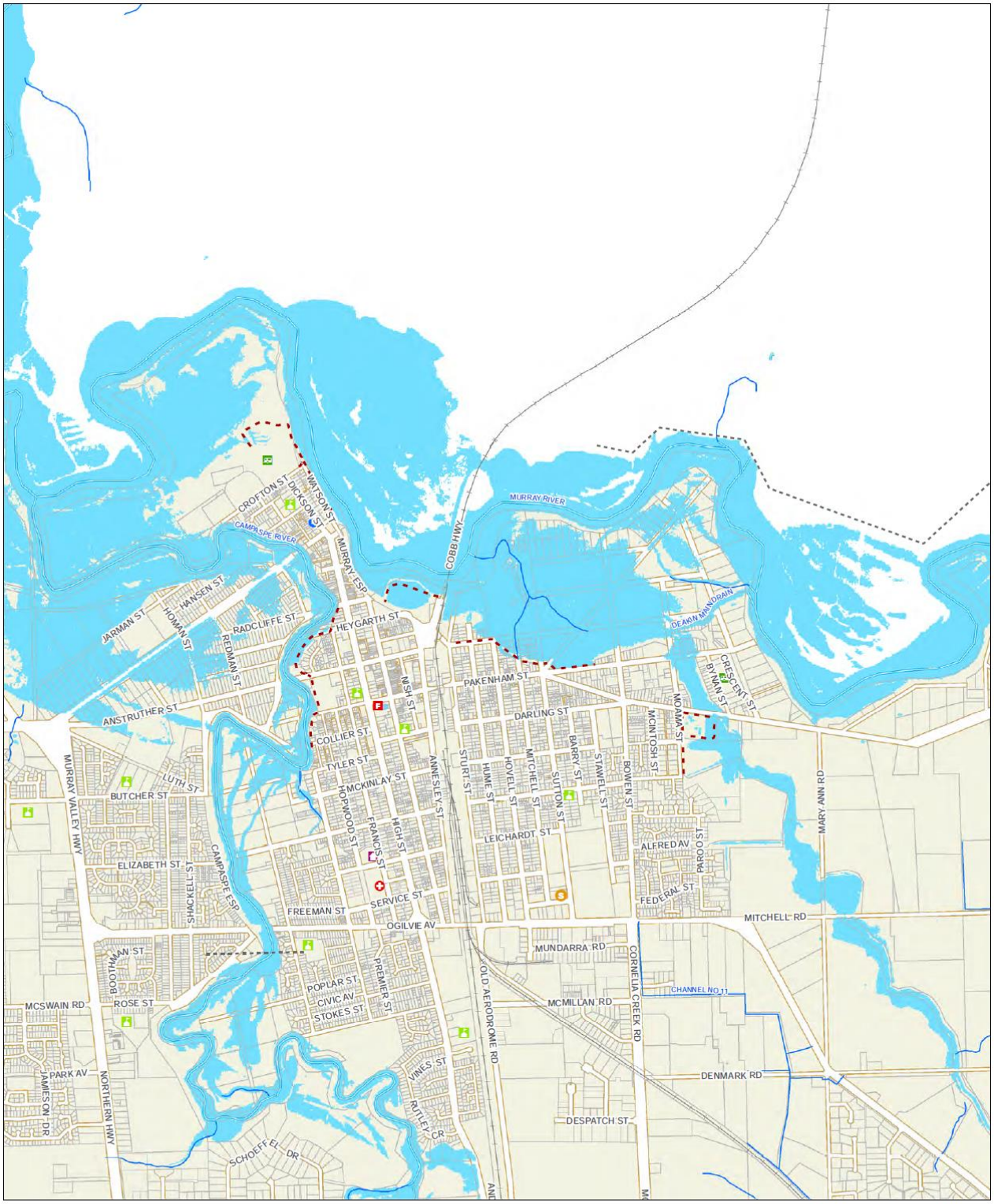
CAMPASPE SHIRE COUNCIL ECHUCA



N

Scale at A4

0 0.1 0.2 0.4 0.6 0.8 Kilometers

1:20,000

- Fire Station
- Hospital
- Police Station
- Nursing Home
- School
- Church
- Camp Ground
- Depot
- SES Unit
- River Gauge
- Rail Trail
- Road
- river/creek
- creek/stream
- Extent of Flood Data
- Levee
- Cadastre

93.5m AHD at Echuca Wharf
(Minor Flood Level)

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Map Produced: 30 Jul 2014

CAMPASPE SHIRE COUNCIL ECHUCA

N

Scale at A4

0 0.1 0.2 0.4 0.6 0.8 Kilometers

1:20,000

- Fire Station
- Hospital
- Police Station
- Nursing Home
- School
- Church
- Camp Ground
- Depot
- SES Unit
- River Gauge
- Rail Trail
- Road
- river/creek
- creek/stream
- Extent of Flood Data
- Levee
- Cadastre

93.9m AHD at Echuca Wharf
(Moderate Flood Level)

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Map Produced: 30 Jul 2014

CAMPASPE SHIRE COUNCIL ECHUCA

N

Scale at A4

0 0.1 0.2 0.4 0.6 0.8 Kilometers

1:20,000

- Fire Station
- Hospital
- Police Station
- Nursing Home
- School
- Church
- Camp Ground
- Depot
- SES Unit
- River Gauge
- Rail Trail
- Road
- river/creek
- creek/stream
- Extent of Flood Data
- Levee
- Cadastre

94.4m AHD at Echuca Wharf
(Major Flood Level)

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Map Produced: 30 Jul 2014

CAMPASPE SHIRE COUNCIL ECHUCA

N

Scale at A4

0 0.1 0.2 0.4 0.6 0.8 Kilometers

1:20,000

- Fire Station
- Hospital
- Police Station
- Nursing Home
- School
- Church
- Camp Ground
- Depot
- SES Unit
- River Gauge
- Rail Trail
- Road
- river/creek
- creek/stream
- Extent of Flood Data
- Levee
- Cadastre

94.77m AHD at Echuca Wharf
(1993 Flood Event)

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Map Produced: 30 Jul 2014

CAMPASPE SHIRE COUNCIL ECHUCA

N

Scale at A4

0 0.1 0.2 0.4 0.6 0.8 Kilometers

1:20,000

- Fire Station
- Hospital
- Police Station
- Nursing Home
- School
- Church
- Camp Ground
- Depot
- SES Unit
- River Gauge
- Rail Trail
- Road
- river/creek
- creek/stream
- Extent of Flood Data
- Levee
- Cadastre

95.6m AHD at Echuca Wharf
(1% AEP Flood)

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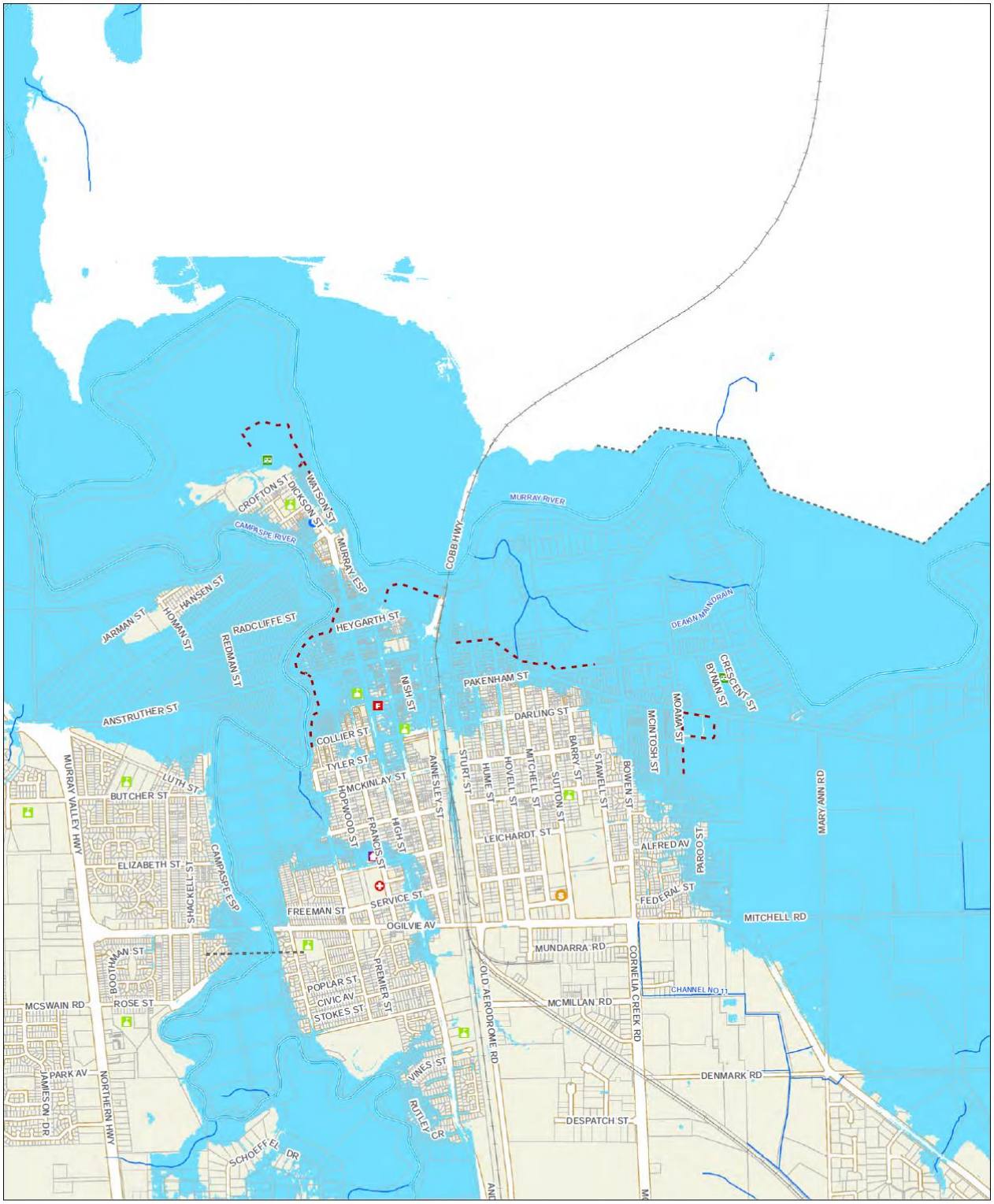
Map Produced: 30 Jul 2014

CAMPASPE SHIRE COUNCIL ECHUCA



N

Scale at A4

0 0.1 0.2 0.4 0.6 0.8 Kilometers

1:20,000

- Fire Station
- Hospital
- Police Station
- Nursing Home
- School
- Church
- Camp Ground
- Depot
- SES Unit
- River Gauge
- Rail Trail
- Road
- river/creek
- creek/stream
- Extent of Flood Data
- Levee
- Cadastre

96.2m AHD at Echuca Wharf
(1870 Flood Event)

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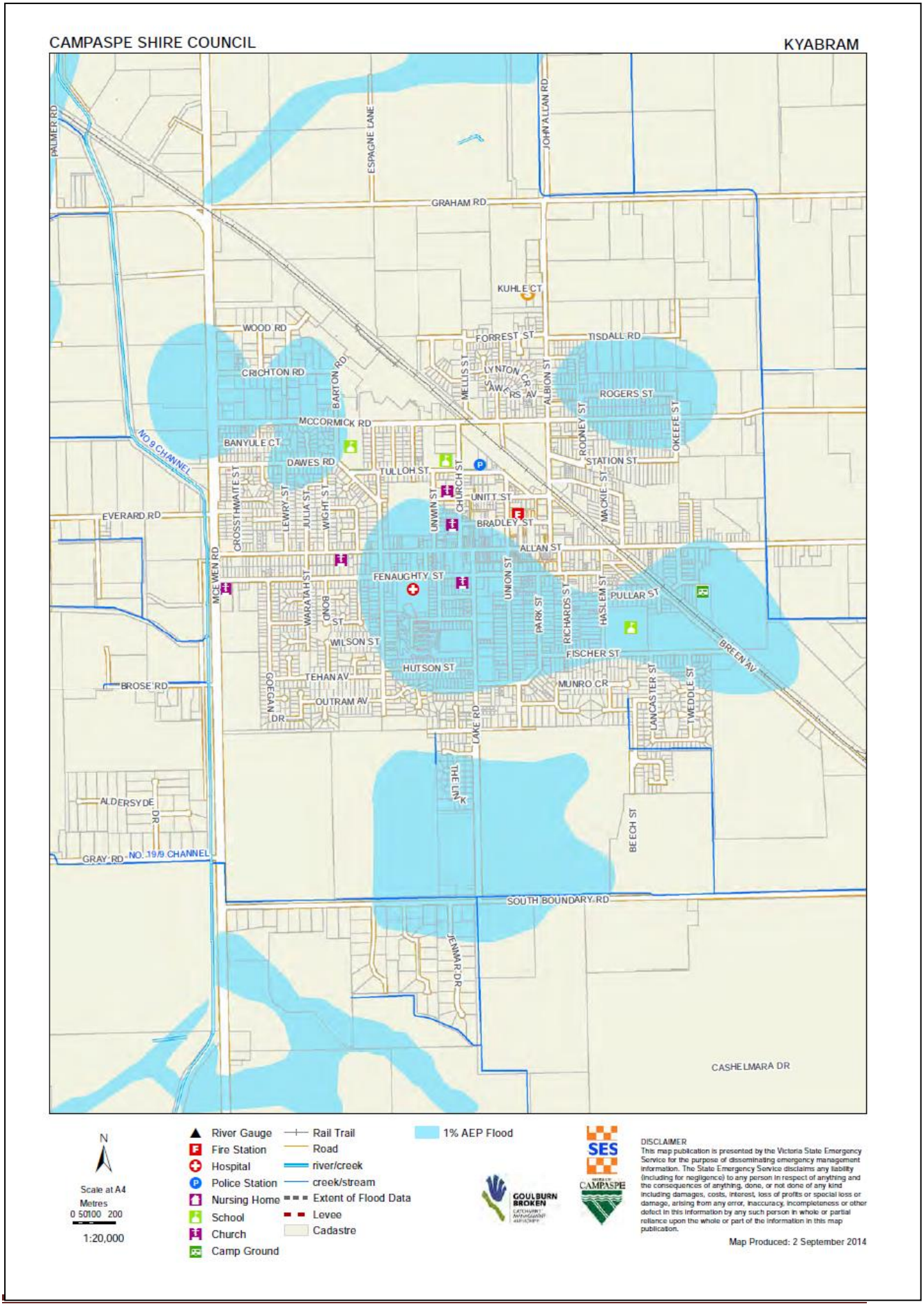
Map Produced: 30 Jul 2014


CAMPASPE SHIRE COUNCIL
KYABRAM
PALMER RD
ESPAGNE LANE
JOHN ALLAN RD
GRAHAM RD
KUHLE CT
WOOD RD
FORREST ST
TISDALL RD
CRICHTON RD
BARTON RD
MELLIS ST
LYNTON CR
LAWSON AV
ALBION ST
ROGERS ST
MCCORMICK RD
NO 9 CHANNEL
BANYULE CT
DAWES RD
TULLOH ST
RODNEY ST
OKEEFE ST
STATION ST
CHURCH ST
UNITT ST
MACKIE ST
CROSSTHWAITE ST
LEWRY ST
JULIA ST
WIGHT ST
UNWIN ST
BRADLEY ST
EVERARD RD
ALLAN ST
MCEWEN RD
FENAUGHTY ST
UNION ST
PULLAR ST
WARATAH ST
BOND ST
PARK ST
RICHARDS ST
HASLEM ST
WILSON ST
FISCHER ST
BREEN AV
HUTSON ST
BROSE RD
TEHAN AV
MUNRO CR
GOEGAN DR
OUTRAM AV
LANCASTER ST
TWEDDLE ST
LAKE RD
THE LINK
ALDERSYDE DR
BEECH ST
GRAY RD
NO 19/9 CHANNEL
SOUTH BOUNDARY RD
JENNAR DR
CASHELMARA DR
N
Scale at A4
Metres
0 50100 200
1:20,000
River Gauge
Fire Station
Hospital
Police Station
Nursing Home
School
Church
Camp Ground
Rail Trail
Road
river/creek
creek/stream
Extent of Flood Data
Levee
Cadastre
1% AEP Flood
GOULBURN BROKEN
SES
CAMPASPE
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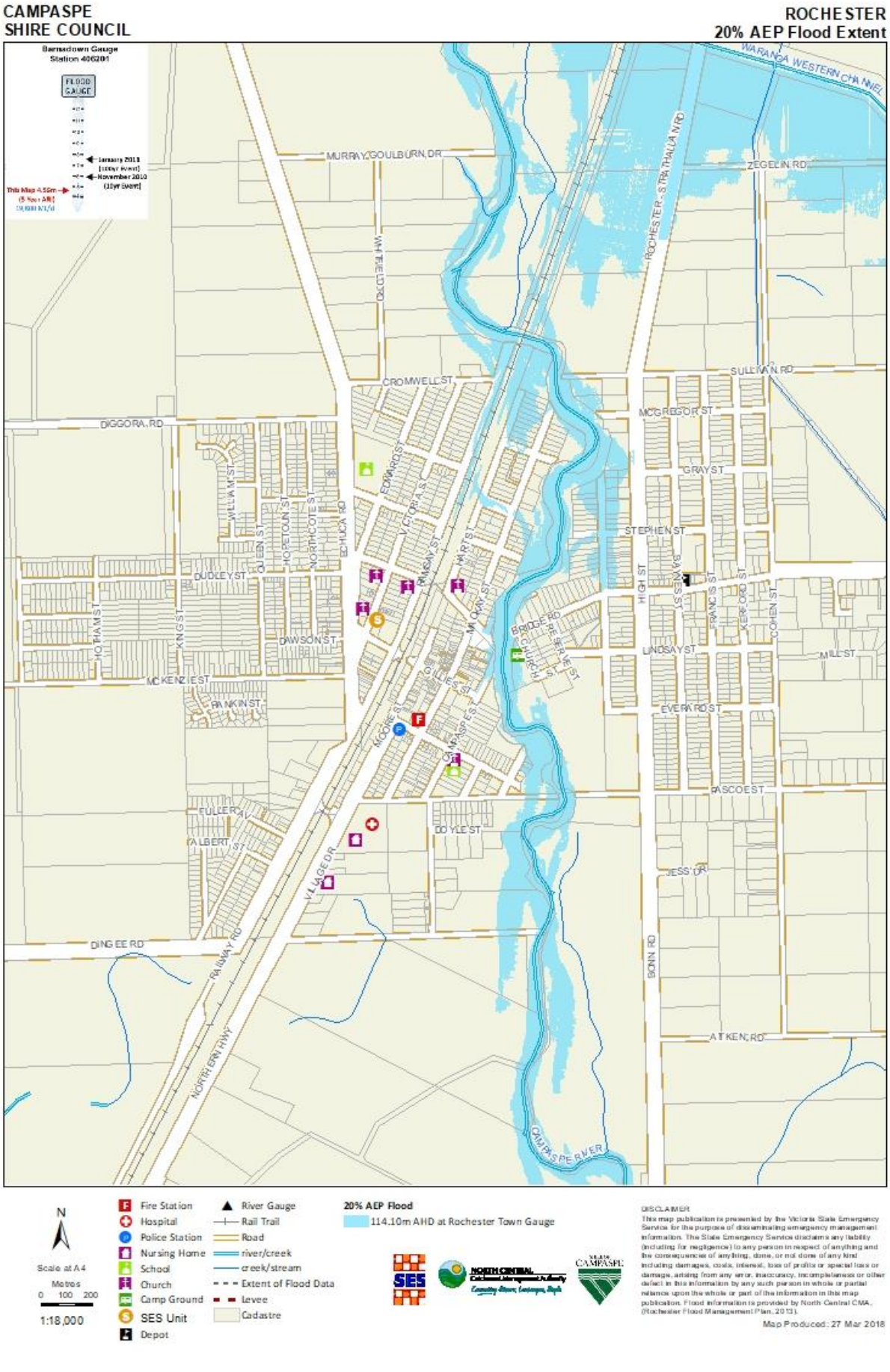
Map Produced: 2 September 2014


CAMPASPE
SHIRE COUNCIL
ROCHESTER
20% AEP Flood Extent
Barnadown Gauge
Station 406201
FLOOD GAUGE
January 2011
November 2010
WARANGA WESTERN CHANNEL
MURRAY GOULBURN DR
ZEGELIN RD
ROCHESTER - STRATHALLAN RD
OLD TOOLLEEN HWY
CROMWELL ST
SULLIVAN RD
DIGGORA RD
MCGREGOR ST
GRAY ST
STEPHEN ST
EDWARD ST
VICTORIA ST
PARK ST
MURRAY ST
ECHUCA RD
WILLIAM ST
QUEEN ST
HORTON ST
NORTHCOTE ST
DUDLEY ST
HOTHAM ST
KING ST
DAWSON ST
MCKENZIE ST
PANKIN ST
MOORE ST
MASS ST
BRIDGE RD
CHURCH ST
HIGH ST
ST JAMES
FRANCIS ST
KERFORD ST
COHEN ST
LINDSAY ST
MILL ST
EVERARD ST
PASCOE ST
FULLER AV
ALBERT ST
DOYLE ST
VILLAGE DR
JESS DR
DINGEE RD
RAILWAY RD
NORTHERN HWY
BONN RD
ATKEN RD
CAMPASPE RIVER
N
Scale at A4
Metres
0 100 200
1:18,000
Fire Station
Hospital
Police Station
Nursing Home
School
Church
Camp Ground
SES Unit
Depot
River Gauge
Rail Trail
Road
river/creek
creek/stream
Extent of Flood Data
Levee
Cadastre
20% AEP Flood
114.10m AHD at Rochester Town Gauge
SES
NORTH CENTRAL
SHIRE OF CAMPASPE
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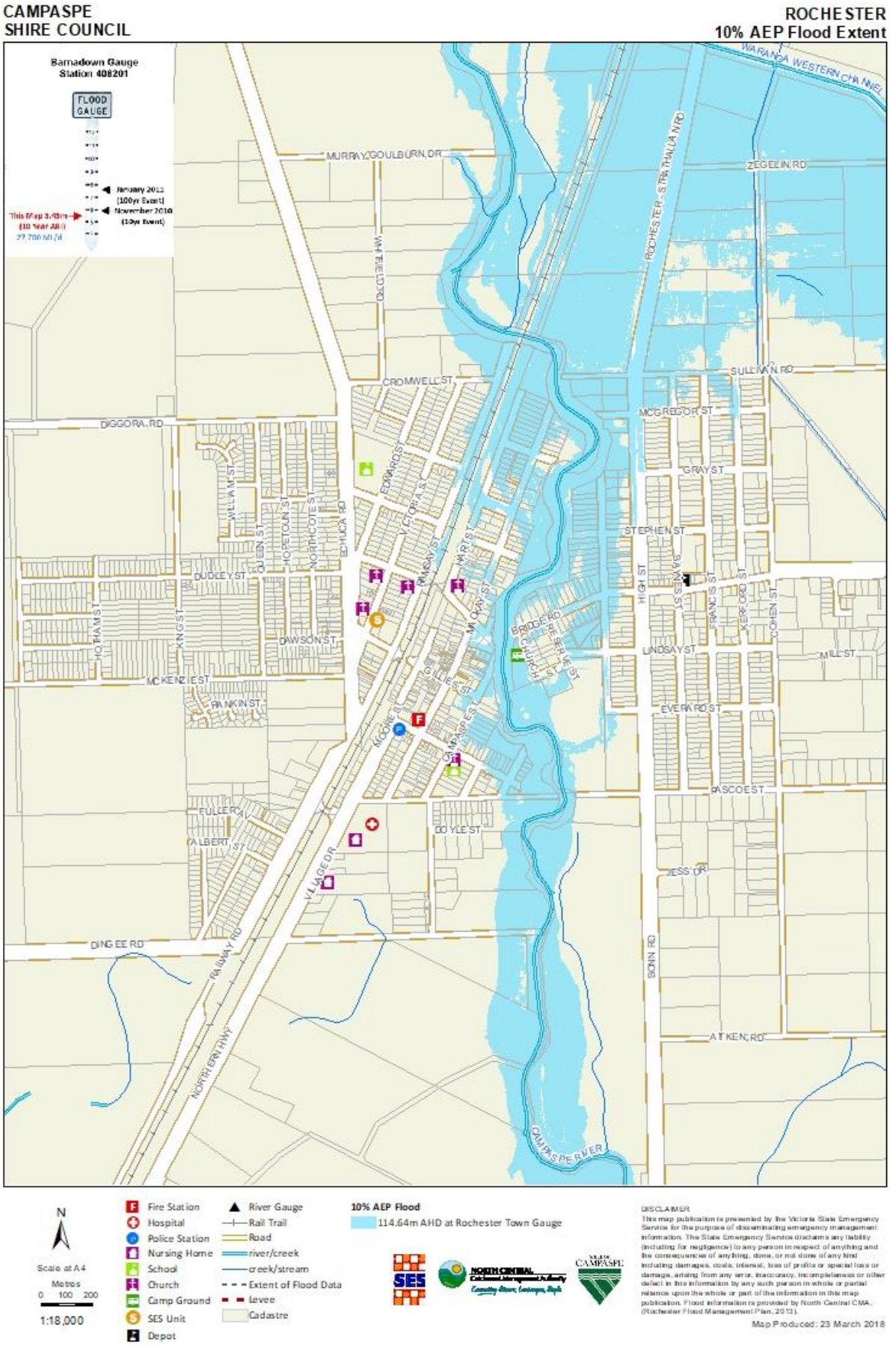
Map Produced: 27 Mar 2018


CAMPASPE
SHIRE COUNCIL
ROCHESTER
10% AEP Flood Extent
Barnadown Gauge
Station 408201
FLOOD GAUGE
January 2011
(100yr Event)
November 2010
(10yr Event)
This Map 3.43m
(10 Year ARI)
27,700 Ml/d
WARANGA WESTERN CHANNEL
MURRAY GOULBURN DR
ZEGELIN RD
ROCHESTER - STRATHALLAN RD
CROMWELL ST
SULLIVAN RD
DIGGORA RD
MCGREGOR ST
GRAY ST
STEPHEN ST
HIGH ST
DUDLEY ST
DAWSON ST
MCKENZIE ST
LINDSAY ST
MILL ST
EVERARD ST
PASCOE ST
FULLER AV
ALBERT ST
DOYLE ST
JESS DR
DINGEE RD
BONN RD
AITKEN RD
NORTHERN HWY
CAMPASPE RIVER
Fire Station
Hospital
Police Station
Nursing Home
School
Church
Camp Ground
SES Unit
Depot
River Gauge
Rail Trail
Road
river/creek
creek/stream
Extent of Flood Data
Levee
Cadastre
10% AEP Flood
114.64m AHD at Rochester Town Gauge
N
Scale at A4
Metres
0 100 200
1:18,000
SES
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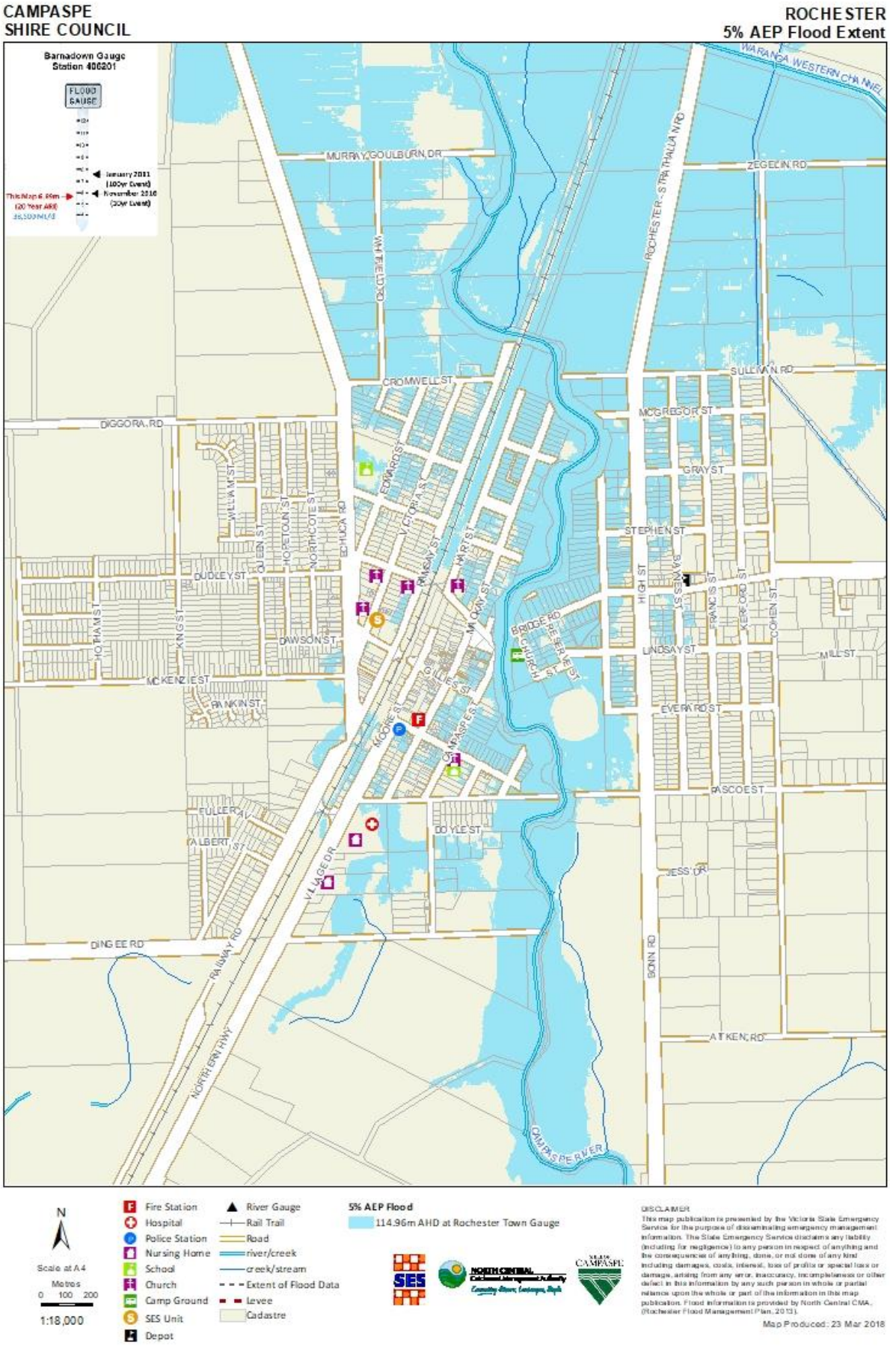
Map Produced: 23 March 2018


CAMPASPE
SHIRE COUNCIL
ROCHESTER
5% AEP Flood Extent
Barnadown Gauge
Station 406201
FLOOD GAUGE
January 2011
(100yr Event)
November 2010
(20yr Event)
This Map is 95m
(20 Year ARI)
WARANGA WESTERN CHANNEL
MURRAY GOULBURN DR
ZEGELIN RD
ROCHESTER - STRATHALLAN RD
CROMWELL ST
SULLIVAN RD
MCGREGOR ST
DIGGORA RD
GRAY ST
STEPHEN ST
DUDLEY ST
DAWSON ST
MCKENZIE ST
PASCOE ST
FULLER AV
ALBERT ST
DOYLE ST
JESS DR
DINGEE RD
ATKEN RD
CAMPASPE RIVER
NORTHERN HWY
RAILWAY RD
BONN RD
HIGH ST
MILL ST
LINDSAY ST
EVERARD ST
N
Scale at A4
Metres
0 100 200
1:18,000
Fire Station
Hospital
Police Station
Nursing Home
School
Church
Camp Ground
SES Unit
Depot
River Gauge
Rail Trail
Road
river/creek
creek/stream
Extent of Flood Data
Levee
Cadastre
5% AEP Flood
114.96m AHD at Rochester Town Gauge
SES
NORTH CENTRAL
SHIRE OF CAMPASPE
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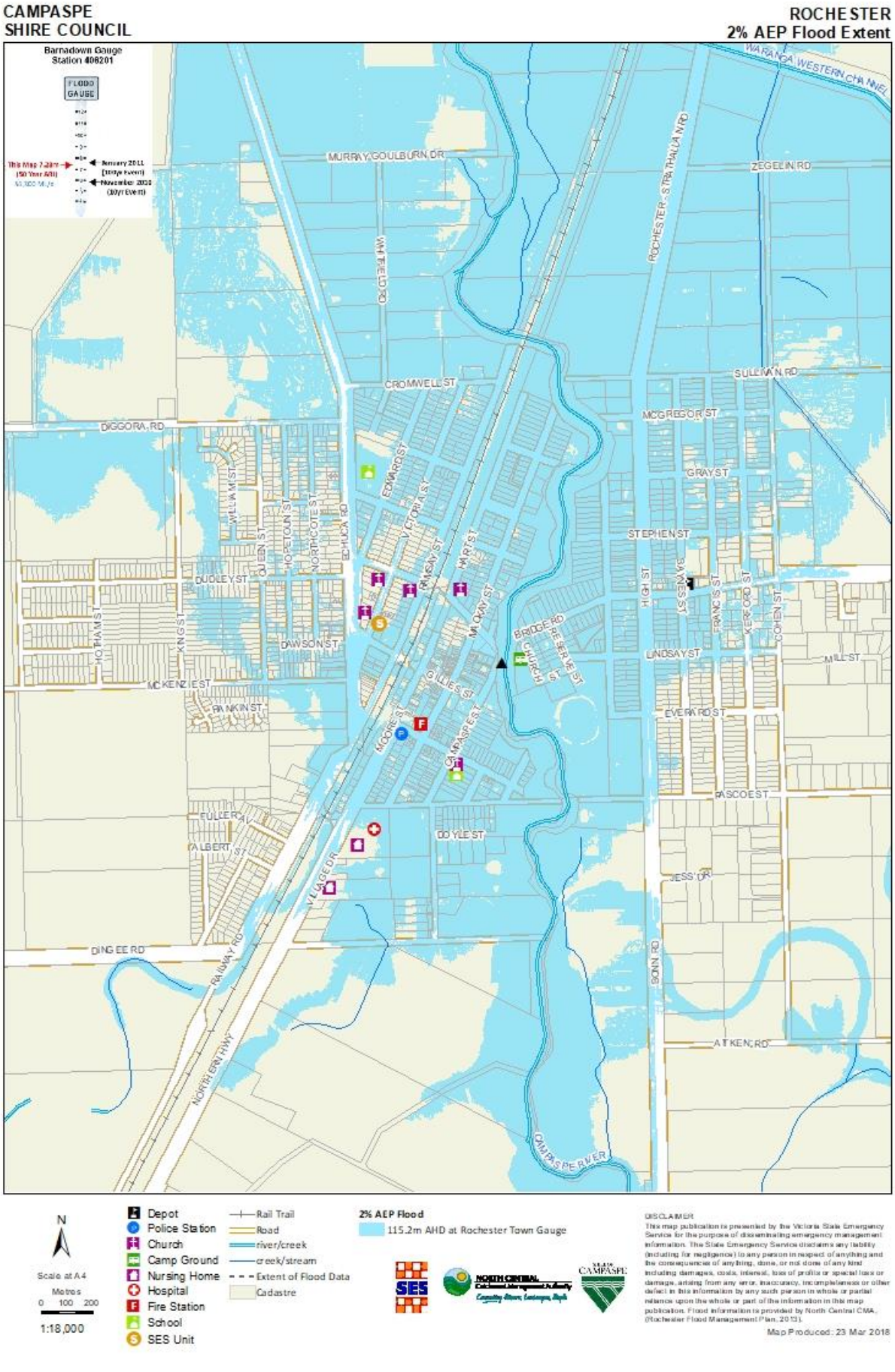
Map Produced: 23 Mar 2018


CAMPASPE
SHIRE COUNCIL
ROCHESTER
2% AEP Flood Extent
Barnadown Gauge
Station 406201
FLOOD GAUGE
This Map 7.23m (50 Year ARI)
January 2011 (100yr Event)
November 2010 (20yr Event)
WARANGA WESTERN CHANNEL
MURRAY GOULBURN DR
ZEGELIN RD
ROCHESTER - STRATHALLAN RD
OLD TOOLLEEN RD
CROMWELL ST
SULLIVAN RD
DIGGORA RD
MCGREGOR ST
GRAY ST
WILLIAM ST
QUEEN ST
HOPETOUN ST
NORTHCOTE ST
EDUCA RD
EDWARD ST
VICTORIA ST
PIMLEY ST
HART ST
STEPHEN ST
HIGH ST
FRANCIS ST
KERFORD ST
COHEN ST
DUDLEY ST
HOTHAM ST
KING ST
DAWSON ST
MURRAY ST
BRIDGE RESERVE ST
CHURCH ST
LINDSAY ST
MILL ST
MCKENZIE ST
PANKIN ST
GILLIES ST
MOORE ST
ST MAS P EST
EVERARD ST
PASCOE ST
FULLER AV
ALBERT ST
DOYLE ST
VILLAGE DR
JESS DR
DINGEE RD
RAILWAY RD
BONN RD
NORTH EIN HWY
AITKEN RD
CAMPASPE RIVER
N
Scale at A4
Metres
0 100 200
1:18,000
Depot
Police Station
Church
Camp Ground
Nursing Home
Hospital
Fire Station
School
SES Unit
Rail Trail
Road
river/creek
creek/stream
Extent of Flood Data
Cadastre
2% AEP Flood
115.2m AHD at Rochester Town Gauge
SES
NORTH CENTRAL
SHIRE OF CAMPASPE
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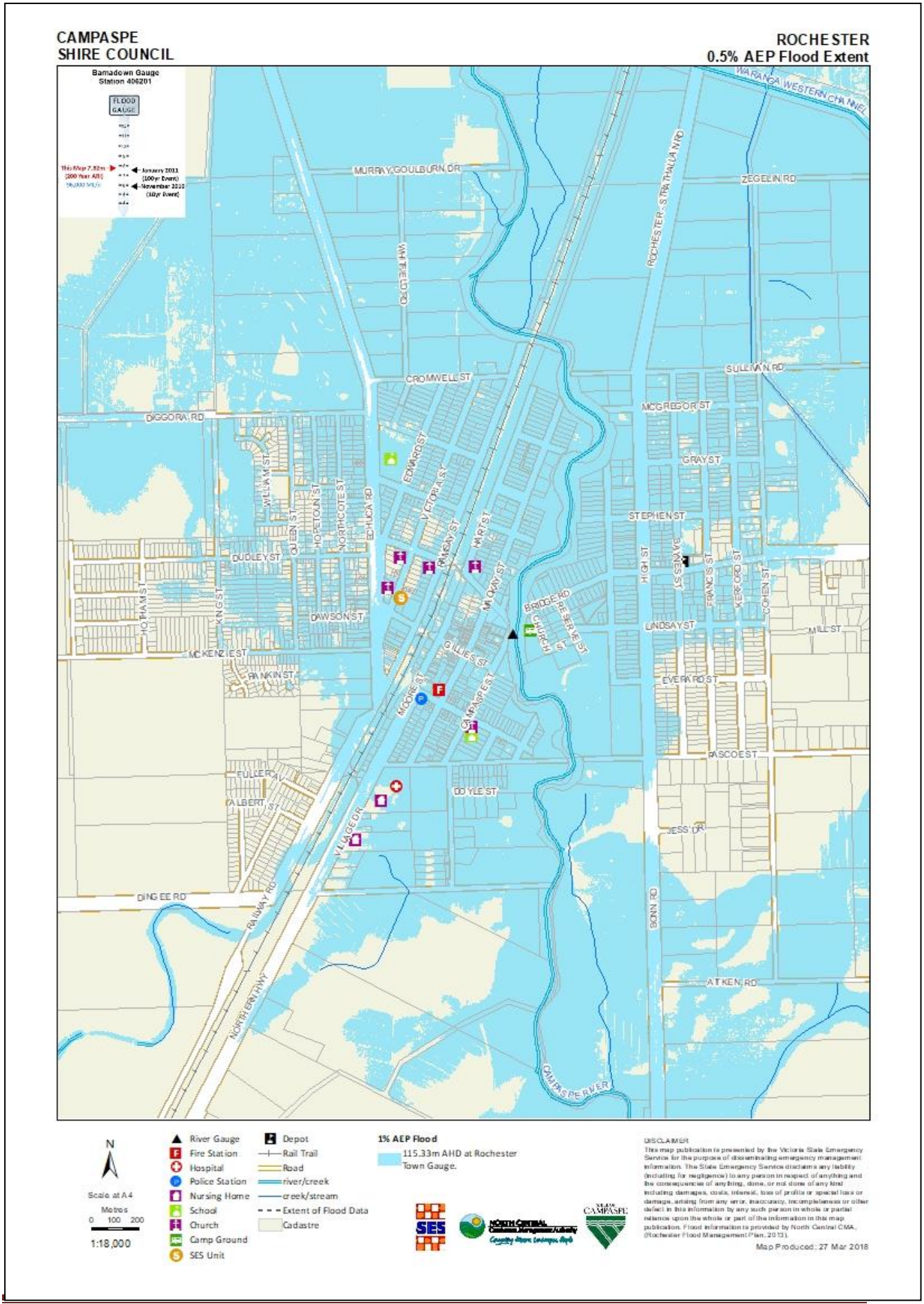
Map Produced: 23 Mar 2018


CAMPASPE
SHIRE COUNCIL
ROCHESTER
0.5% AEP Flood Extent
Bamadown Gauge
Station 406201
FLOOD GAUGE
This Map 7.82m (200 Year ARI)
January 2011 (100yr Event)
November 2010 (10yr Event)
WARANGA WESTERN CHANNEL
MURRAY GOULBURN DR
ZEGELIN RD
ROCHESTER - STRATHALLAN RD
CROMWELL ST
SULLIVAN RD
DIGGORA RD
MCGREGOR ST
GRAY ST
STEPHEN ST
DUDLEY ST
DAWSON ST
MCKENZIE ST
FULLER AV
ALBERT ST
DOYLE ST
DINGEE RD
RAILWAY RD
NORTH EAST HWY
JESS DR
BONN RD
ATKEN RD
CAMPASPE RIVER
EVERARD ST
LINDSAY ST
MILL ST
PASCOE ST
WILLIAM ST
QUEEN ST
HOPETOUN ST
NORTHCOTE ST
ECHUCA RD
EDWARD ST
VICTORIA ST
PINEAY ST
HART ST
MURRAY ST
GILLIES ST
MOORE ST
CAMPASPE ST
CHURCH ST
BRIDGE RESERVE ST
HIGH ST
ANNESS ST
FRANCIS ST
KERFORD ST
COHEN ST
HOTHAM ST
KING ST
PANKIN ST
VILLAGE DR
N
Scale at A4
Metres
0 100 200
1:18,000
River Gauge
Fire Station
Hospital
Police Station
Nursing Home
School
Church
Camp Ground
SES Unit
Depot
Rail Trail
Road
river/creek
creek/stream
Extent of Flood Data
Cadastre
1% AEP Flood
115.33m AHD at Rochester Town Gauge.
SES
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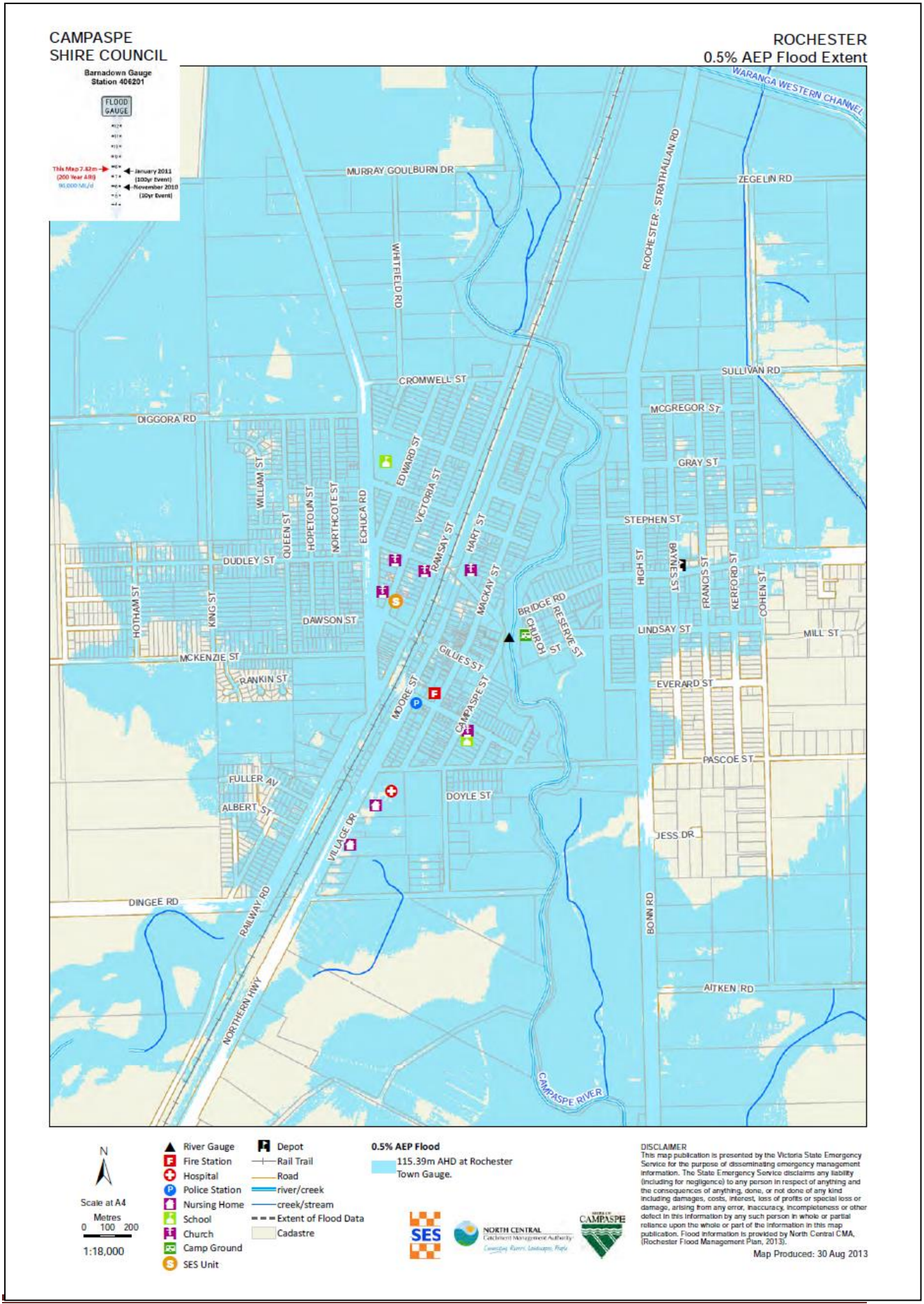
Map Produced: 27 Mar 2018


CAMPASPE
SHIRE COUNCIL
ROCHESTER
0.5% AEP Flood Extent
Barnadown Gauge
Station 406201
FLOOD GAUGE
This Map 7.82m (200 Year ARI)
January 2011 (100yr Event)
November 2010 (30yr Event)
WARANGA WESTERN CHANNEL
MURRAY GOULBURN DR
ZEGELIN RD
ROCHESTER - STRATHALLAN RD
WHITFIELD RD
SULLIVAN RD
CROMWELL ST
MCGREGOR ST
DIGGORA RD
GRAY ST
EDWARD ST
VICTORIA ST
WILLIAM ST
QUEEN ST
HOPETOUN ST
NORTHCOTE ST
ECHUCA RD
RAMSAY ST
HART ST
STEPHEN ST
DUDLEY ST
MACKAY ST
HIGH ST
BAYNES ST
FRANCIS ST
KERFORD ST
COHEN ST
HOTHAM ST
KING ST
DAWSON ST
BRIDGE RD
RESERVE ST
CHURCH ST
LINDSAY ST
MILL ST
MCKENZIE ST
GILLIES ST
RANKIN ST
MOORE ST
CAMPASPE ST
EVERARD ST
PASCOE ST
FULLER AV
ALBERT ST
DOYLE ST
VILLAGE DR
JESS DR
DINGEE RD
RAILWAY RD
BONN RD
NORTHERN HWY
AITKEN RD
CAMPASPE RIVER
N
Scale at A4
Metres
0 100 200
1:18,000
River Gauge
Fire Station
Hospital
Police Station
Nursing Home
School
Church
Camp Ground
SES Unit
Depot
Rail Trail
Road
river/creek
creek/stream
Extent of Flood Data
Cadastre
0.5% AEP Flood
115.39m AHD at Rochester Town Gauge.
SES
NORTH CENTRAL Catchment Management Authority
CAMPASPE
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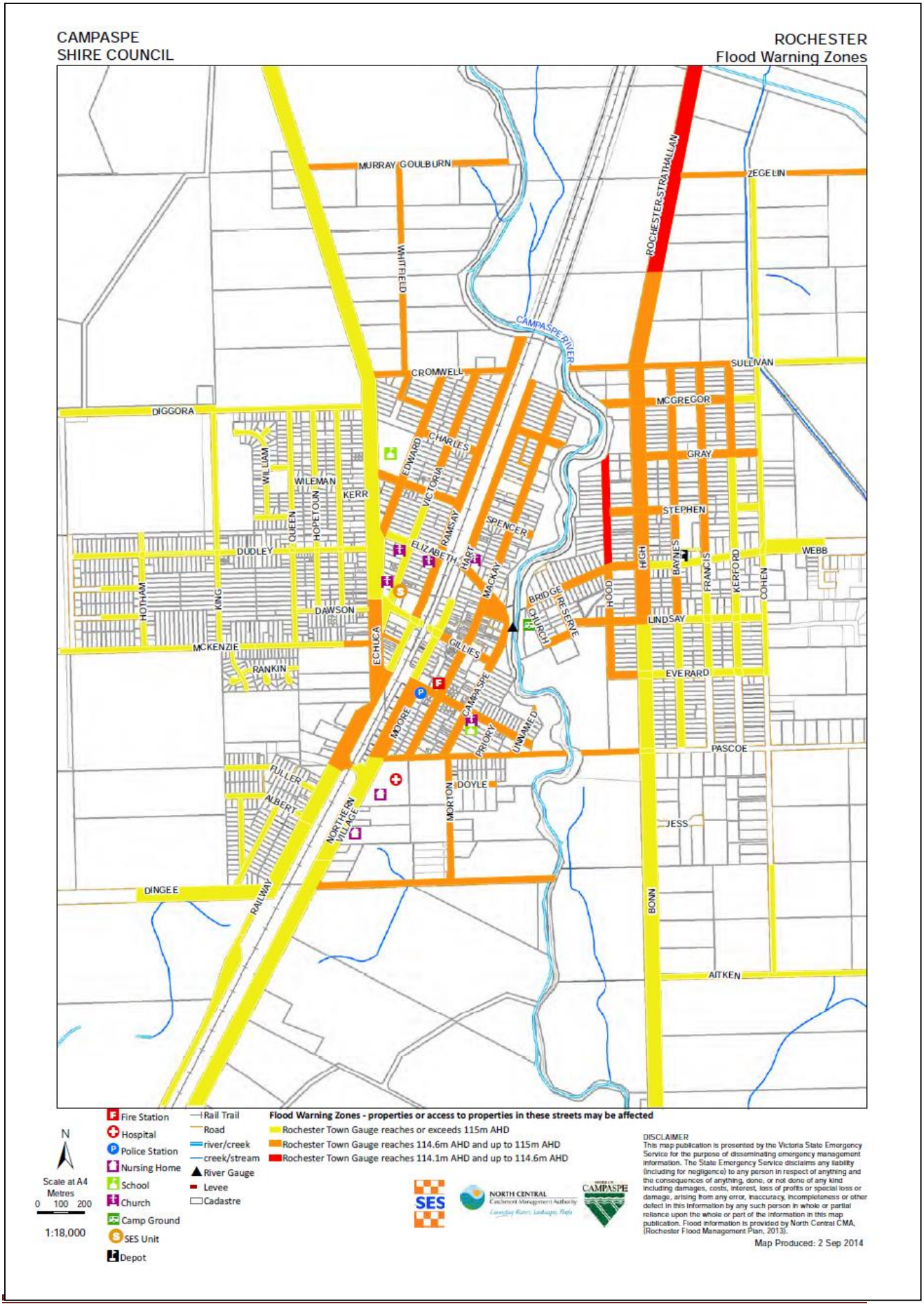
Map Produced: 30 Aug 2013


CAMPASPE
SHIRE COUNCIL
ROCHESTER
Flood Warning Zones
MURRAY GOULBURN
WHITFIELD
ROCHESTER-STRATHALLAN
ZEGELIN
CAMPASPE RIVER
CROMWELL
SULLIVAN
MCGREGOR
DIGGORA
GRAY
STEPHEN
WILLIAM
WILEMAN
KERR
EDWARD
CHARLES
VICTORIA
RAMSAY
SPENCER
QUEEN
HOPETOUN
DUDLEY
ELIZABETH
HART
MACKAY
HIGH
BAYNES
FRANCIS
KERFORD
COHEN
WEBB
HOTHAM
KING
DAWSON
BRIDGE
CHURCH
RESERVE
HOOD
LINDSAY
MCKENZIE
GILLIES
ECHUCA
RANKIN
EVERARD
CAMPASPE
MOORE
PRIORY
UNNAMED
PASCOE
FULLER
ALBERT
DOYLE
MORTON
NORTHERN VILLAGE
JESS
DINGEE
RAILWAY
BONN
AITKEN
Fire Station
Hospital
Police Station
Nursing Home
School
Church
Camp Ground
SES Unit
Depot
Rail Trail
Road
river/creek
creek/stream
River Gauge
Levee
Cadastre
Flood Warning Zones - properties or access to properties in these streets may be affected
Rochester Town Gauge reaches or exceeds 115m AHD
Rochester Town Gauge reaches 114.6m AHD and up to 115m AHD
Rochester Town Gauge reaches 114.1m AHD and up to 114.6m AHD
N
Scale at A4
Metres
0 100 200
1:18,000
SES
NORTH CENTRAL
Catchment Management Authority
CAMPASPE
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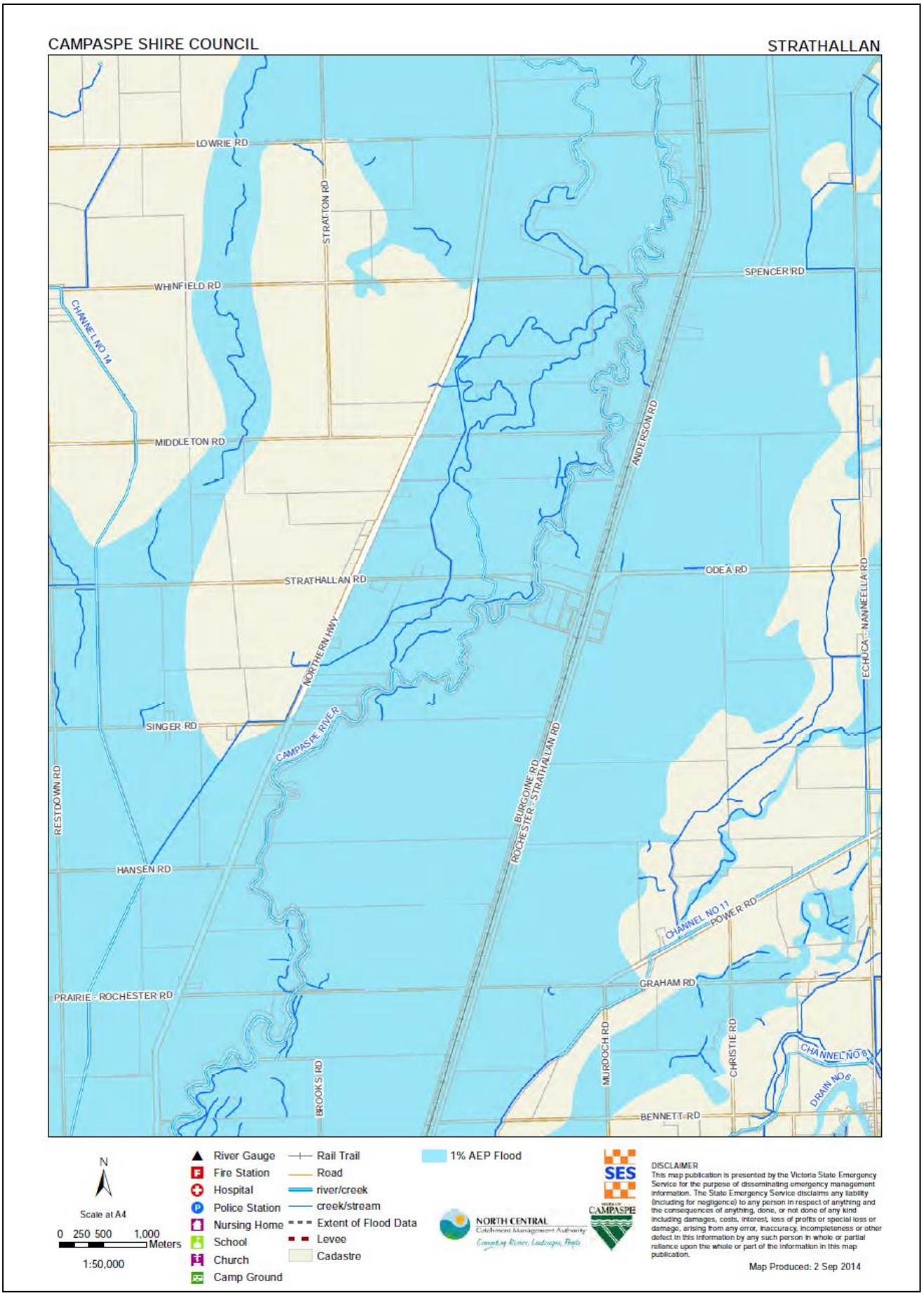
Map Produced: 2 Sep 2014


CAMPASPE SHIRE COUNCIL
STRATHALLAN
LOWRIE RD
STRATTON RD
WHINFIELD RD
SPENCER RD
CHANNEL NO 14
MIDDLETON RD
ANDERSON RD
STRATHALLAN RD
ODEA RD
NORTHERN HWY
ECHUCA - NANNEELLA RD
SINGER RD
CAMPASPE RIVER
BURGOINE RD
ROCHESTER - STRATHALLAN RD
RESTDOWN RD
HANSEN RD
CHANNEL NO 11
POWER RD
GRAHAM RD
PRAIRIE - ROCHESTER RD
MURDOCH RD
CHRISTIE RD
CHANNEL NO 6
DRAIN NO 6
BROOKS RD
BENNETT RD
N
Scale at A4
0 250 500 1,000
Meters
1:50,000
River Gauge
Fire Station
Hospital
Police Station
Nursing Home
School
Church
Camp Ground
Rail Trail
Road
river/creek
creek/stream
Extent of Flood Data
Levee
Cadastre
1% AEP Flood
NORTH CENTRAL
Catchment Management Authority
SES
CAMPASPE
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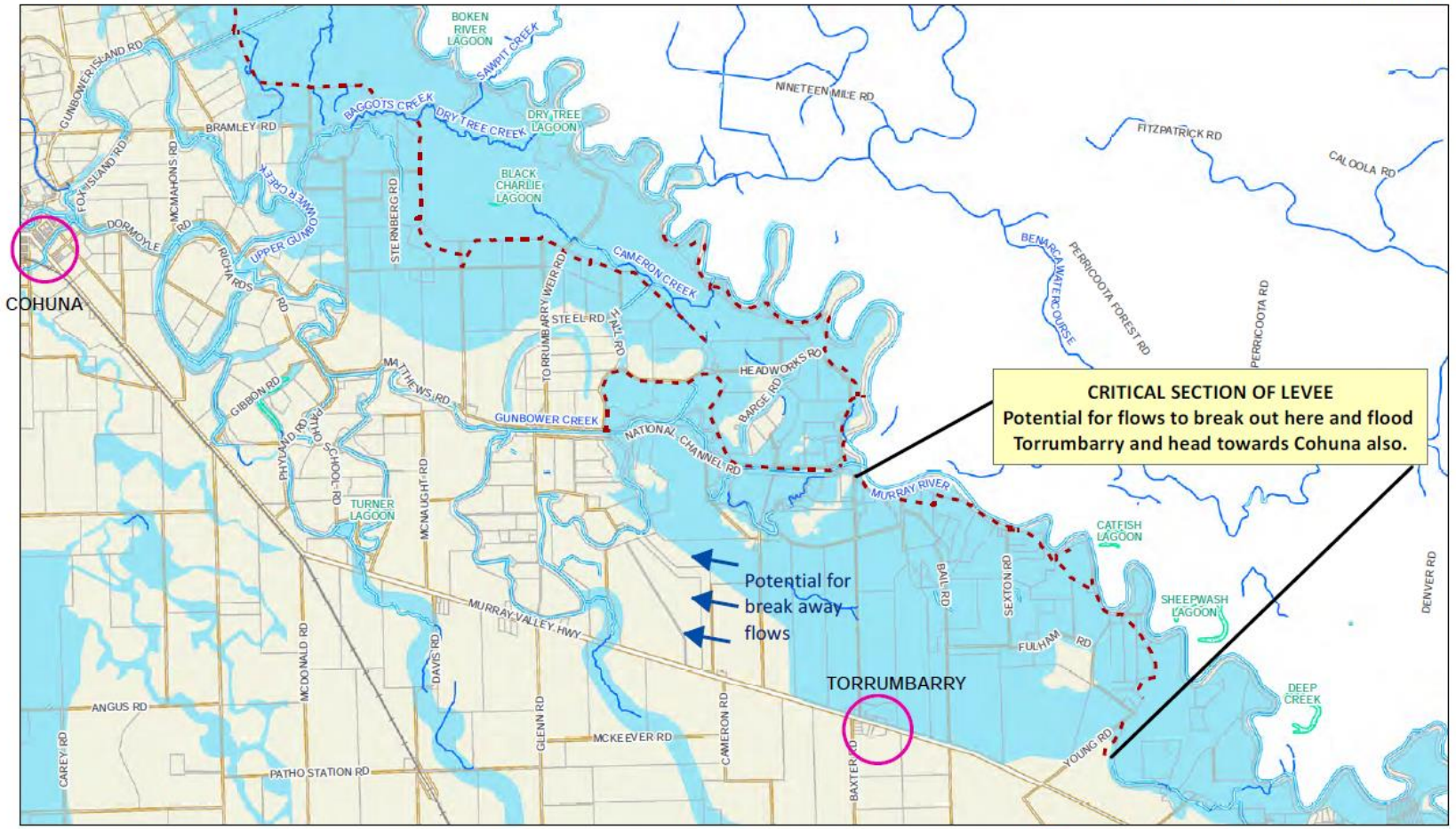
Map Produced: 2 Sep 2014

CAMPASPE SHIRE COUNCIL

TORRUMBARRY -1% AEP Flood Extent



N

Scale at A4

Metres

0 500 1,000

1:80,000

Rail Trail
Road
river/creek
creek/stream
Levee
Cadastre
1% AEP Flood
1% AEP Flood Extent

SES

CAMPASPE

NORTH CENTRAL Catchment Management Authority

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Map Produced: 2 Sep 2014

APPENDIX G – REFERENCES AND INTELLIGENCE SOURCES

(BOM- There needs to be clear referencing throughout the report, e.g. it seems quite clear that a fair bit of information comes out of the Flood Intelligence project (SES/DSE). A reference to this project is not provided in Appendix G. It could be that this project is still in its draft stage, but then I would not use the information (until it is actually signed off). This is also relevant to the map in Appendix F).

(BOM- The Bureau map for the Murray Riverina has been 'squeezed' into a portrait format (i.e. the map is clearly a landscape). Also, I would have liked clearer reference on the 'production' dates of BOM maps, either in Appendix G or as a disclaimer in Appendix F).

The following studies may be useful in understanding the nature of flooding within the Campaspe Municipal District:

- Murray River Flood Plain Management Study - Gutteridge Haskins & Davey 1986
- The Murray River Flood Plain Atlas produced by Gutteridge Haskins & Davey Pty Ltd, Cameron McNamara Pty. Ltd, Laurie, Montgomerie & Pettit - Rural Water Commission of Victoria and New South Wales. Water Resources Commission 1986 (available in the State Library of Victoria)
- Echuca Flood Mitigation Proposal, Design Report, Rural Water Commission 1987 (in Dataworks Appendix A to the Echuca Flood Mitigation Scheme Operation Manual Final Report 1994)
- Echuca Flood Mitigation Proposal Approved Scheme – Rural Water Commission 1987 (in Dataworks)
- Feasibility Study for Surface Drainage of Woolwash Timmering Depression 1991
- Echuca Moama Riverine Strategy 1994
- Echuca Flood Mitigation Scheme Operation Manual Final Report Planright 1994 (in Dataworks)
- Echuca Flood Mitigation Scheme Maintenance Manual Final Report Planright 1994 (in Dataworks)
- Moama Echuca Flood Study Sinclair Knight Merz 1997
- Echuca Flood Mitigation Scheme Levee Audit Report - Department of Natural Resources and Environment 1996 (in Dataworks)
- Lower Goulburn Waterway and Floodplain Management Plan 1998
- Echuca Levee Bank Survey – Fisher Stewart 1998 - for sections between the approved levees (in central records hard copy files 78-10-01)
- Lower Goulburn Levee Audit Final Modified Findlay Report SMEC – 1998 available on the Goulburn Broken Catchment Management Authority website
- Lower Goulburn Flood Rehabilitation Scheme SKM & Water Technology – 2005 available on the Goulburn Broken Catchment Management Authority website.
- Murray River Levee Audit Project – Final Report CMPS&F March 1997 for Building Services Agency
- Sinclair Knight Mertz Pty Ltd (SKM, 2011): Review into the Operation of Storages During Flooding, Victorian Floods Review. 29 September 2011
- Water Technology (2013): Rochester Flood Management Plan. April 2013

Note: Dataworks is Council's electronic document management system.

Other sources of information of direct relevance to the Municipality include:

- http://www.nccma.vic.gov.au
  North Central Catchment Management Authority for various references
- http://www.gbcma.vic.gov.au/default.asp?ID=floodplain_and_drainage
  Goulburn Broken Catchment Management Authority for various references and maps
- http://planningschemes.dpcd.vic.gov.au/index.html
  Department of Planning and Community Development for planning scheme flood maps

- http://www.data.water.vic.gov.au
  for historical data on water quality, river heights and flows
- http://www.bom.gov.au
  Bureau of Meteorology for river gauge readings and flood warnings
- http://www.floodvictoria.vic.gov.au
  for information on historic floods in Victoria
- http://www.ses.vic.gov.au
  State Emergency Service
- http://www.ema.gov.au
  Emergency Management in Australia
- http://www.dse.vic.gov.au/fire-and-other-emergencies
  Department of Sustainability and Environment emergency management.
- COUNCIL, NCCMA and VICSES Geographical Information System (GIS) – these contain layers showing drainage assets, flooding extents, flood related call-out locations, aerial photographs, roads, title boundaries, levees and other useful information.
- Water Technology (2012): Strategic Flood Intelligence Report – Campaspe Basin and Goulburn Basin, May 2012.

Relevant but more general references include:

- Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000), Standing Committee on Agriculture and Resource Management (SCARM) Report No 73: Floodplain Management in Australia, Best Practice Principles and Guidelines.
- Bureau of Meteorology (1996): Bureau of Meteorology Policy on the Provision of the Flash Flood Warning Service. May 1996.
- Department of Natural Resources and Environment (DNRE) (2000): Flood Data Transfer Project – – Flood Data and Flood Planning Maps as well as Flood Mapping and River Basin Reports.
- Department of Sustainability and Environment (DSE) (2008): Victoria Caravan Parks Flood Emergency Management Plan Template and Guidelines. (Two documents) March 2008.
- Victorian Flood Management Strategy 1997-2007
- Emergency Management Act 1986
- Emergency Management Manual Victoria, 1997 Edition
- http://www.ema.gov.au
  Emergency Management in Australia
  - Managing the Floodplain, Manual 19, EMA 2009
  - Flood Preparedness, Manual 20, EMA 2009
  - Flood Warning, Manual 21, EMA 2009
  - Flood Response, Manual 22, EMA 2009
  - Emergency Management Planning for Flood Affected by Dams, Manual 23, EMA 2009
- Water Act 1989
- Flood Warning Station Information Manual - February 1999.

APPENDIX H – SANDBAGS

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 council.

Residential and commercial property owners

Sandbags may be obtained (purchased) from hardware suppliers or rural suppliers.
Sand may be obtained from sand and soil suppliers.

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:

Echuca VICSES Local Headquarters (LHQ)	4000 bags (minimum)
Rochester VICSES Local Headquarters (LHQ)	4000 bags (minimum)
Kyabram VICSES Local Headquarters (LHQ)	4000 bags (minimum)
Rushworth VICSES Local Headquarters (LHQ)	1000 bags (minimum)
Colbinabbin CFA Headquarters	2000 bags (minimum)
Stanhope CFA Headquarters	1000 bags (minimum,)

Additional sandbag supplies are held at the North West (Loddon Mallee) VICSES Regional Offices, located in Bendigo and 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 – Tongala	4000 bags

Council is a signatory to the Municipal Association of Victoria Protocol for Inter-Council Emergency Management Resource Sharing. Council also has an arrangement with neighbouring Councils, and with Northern Victorian Cluster Councils for sharing resources, as required.

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 by VICSES to an alternative source of sandbags (e.g. local hardware store or sandbag supplier).

Distribution Points

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

A process for identifying appropriate / suitable locations is currently being determined by VICSES.

Suggested sandbag collection points:
*additional/alternate points can be nominated by the Incident Controller

Echuca
Echuca South Recreation Reserve, High St
Echuca East Football Ground, Sutton St
Rochester
East side of river – Recreation Reserve, Reserve Street
West Side of river – Cnr Gillies St & Ramsay St (opposite swimming pool)
Kyabram
Showgrounds, Allan St
Northern Oval, Tisdall Rd
Stanhope
Recreation Reserve, Midland Hwy
Colbinabbin
Football Oval, off Mitchell St
Rushworth
Public Park, Coyle St

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 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.

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. Some sand suppliers are identified in the MFEP and VICSES Units maintain a list of suppliers for each area.

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

Council

Council will have arrangements in place to acquire sand for its own purposes.

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.

Distribution List

This plan is distributed to members of the Sub Committee, and representatives of the Campaspe Shire Council and Victoria Police as the coordinator of resources, control and support agencies for flood, organisations who manage water facilities, organisations who manage catchments, and organisations who predict floods. (ie Campaspe Shire Council, Victoria Police, State Emergency Service (Region), State Emergency Service (Units), Echuca/Moama Search & Rescue Squad, Goulburn Murray Water, Coliban Water, Goulburn Valley Water, North Central Catchment Management Authority, Goulburn Broken Catchment Management Authority, Department of Environment Land Water and Planning, and the Bureau of Meteorology).

Name	Position	Organisation	Branch	Plan No.
Master copy	Held by Municipal Emergency Coordinator	Campaspe Shire Council	Echuca	1
Ben Trevena	Municipal Emergency Coordinator	Campaspe Shire Council	Echuca	2
Louise Mate	Government Publications Technician	State Library of Victoria	Melbourne	3
				4
Mark Cattell	Regional Manager	Victoria State Emergency Service	North West Regional Headquarters	5
Mark Whitehead	President	Search & Rescue	Echuca-Moama Squad	6
Travis McCarthy	Regional Emergency Management Inspector – Western Region	Victoria Police	Bendigo	7
Neville Pearce	General Manager Operations and Headworks	Coliban Region Water Authority	Bendigo	8
Neville Whittaker	District Manager Central	Goulburn Valley Region Water Authority	Shepparton	9
Brian Letcher	Operations Coordinator Central Goulburn	Goulburn Murray Water	Tatura	10
Camille White	Floodplain Manager	North Central Catchment Management Authority	Bendigo	11
Guy Tierney	Statutory Planning and Floodplain Manager	Goulburn Broken Catchment Management Authority	Shepparton	12
Jon Cuddy	Project Leader Emergency Management	Department of Environment, Land, Water and Planning	Epsom	13
Elma Kazazic	Regional Hydrology Manager, Victoria	Bureau of Meteorology	Climate and Water Division, Melbourne	14