Inquiry into flood mitigation infrastructure in Victoria

Submission no.5

21 July 2011

Ms C Williams
Executive Officer
Environment and Natural Resources Centre
Parliament House
Spring Street
EAST MELBOURNE VIC 3002

Dear Caroline

Re: Inquiry into flood mitigation infrastructure in Victoria

We refer to your letter dated 2 June 2011 inviting submissions to the Inquiry into flood mitigation infrastructure in Victoria.

Council welcomes the opportunity to have input into the Inquiry and a copy of Council’s submission is enclosed.

If you have any questions in relation to the submission, please contact the undersigned on 5481 2242 or by email: j.aujard@campaspe.vic.gov.au

Yours faithfully

[Signature]

JON AUJARD
MUNICIPAL EMERGENCY MANAGER

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submission.doc
Flood Mitigation
Infrastructure Submission
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Section 1: Introduction

The Shire of Campaspe welcomes the opportunity to provide input into the inquiry by the Environment and Natural Resources Committee into flood mitigation infrastructure in Victoria.

It is understood the Committee is required to investigate matters relating to flood mitigation infrastructure in Victoria, with particular reference to:

a) Identifying best practice and emerging technology for flood mitigation and monitoring infrastructure including river gauges

b) The management of levees across Victoria, including ownership, responsibility and maintenance on both public and private land

c) Waterways management, including the nature and extent of vegetation clearing activities within waterways and their general maintenance

d) Identifying those entities and individuals having ownership of waterways and the responsibility for their clearing and their maintenance

e) The extent to which, if any, local knowledge of residents is employed in effecting waterways clearing and maintenance

Submissions are due by 5 August 2011.

This submission specifically addresses terms of reference a), b) and c).
Section 2: The Municipal Area

The Shire of Campaspe is located in north central Victoria, about 180 kilometres north of Melbourne and is named after the Campaspe River (which was named by Major Mitchell in 1836 after Alexander the Great's concubine). The Shire is bounded by the Murray River and the New South Wales border in the north, the Goulburn River as part of the boundary with Moira Shire in the north-east, the City of Greater Shepparton in the east, Strathbogie Shire and the City of Greater Bendigo in the south, Loddon Shire in the west, and Gannawarra Shire in the north-west. The Shire is served by the Midland Highway, the Murray Valley Highway, the Northern Highway and the Melbourne-Bendigo-Echuca railway line.

The Shire of Campaspe is a predominantly rural area, but has significant residential areas in the townships of Echuca (with Moama immediately across the border in NSW) and Kyabram. The largest town is Echuca, followed by Kyabram with smaller townships including Gunbower, Lockington, Rochester, Rushworth, Stanhope and Tongala. The population of the Shire increased from about 32,000 in 1991 to over 35,000 in 2006. Most of the recent growth has been in Echuca. The population of Echuca is around 13,000 (with a further 5,000 in Moama), Kyabram almost 7,000 and Rochester is around 3,000.

The Shire encompasses a total land area of about 4,500 square kilometres. Land is used mainly for agriculture, particularly dairy farming, cereal and grain growing and sheep grazing. Tourism is also an important industry.

The main areas of employment are: agriculture, forestry and fishing 20.3%; manufacturing 15.8%; construction 5.6%; wholesale and retail trade 18.4%; transport and storage 3.5%; accommodation, cafes, restaurants 4.9%; education 6.1%; cultural and recreation services 1.3%; finance, insurance, property and business services 6.6%; health and community services 9.6%; government administration and defence 1.8%; other 3.7% (2006 Census).

The Shire is predominantly flat with forested hills in the south. The Mount Camel Range divides the southern part of the Shire and is located to the east of the Campaspe River running from the southern boundary of the municipality flattening out into the plains to the east of Rochester.

As the Shire is located north of the dividing range all waterways eventually flow into the Murray River. The major river systems and water features in the Shire include the Campaspe, Murray and Goulburn Rivers, Bendigo Creek, Kow Swamp, Waranga Basin, Lake Cooper, Greens Lake, Wallenjoe Wetlands and many irrigation and drainage channels.
The Campaspe River has its headwaters near Mt Macedon and its confluence with the Murray River occurs at Echuca, which can put that town at significant risk if both the Murray and Campaspe Rivers are in flood.

In addition, a major irrigation dam, Lake Eppalock, is situated just south of the Shire on the Campaspe River. The Coliban River is also a tributary to Lake Eppalock. There are also several other important tributaries to the Campaspe River below Lake Eppalock including Axe Creek, Sweenies Creek, Forrest Creek and Mt Pleasant Creek.

The Goulburn River joins the Murray River about 15 km upstream of Echuca and has its head water upstream of Lake Eildon. It flows through Shepparton on its way to the Murray.

The Bendigo Creek has its headwaters near Bendigo and flows northward along the western boundary of the Shire and discharges into Kow Swamp. The Pyramid Creek discharges from Kow Swamp to the north west.

In addition the central part of the Shire is subject to cross country flows in heavy rain events. This flow commences at the southern part of the Shire and flows northward through the Nine Mile Creek, Wanalta Creek, Lake Cooper, Wallenjoe Wetland and Timmering Depression and discharges into the Goulburn and Murray Rivers through the Southern Cross Drain near Echuca.

Levees have been constructed in the Shire over the years for a number of reasons. Some have been constructed adjacent to rivers to mitigate riverine flooding, in particular:
- the Goulburn River and
- the Murray River.

Other 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
- to the east of Rochester and
- in the Wanalta/ Colbinabbin/Corop area in the south-eastern part of the Shire.
The structural integrity, the date of construction, the extent of maintenance and the protection provided by many of these levees 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 addition there is a levee system which surrounds part of Echuca that was completed in 1993 as part of a formal scheme initiated by the former State Rivers and Water Supply Commission following the floods of the mid 1970’s. They were engineered to protect a specific part of the urban area adjacent to the Campaspe and Murray Rivers to a specific flood height. These levees are managed and maintained by the Council.

The only levees that Council is responsible for in the Shire are located in Echuca that were constructed as part of the formal scheme.
Section 3: Flood History

Historically significant flooding has occurred along the rivers as shown below:

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<th>Campaspe River</th>
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The Shire of Campaspe has also experienced four recent flooding events. The first event in September 2010, one in late November through to early December 2010, the most significant event in early January 2011 and the fourth in early February 2011. A disc with photographs showing flooding at various locations around the Shire during these events is attached in the Appendix 1. Appendix 2 shows the area inundated by the 1 in 100 year flood. This area is similar to the area inundated in the January 2011 flood event.

The main rivers affected during this period were the Goulburn, the Campaspe and the Murray Rivers and the towns most at risk were Rochester and Echuca. In addition some rural areas were significantly affected by overland sheet flow.

The following pages provide detailed information in relation to each of the recent flood events.
3.1 September 2010

On 4 and 5 September 2010 heavy rains swept across the State. This resulted in the Goulburn River flooding. It peaked at the Shepparton gauge (outside the Shire) at 11.09m at the gauge at 9.45am on 9 September (compared to 11.7m in the 1993 floods). The flood was predicted by the Bureau of Meteorology (BOM) to reach 11.1m at Shepparton. The flooding resulted in a number of houses and properties around Shepparton being flooded. The flood level at the gauge triggered the removal of the bars at Loch Garry downstream from Shepparton, to allow the flood waters to spill onto the flood plain. The Goulburn then peaked at McCoys Bridge within the Shire at around 10.2m on Friday 10 September.

The BOM predicted on 7 September that the Murray River would peak at 94m Australian Height Datum (AHD) at the Echuca Wharf but then reduced it to around 93.5m (minor flood level) to occur on 15 September. The actual height reached was 91.97m on 19 September at 10.45pm. This was significantly less than the original prediction.

The NSW SES issued a River Closure Order for the Murray River on Friday 10 September 2010 which prohibited water craft operating on the river.

The BOM originally predicted a height of 7.5m on 18 September at Torrumbarry. The actual peak occurred some days later.

As a result of the above, the major issues for the Shire of Campaspe were flooding along the Goulburn River and Murray River with the original prediction suggesting this would be a significant matter and potentially inundate or isolate many residences.

The SES arranged the filling of sand bags in Echuca which were placed around some low lying properties in Echuca outside the levee system. Some levees in the Yambuna area were also sand bagged.

No houses were inundated however popular tourist facilities in the Port of Echuca and walking tracks and reserves adjacent to the Campaspe and Murray Rivers were closed for an extended period, primarily due to the risk of falling trees.

Inflows into the upper Campaspe River system took the water storage at Lake Eppalock from approximately 100,000ML to 200,000ML. Its total capacity is 304,000ML.

Separate overland flooding originated south west of Rushworth in the rolling forested hills and made its way into the Wanalta Creek and its tributary Nine Mile Creek and Moora Creek. Wanalta Creek heads northwards and spills into low lying country containing the One Tree and Two Tree Swamp and Wallenjoe Wetland which discharges into Greens Lake to the north west and Mansfield Swamp to the north east. The flows eventually make their way into the Murray or Goulburn Rivers in the north of the Shire. There are various irrigation channels which dissect the area redirecting the natural flow. As a result there are various flood control structures operated by Goulburn Murray Water which regulate the flow. These structures are operated according to long standing procedures.

Many farm paddocks were inundated which had a serious effect on crops and many local roads were damaged by the flood waters.
3.2 November/December 2010

Following up to 76mm of rain in the Campaspe River catchment from 9.00am Saturday 27 through to early Sunday 28 November 2010 the Campaspe River rose quickly to peak in Rochester on Monday 29 November at 8am at 114.4m AHD at the bridge (or 9.001 at the syphon at 9.30am).

The North Central Catchment Management Authority (NCCMA) originally predicted a peak of 114.2m at 6.00pm on Sunday 28 November but adjusted this to 114.4m at 9.15pm on Sunday, which proved to be an accurate prediction.

Before the rain the storage at Lake Eppalock, well upstream of Rochester, was approximately 240,000 Ml. Inflows to Lake Eppalock were around 85,000 Ml per day at their peak flow. With around 60,000 Ml of air space remaining the reservoir spilled during Sunday with major flooding downstream.

The Campaspe River at Redesdale upstream of Eppalock peaked at around 4.34m (moderate flood level 4.0m) early Sunday morning. The River at Barnadown downstream of Eppalock rose above the moderate flood level (4.6m) early Sunday morning and exceeded the major flood level (5.5m) later on Sunday.

In addition Axe Creek, Sweenies Creek, Forrest Creek and Mt Pleasant Creek, which are tributaries of the Campaspe River, all flooded.

In Rochester a number of streets were inundated and closed to traffic including the main VicRoads bridge over the Campaspe River on the Kyabram Rochester Road which was closed for a number of hours. Sand bagging of houses was carried out by the SES at some low lying properties and although some were inundated there was no above floor inundation. The caravan park was flooded and caravans were removed to higher ground although after a significant delay. Trees in areas adjacent to the river were adversely affected and public areas were closed due to the risk of falling trees.

The Coliban Water treatment plant was adversely affected and a “Boil Water” notice was issued to the community.

The Rochester caravan park, which is adjacent to the river, was evacuated and 32 of those residents made contact with the Recovery Manager and requested assistance. Three of those residents were temporarily relocated to the local motel.

The Goulburn River also rose as a result of the rain. It peaked at 10.12m on Tuesday 14 December 2010 which is just above a moderate flood level of 10.0m at McCoys Bridge.

On Friday 10 December the BOM were predicting a peak of 93.8m on Thursday 16 December at the wharf in Echuca. This level would have caused some local inundation within Echuca.

The Murray River finally peaked at only 92.137m at the wharf at 8.45pm on Saturday 11 December which was more than 1.6m less, but much earlier than predicted. No houses were affected however popular tourist facilities and reserves adjacent to the Campaspe and Murray Rivers were closed for an extended period, primarily due to the risk of falling trees in sodden ground.

In this flood event the area south west of Rushworth in the southern part of the Shire (which is described under the September 2010 flood event) was again flooded due to the amount of rain falling on a catchment that was still saturated from the September 2010 event.

To the north in the Wanalta/Colbinabbin area two households required assistance due to their houses being inundated. One resident required temporary relocation to a motel.
Further many roads and farm paddocks were inundated, in some cases seriously affecting crops. Some of the swamps and low lying country held water until the event in January when the area was again inundated.
3.3 January 2011

In the week commencing 10 January 2011 significant rainfall was received across most of the State. In particular the catchment of the Campaspe River received significant rainfall with areas near Kyneton upstream of Lake Eppalock receiving up to 120mm. This rainfall resulted in major flooding in the Campaspe River system.

The secondary spillway at Eppalock discharged water for the first time since construction (with the reservoir reaching approximately 118% of design capacity) and the Campaspe River reached major flood level, with significant impacts in Rochester and the plains between Rochester and Echuca.

In Rochester the river level peaked at around 115.2m or 115.3m AHD at the bridge gauge or 9.17m at the automatic gauge at the syphon at 5.45pm on Saturday 15 January 2011. It should be noted that the gauge at the bridge is split into two sections. The main section near the bridge cannot be easily accessed when the river rises above a moderate flood level. Hence a shorter length of gauge is placed some distance away, nearer to Mackay Street. This can usually be accessed when the other section is inaccessible. However on this occasion this shorter section was overtopped, thus making it difficult to know the exact height of the flood peak.

The flooding resulted in 80% of the town being inundated. Over 250 properties had above floor inundation. Further all businesses in the town were directly affected. The level was higher than the 1 in 100 year flood, probably around the 1 in 150 year flood.

Downstream in Echuca the river peaked at 95.75m AHD at the gauge upstream of Ogilvie Avenue at 9.00pm on Sunday 16 January 2011. Less than ten houses were inundated. These were predominately located near the Ogilvie Avenue bridge and around Chelsworth Drive. For a time on Saturday night and into Sunday morning it was thought that the river would overtop the levees given the magnitude of the flood in Rochester. Ultimately the levees were not overtopped, with a reasonable freeboard remaining. The level reached was about equal to the 1 in 100 year flood upstream of Ogilvie Avenue in Echuca, and less downstream of the bridge.

Adjacent to the Campaspe River there were many local roads, community facilities and private properties damaged as a result of the flood waters.

In the Wanalta/Colbinabbin area roads and farm paddocks were again inundated. Some of the swamps and low lying country were still holding water following the previous events.

The Bendigo Creek also flooded requiring the temporary closure of many of the east west roads which cross it.

Following the January flood event, Council distributed questionnaires to residences in Rochester in early February seeking opinions on “what worked well”, “what did not work well” and “suggestions for improvement”. About 180 responses were received.

A community meeting was also conducted by Council on 1 March in Rochester where the community had an opportunity to provide comments and seek answers to queries.
3.4  **February 2011**

From 9am Friday 4 February through to Saturday 5 February 2011, rainfall totals of between 30mm and 70mm were recorded in the Campaspe River catchment.

With the catchment already saturated this rainfall caused stream rises in the Campaspe River catchment, with rapid rises observed along some tributaries. Areas of moderate flooding developed in the Campaspe River during Saturday.

Residents were advised by the NCCMA that the river was expected to reach the same level as the November/December event level ie 114.4m AHD at the bridge on Sunday. Early Sunday morning the BOM predicted a peak around 9m (major flood level 9.1m) at the syphon to occur on Sunday evening which was similar to the NCCMA prediction.

On Sunday morning the SES distributed a community newsletter including a map showing the likely extent of flooding at a peak of 114.4m, which ultimately proved to be accurate.

The SES undertook some precautionary sand bagging of low lying areas prior to the peak arriving.

The Campaspe River at Barnadown peaked at 5.44m (major flood level 5.5m) at 11pm Saturday. At Rochester the Campaspe River peaked at 114.3m AHD at the bridge at 4pm and 8.93m (moderate flood level 8.8m) at the syphon around 7pm Sunday. The actual levels closely matched the predictions provided by the NCCMA and BOM.

At the peak in Rochester a number of local streets were flooded and the approaches to the bridge on the Kyabram-Rochester Road were closed for a number of hours but there were no houses with above floor inundation. The caravan park was again affected.

In Echuca there were no significant issues related to the flood event. However public areas adjacent to the Campaspe River and Murray River were flooded and remained closed (they hadn’t been reopened following the January floods) due to the risk of falling trees.

In the Wanalla/Colbinabbin area some rural properties were again inundated but no house inundation was reported.
Section 4: Terms of Reference

The first three terms of reference are addressed on the following pages.
Section 4.1: Best Practice Flood Mitigation and Monitoring Infrastructure

Identifying best practice and emerging technology for flood mitigation and monitoring infrastructure including river gauges

4.1.1 Flood Mitigation

Non-structural or structural measures can be used in flood mitigation.

Non-structural measures include land-use planning, building code implementation, flood insurance, general preparedness of the community and warning systems.

Structural measures use physical solutions such as levees, to provide the first line of protection, generally for large areas. On a smaller localised scale it can include elevation-in-place of buildings and flood-proofing of individual structures and secondary levees.

To develop effective non-structural or structural measures a good understanding of the behaviour of the catchment during a flood is required. This could be achieved through undertaking a Flood Study. Such a study should include the collection of floor levels of buildings at risk from different recurrence interval floods. It should also include a hydrologic and hydraulic analysis, risk and damage analysis for various recurrence interval floods (flood hazard mapping) and an analysis of cost benefit for potential mitigation arrangements. The final results and conclusions should be included in a Flood Plain Management Plan.

Included in Appendix 3 is a communiqué which was an outcome of a forum convened by Engineers Australia and supported by the Institute of Public Works Engineering Australia and Consult Australia which reviewed the experiences of the January 2011 floods in Victoria. It was attended by representatives from local government, government agencies, private firms and politicians all affected by the floods. A number of the issues raised are pertinent to this review, flood mitigation in general and support comments in this submission.

4.1.1.1 Non Structural

Community Preparedness
The information contained in the Flood Plain Management Plan can be used to prepare the community for significant flooding events, say greater than 1 in 20 year flood. As these floods don’t occur frequently (by definition) there needs to be a process to prepare the community, and maintain the preparedness for the extended periods between floods. The SES have a format called FloodSafe which should be used for this purpose. However they would need adequate educational resourcing to provide this program on a regular basis. The building floor level information and extent of various recurrence interval floods determined as part of the Flood Study should be included in the FloodSafe program. This program should be periodically updated within those communities at risk.

The program provides information to those at risk on how to prepare for, and respond to a flood. The intention is to reduce the risk to life and property.
Planning Scheme
The Flood Study, including data on recent flood events and any additional modelling undertaken, should be used to update the planning scheme controls relevant to the flood constraints.

These include the following zone and overlays:

- The Urban Flood Zone boundaries need to be reviewed given the increased height of the flood waters. This zone is the only zone able to place a prohibition on new accommodation (housing) being developed in active flood ways.

- The Flood way Overlay, usually used in rural areas, has not been accurately mapped for large areas of the municipality. The effect of development on higher flood risk properties or areas where land levels should not be altered without clear investigation of the impact on the efficiency of the flood way can be missed or the importance underestimated where there is no mapping available. In the southern part of the Shire there is no mapping at all in some areas despite the presence of creeks, water ways and flood plains.

- The Land Subject to Inundation Overlay (LSIO) mapping in the Planning Scheme does not accurately reflect the areas that are subject to flooding, including sheet flooding for wide areas of the municipality.

The mapping in the planning scheme is the mechanism available to the public for prior knowledge of the flood threat. It provides an indication to the public of those areas likely to flood and therefore gives them a basis to make decisions regarding buildings and long term preparations for flooding.

Building Regulations
The responsibility for considering flood risk and appropriate floor levels for new building work is controlled under Regulation 802 of the Victorian Building Regulations. Both the Water Act 1989 and Planning Schemes created under the Planning and Environment Act are directly cross-referenced in determining the appropriate flood level for a site. Where there is an absence of designated levels, planning scheme control or other approved levels, the responsibility for setting a level falls to the Municipal Building Surveyor.

Following the January 2011 flood event, peak flood levels were marked by Council on buildings, fences and other structures adjacent to the Campaspe River. These points were then surveyed by the NCCMA and the levels recorded. The levels exceed previous designated levels and the extent of the land inundated has also exceeded previous designation.

Uncertainty and risk to those involved in assessing and issuing flood levels, which are currently lower than what is now the highest flood on record for the area, would be removed by the adoption of interim levels.

There is a need for interim levels to be proclaimed for Rochester and the surrounding area, based on the levels of the January 2011 flood until a detailed flood study can be undertaken. Therefore, there should be appropriate mechanisms to control any new developments, taking into account the known flood level, until new designations are adopted.

Flood Insurance
Many residents and business owners were unclear as to whether they were covered for flood damage.

Clarity needs to be provided to those taking out insurance as to what events are covered and not covered.

Further, when there are delays in processing claims invariably there is more anxiety and additional costs are incurred, such as costs for temporary accommodation. Claims need to be processed promptly to allow people to “move on with their lives”.

Shire of Campaspe – Inquiry into Flood Mitigation Infrastructure in Victoria - July 2011
**Warnings**

Warnings can take two forms. Firstly “alerts” which only raise the alarm and “notifications” which raise the alarm and provide additional information. An “alert” can take the form of a siren or bell ring. It warns the community of an impending issue but provides little else in the way of information. The new national Emergency Alert system using mobile and fixed line telephones is a “notification” as it usually provides additional information on the current situation and gives a direction to take certain actions.

The Emergency Alerts issued to individual’s mobile phones during the recent events suffered from a number of issues. Often the messages were either incomplete, inaccurate, contained spelling mistakes of key local features, were not issued in a timely fashion or they were issued to only part of the population affected.

By way of example, in the January 2011 floods transport transfer points were set up by the SES at two locations in Rochester, one either side of the river, as the flooded river splits the town in two. One site was located in the west at the St Johns Presbyterian Church on the corner of Victoria Street and the Northern Highway and the other in front of the Nelson Silos buildings on the Kyabram Rochester Road in the east.

Residents were advised to evacuate by the SES using the Emergency Alert system. However the site on the east side of the river was omitted from the message. Clearly residents on the east couldn’t access the west and this caused concern and left them with no appropriate course of action. The Church property in the west and surrounding streets was ultimately inundated at the peak of the flood making access for buses and residents difficult. Further, the description of the Church location in the Emergency Alert was incorrect. Given that the Alerts are sent from a central location, these issues could have been avoided if the messages had been checked locally before transmittal. These issues were raised in the community feedback to Council.

Again in Rochester the SES sent Emergency Alerts to inform the community of a public meeting regarding the impending flood. However only part of the population received these alerts as the transmission was commenced too late to complete all the messages before the meeting. Many people only heard of the meeting by word of mouth.

By way of another example, Echuca residents in low lying areas were requested to evacuate. Residents didn’t know what areas were considered low lying and therefore if the message referred to them or not. Much of the town is adjacent to two rivers and could be considered low lying.

The process for issuing Emergency Alerts needs to ensure they are timely, complete and accurate.

There would also appear to be a belief in the community, now that the Emergency Alert system has been introduced, that people will get many messages at appropriate intervals updating them on the current situation. The system was never designed for that purpose. Perhaps the system is partly a “victim of its own success”. This belief needs to be rectified or the system modified.

There is a group of “vulnerable” people that need special warnings and assistance. Groups including the aged, the young, the infirm and those with disabilities need warnings in a format that they can readily receive and act on. Further they may need special assistance in responding to the warnings. There are also institutions that need tailored warnings, such as hospitals. The Rochester, Elmore and District Health Service required evacuation in the January 2011 floods, and with little time between the warning and the flood waters arriving, the evacuation was completed just in time.
Many people followed the Bureau of Meteorology (BOM) web site to keep informed on the flood predictions and current height of the river, particularly upstream of their property. However the information provided by the BOM needs to be relevant and timely. For example in Rochester the community relates to levels at the manual gauge at the bridge. This is calibrated to Australian Height Datum and was only updated on the web site spasmodically. However the BOM automatic gauge is located downstream at the syphon and is calibrated to a local datum. This issue caused confusion to the community. Further not all members of a community have access to the web to gain this information.

The BOM website should provide information in a form that is relevant to the affected community.

Another method of providing information and warnings to the public is through the distribution of newsletters. In Rochester in February 2011 the SES also distributed a community newsletter which included a map showing the likely extent of flooding (which ultimately proved to be accurate).

Another method is to hold public meetings. However the information provided should be well targeted to the audience to meet their specific needs. Maps showing the extent of flooding should be available as property owners who are particularly interested in whether their property will be flooded. The predicted height together with an explanation of the level of confidence in the prediction is also required. If residents know the floor height of their houses then this gives good information for the community take the best course of action.

During the recent flood events the SES trialled “community meetings on the radio” where the SES presenter was asked a range of questions by the radio host that anticipated the types of questions that a resident would ask. This style of presenting information is appropriate to situations where there is insufficient time to organise a face to face community meeting. Care needs to be taken that all the key points are brought out in the discussion otherwise a statement of the factual situation by the presenter would be preferable.

Radio broadcasts from “emergency service radio stations” have proved to be an important source of information to the community. This form of communication is most appropriate where the situation is changing quickly. Television can, to a lesser extent, perform this role.

Newspapers are also used to provide information. They are most appropriate for educational material in advance of any emergency or where the situation is not changing quickly.

Another method is through door knocking of premises. This can be effective in getting the community to react to a particular situation as personal contact allows for an explanation to be provided to each recipient. However it can be resource intensive and time consuming.

Most warnings provide information in one direction only ie from the emergency service agency to the community. They generally don’t provide for the community to send information to the emergency service agency or allow for a two way exchange of information.

Other methods can be used to provide two way communication with the community (see Emerging Technology below).
**Flood Predictions**

Accurate flood predictions, in terms of both height and timing, are required to provide appropriate warnings.

In Rochester the predictions of flood levels provided by the BOM and the NCCMA for the September, November/December 2010 and February 2011 floods were sufficiently accurate in terms of both height and timing. They were provided sufficiently ahead of time to allow appropriate actions by the community and emergency service agencies to be undertaken.

By contrast the prediction provided by the NCCMA for the January 2011 flood in Rochester was provided too late and was inaccurate in terms of height and timing of the peak. The NCCMA predicted a flood peak of 114.8m AHD (or 400mm higher than the November/December flood) at the gauge at the bridge on the Kyabram – Rochester Road. The actual level reached was around 115.2m to 115.3m (as the gauge near the bridge in Mackay Street was overtopped a survey of residual flood marks has determined this level) at the bridge ie 400mm to 500mm higher than predicted. The time of the peak was predicted as 10.00pm on Saturday 15 January 2011 or into the early hours of Sunday morning with perhaps two peaks. Only one peak occurred arriving at 5.45pm on Saturday. The mapping showing the extent of the flooding based on 114.8m was not produced until after the community meeting on the afternoon of Friday 14 January and therefore was not available for communication at the meeting.

If the community had had better information on the flood height they would have been able to lift personal items, such items as furniture, out of harms way and move cars to higher ground, thus reducing the cost of damages.

It appears that the NCCMA is insufficiently resourced to be able to either undertake the required flood studies in advance of any flood or provide accurate flood height predictions and relevant mapping during an event within the time required.

The NCCMA should be sufficiently resourced to undertake flood studies, flood analysis, provide flood height predictions and mapping, and provide accurately and timely information to the emergency service agencies and the community during a flood.

Given that the Council was given a “heads up” from the local SES on Thursday 13 January at 9.45pm that there could be serious flooding on the Campaspe River and in Rochester, and given that the community meeting was held at about 2.00pm on Friday 14 January some 16 hours later there was only about 27 hours remaining for the community to act before the peak arrived. The period from 9.45pm Thursday to 2.00pm Friday was lost time when the community could have been preparing.

Flood predictions need to be made and warnings provided to the community in a timely manner, given the short time frame between the “heads up” and the peak arriving. That is, the processes and resources available need to be appropriate to the particular circumstances.

**Pre Mapping Flood Scenarios**

An approach that would assist both the NCCMA and the community to respond to a particular event is to produce a range of flood mapping in advance for different recurrence interval flood events. This could be an output from the Flood Study.
**Property Buyouts**

In Echuca the low lying properties south of Warren Street were inundated in the January 2011 flood. The Department of Sustainability and Environment had a scheme to (non-compulsorily) buy back private property in this area following the floods in the 1974 and 1975. This was a result of a strategy developed by the State Rivers and Water Supply Commission and the City of Echuca with property purchases commencing in 1980. A large number of properties were purchased however the purchases ceased in about 1991. No purchases have taken place in recent years. There are about twenty private houses remaining in the area. Having houses situated in a flood plain puts properties and lives at risk during a significant flood event, including emergency service personnel who may be involved in evacuations.

Included in Appendix 4 is an aerial photograph showing the properties previously purchased. The scheme to purchase properties through non-compulsory acquisition in the area south of Warren Street should be reinstated to purchase the remaining properties as they become available.

**Emergency Management Resources**

The skills and training of emergency service personnel can have an effect on the ultimate impact a flood may have on the community. So too can the number of personnel and plant and equipment available. During the floods the SES was clearly unable to provide sufficiently professional emergency management personnel to operate over an extended period of time. If the SES is to be the control agency for floods (as is prescribed in the Emergency Management Manual Victoria) then it needs to be resourced accordingly.

**Management of Reservoirs**

The Rochester community had concerns about the management of Lake Eppalock and its role in flood mitigation and how it affected the flood peak. Although it is understood that Lake Eppalock is not designed for flood mitigation, it should be operated so that it achieves the best protection downstream within other obligations.

**Emerging Technology**

During the January 2011 floods a private resident who was upstream of Rochester set up a Facebook page providing information on the latest flood heights. Apparently this was used by a number of other residents to stay informed based on first hand real time knowledge. It also provides for two way communication. There have been discussions across Australia in recent times amongst emergency service agencies, particularly triggered by the Queensland floods, regarding how to best use social media during emergencies.

The role of social media in emergency management should be investigated.

Other web based technology allows residents to “opt in” in to a telephone alert system. The system provides for telephone alerts to be automatically directed to those properties at risk from a specified flood peak. If the call is answered a recorded message is played with the current information. If the call is not answered the first time the system can be set to redial at intervals. However this relies on good modelling of flood waters and a knowledge of the floor levels of all properties likely to be affected.

**4.1.1.2 Structural**

**Levees**

The discussion on levees is dealt with under section 4.2 Management of Levees.
Raising Existing Buildings
Another form of mitigation is to raise existing buildings, and in particular houses, above a given flood level. This would generally only be economic for weather board houses where they only needed to be raised a small amount, say half a metre.

The Flood Study should identify buildings where it may be financially viable to raise a building above a specified flood level.

Critical Infrastructure
There is critical infrastructure in any community that should be protected against flooding as it is critical to the recovery of the community after the event. Examples are water treatment plants including the supply system and distribution pipes, sewer treatment plants and pipes, telephone systems and electrical substations.

A risk assessment should be undertaken for all critical infrastructure and appropriate flood mitigation installed.

The Rochester Elmore and District Health Service (hospital) required evacuation because, at a minimum it was going to become isolated and town water and sewerage would be unavailable, but more than likely it would be inundated. Sections of the hospital did become inundated including the power supply which was built at the incorrect level. Given this is a new complex, critical infrastructure such as power should have been better designed and constructed.

Improving the Efficiency of the Flood way
Improving the efficiency of the active flood ways needs to be considered based on the findings in the Flood Study.

This may include removing obstruction. Obstruction may be structural, such as disused but historic bridges, public and private buildings (this is discussed in section 4.1.1.1) or involve the management of vegetation (this is discussed in section 4.3).

Flood bypasses should be considered along with levees. Wangaratta is a case of successful use of an engineered flood way using the Hume Freeway. Thought should be given to constructing flood bypasses for smaller towns like Rochester where there is no existing levee protection, and levees may only provide limited protection or may be inappropriate (depending on the outcome of the Flood Study).

Other
An issue related to flood mitigation, as indicated above, is the network of irrigation and drainage channels criss-crossing the Shire.

Currently the Northern Victoria Irrigation Project (NVIRP) is rationalising the irrigation system. Often channels either protect properties from sheet flow or redirect sheet flow to unwanted locations. The removal of channels may have the opposite impact.

There should be careful consideration of the effect on the overland flows when considering their removal.
4.1.2 Flood Monitoring Infrastructure

There is general confusion in the community about gauge readings in metres to a local datum and gauge reading in metres to the Australian Height Datum (AHD). Community feedback to the Council suggests that they would prefer all gauges to be calibrated to AHD.

Gauges need to provide information not only to the various government agencies but also to the community in a form that has meaning to them.

For example, in Rochester, the automatic gauge is located north of the town at the syphon and is calibrated to a local datum in metres whilst the gauge that the community relates to is located at the bridge on the Kyabram Rochester Road. The bridge gauge is calibrated in metres to AHD but needs to be read manually. Taking readings at this gauge can be difficult as access can be restricted by flood waters. The gauge is split in two with a shorter section of the gauge situated near Mackay Street some hundred metres from the main section of the gauge located on the river bank. The shorter section of the gauge was covered by flood waters in January 2011 at the peak and the main section was not readable as it was isolated by the flood waters. The gauge at the bridge should be converted to an automatic gauge calibrated to AHD and this information should be provided on the BOM web site.

Further, the community generally are not aware of the level of the floor of their houses and buildings. As a consequence people find it difficult to relate a predicted flood level (particularly if it is a gauge reading to a local datum and not AHD) to their floor level. A Flood Plain Management Plan should be prepared which includes information on floor levels of buildings at risk from different recurrence interval floods. This plan should include a hydrologic and hydraulic analysis, risk and damage analysis for various recurrence interval floods and an analysis of cost benefit for potential mitigation arrangements. The level information should be provided to the building owners in a structured format, for example a FloodSafe program conducted by the SES, within the communities at risk from flooding.

An additional issue in Rochester is that there maybe only one or two days between heavy rainfall at the top of the Campaspe River catchment near Kyneton and a flood event in the town. Thus any monitoring system needs to be appropriately designed to provide sufficient information at an appropriate time to allow for analysis by the BOM and NCCMA to issue any flood warnings and then allow sufficient time for property owners to make appropriate preparations or evacuate.

The information provided also needs to be of assistance to rural property owners, not just residents of towns.

Additional or improved automatic river gauges and rain gauges in the Campaspe catchment could assist in providing more accurate and timely flood predictions.

Investigations should be undertaken into the viability of providing additional automatic river gauges at:
- the bridge in Rochester (rather than, or in addition to, the syphon)
- Elmore
- Sweenies Creek (or on Axe Creek just upstream of the Campaspe River)
- Forest Creek and
- Coliban River upstream of Eppalock.

Additional automatic rain gauges should be considered for:
- the upper Campaspe River catchment.
Consideration should also be given to updating the manual gauge on the Campaspe River at Rose Street in Echuca. Although set up to automatically record data on water quality for the NCCMA, it needs to be read manually for river height. It should be upgraded to automatically provide river heights. This would assist in tracking the passing of any flood peak.

Further NCCMA flood analysis, prediction and mapping capabilities need to be better resourced to ensure that they can provide accurate and timely information to the emergency service agencies and the community.

In the area between Rochester and Echuca the river fans out onto the flood plain and extends many kilometres across when in major flood. There are numerous farms in this area. The only mapping provided on the extent of the flooding arrived too late.

In each of the flood events overland flooding originated south west of Rushworth in the rolling forested hills and made its way into the Wanalta Creek and Nine Mile Creek. These creeks head northwards and spill into low lying country containing the One Tree and Two Tree Swamp and Wallenjoe Wetland and eventually discharge into the Murray or Goulburn Rivers in the north of the Shire.

In September 2010 in the Wanalta/Colbinabbin area, two houses were inundated above the floor and many roads and farm paddocks were inundated, in some cases seriously affecting crops.

Despite the seriousness of this event there was no information provided at all, either in terms of the extent or timing of the flooding. Better monitoring is required in this area.

As various authorities including the BOM, the NCCMA, GMW, and the SES are responsible for a range of interlinked activities including predicting flood heights and flows, managing the irrigation system and responding in an emergency they should jointly develop protocols to provide for appropriate flood monitoring, prediction and response.
Response

1. To achieve a good understanding of the behaviour of a flood in a given catchment a Flood Study should be undertaken. The final results and conclusions should be included in a Flood Plain Management Plan.

2. The SES should be adequately resourced with education officers and should undertake a FloodSafe program in at risk communities.

3. The Urban Flood Zone, Flood way Overlay and the Land Subject to Inundation Overlay (LSIO) mapping in the Planning Scheme should be updated.

4. There should be interim development controls on floor levels for new developments on any land that was recently flooded.

5. The process for issuing Emergency Alerts needs to ensure that they are timely, complete and accurate.

6. The community needs to be educated on the purpose of the Emergency Alert system.

7. The Bureau of Meteorology website should provide information in a form that is relevant to the affected communities.

8. Traditional information and warning systems such as the distribution of newsletters and public meetings should continue and be targeted to the specific needs of the affected communities.

9. The North Central Catchment Management Authority should be sufficiently resourced to undertake Flood Studies, flood analysis, provide flood height predictions and mapping, and provide accurately and timely information to the emergency service agencies and the community during a flood.

10. The scheme to purchase flood affected properties, through non-compulsory acquisition, in Echuca south of Warren Street should be reinstated so that the remaining properties can be purchased.

11. For the SES to act as the control agency for floods it needs to be resourced appropriately.

12. The role of social media and other web based technology in emergency management should be investigated.
13. Any Flood Study should identify buildings where it may be financially viable to raise a building above a specified flood level.

14. When Northern Victoria Irrigation Renewal Project considers the removal of any existing irrigation channels there should be careful consideration of any possible adverse effects on overland flows.

15. Any flood monitoring system needs to be appropriately designed to provide sufficient information at an appropriate time to allow for analysis by the BOM and NCCMA to issue any flood warnings and then allow sufficient time for urban and rural property owners to make appropriate preparations or evacuate.

16. Investigations should be undertaken into the viability of providing additional automatic river gauges at:
   - the bridge in Rochester (rather than, or in addition to, the syphon)
   - Elmore
   - Sweenies Creek (or on Axe Creek just upstream of the Campaspe River)
   - Forest Creek
   - Coliban River upstream of Eppalock
   - Rose Street in Echuca

16. Investigations should be undertaken into the viability of providing additional automatic rain gauges at:
   - the Campaspe River upper catchment

17. Better flood monitoring is required in the Wanalta/Colbinabbin area.
Section 4.2: Management of Levees

The management of levees across Victoria, including ownership, responsibility and maintenance on both public and private land.

In the Shire, flooding could generally be categorised as two types. One is riverine flooding and the other is flash flooding. Flash flooding, for example, could be sheet flow through paddocks or localised urban flooding due to drain capacity being exceeded. Generally levees are constructed to protect property against riverine flooding however they can protect against flash flooding. They can also prevent water from escaping if flooding comes from an unexpected direction.

Levees along the Murray and the Goulburn rivers have been constructed to protect against riverine flooding. Sometimes they are built on private property and sometimes on crown land. Often they have been built during or in response to a specific flood event. Some have been funded by private property owners and others have been funded, at least in part, by governments. The exact history of many of these levees is not known, nor is the structural integrity known, nor the design flood height. Further the levees that have been built without formal approval have generally been allowed to remain in place. Little or no maintenance has been carried out on them in recent years, particularly the levees located on crown land. The NCCMA has maps showing the location although not the heights of most of the levees along major rivers.

The levee system built around Echuca was constructed as part of a formal scheme initiated by the former State Rivers and Water Supply Commission following the floods in the 1974 and 1975. The scheme was in accordance with section 33 (b) of the Water Act 1958 and Division 8 and Part XXI of the Local Government Act 1958. The construction of the levees was completed just prior to the 1993 floods. In the scheme Council was responsible for the construction and ongoing management. The levees were constructed to give a known level of flood protection and to a known engineering standard. The Council contributed 20% towards the cost with the remainder being equally funded by the State and Federal Governments. Council undertakes regular inspections of the levees and also undertakes their maintenance.

The levees are located on crown land, road reserves or in easements on private property. One section is located on Coliban Water land protecting the water treatment plant and responsibility for maintenance needs to be clarified.

A significant issue for Council will arise if the levees either need to be replaced or extended. The scheme did not make it clear who was responsible for the cost of renewal or extension, only that Council was responsible for the ongoing management. In either case the financial burden would be beyond Council. This is not surprising as Council originally couldn’t afford to fund the construction. It would be inappropriate for Councils to rely on vagaries of grant funding to renew such an important piece of infrastructure at the end of its life.

Funding for renewal of urban levees at the end of their lives needs to be resolved and a renewal funding program developed which involves Councils and the State and Federal Governments.

Also there are many levees constructed to protect agricultural properties against flash flooding causing damage to crops and pasture. Generally these are constructed on private property. They can be found in the Runnymede and Muskerry areas, in the area east of Rochester and around the Wanalta/Corop area. In many, if not most cases, these levees have been built without formal approval and therefore any mapping is limited.
Although these levees may protect an individual’s farm, often they have the unintended consequence of redirecting flows onto other people’s properties or roads. Aggrieved landowners often approach Council with an expectation that Council will conduct a drainage investigation into the changes these levees have made to overland flow paths and then put in place actions to correct the problem either through enforcement or works. Generally this is well beyond Council’s capacity or legal responsibility but there does not seem to be any organisation responsible for the planning and maintenance of the overland flow path in rural areas. That is, there is no regional drainage authority for rural areas. In urban areas the Water Act prescribes who is responsible for regional drainage however this is not true in rural areas.

One further complication in an irrigation area such as the Shire of Campaspe is the effect that the irrigation channels and drainage channels have on the natural flow of flood waters. Land use and development in the area is significantly different to what it was when the irrigation system was laid out a century ago. Consequently these channels may now have adverse effects on private land, roads and buildings in a heavy rain storms or floods.

Levees will not be managed appropriately until their ownership or the body responsible is determined and appropriate funding and resources are provided. Also there are issues of liability and insurance to resolve to provide for the appropriate protection of the responsible body.

Amendments should then be made to the Water Act, the Local Government Act and the Catchment and Land Protection Act to prescribe responsibilities and liabilities in regard to maintenance, renewal, management and ownership of levees. Also the responsibility for regional drainage in rural areas needs to be prescribed. This should include the authority to plan and carry out works and take enforcement action against the construction of illegal structures when required. Additional funding should be provided through the NCCMA to undertake essential maintenance in the short term.

4.2.1 Ownership

As stated above, along the Murray and the Goulburn rivers some levees are built on private property and some on crown land. Some have been funded by private property owners and others have been funded, at least in part, by governments, even those on private property.

The levee system built around Echuca was constructed as part of a formal scheme initiated by the former State Rivers and Water Supply Commission following the floods in the 1970’s. The scheme makes Council responsible for the construction and ongoing management. It is not clear what “ongoing management” means. Does it mean that Council owns them? Does it mean Council is required to fund the renewal of the levees at the end of their lives?

There are many levees constructed to protect agricultural properties against flash flooding causing damage to crops and pasture. Generally these levees have been constructed by the owner at the time on their property.

Levees will not be managed appropriately until their ownership (or who is legally responsible) is resolved and appropriate funding and resources provided.

4.2.2 Responsibility

There is some anecdotal evidence that the Board of Land and Works constructed levees in the region, some on private land and some on public land, from the start of the century up until it was abolished in 1964. However extensive details are not known. If this is true, the State government could have some responsibility for the operation, maintenance and renewal of levees in the region.
In more recent times Catchment Management Authorities have a role under the Water Act “to provide, operate and protect drainage systems …. and designated lands or works within its district” where they have waterway management districts. However it is understood that the declaration of waterway management districts is limited. Where waterway management districts have been declared the responsibilities would include a strategic overview of all levees and whether they provide appropriate protection to property and land, the design flood recurrence interval and design flood height achieved, and whether the standard of construction and maintenance is appropriate. Mapping of the existing levees is inconsistent and to varying standards. The NCCMA is not resourced sufficiently to carry out this role in a comprehensive fashion.

There is an additional issue for areas adjacent to the border with NSW in that any addition or change to a levee system in NSW can adversely affect the area in Victoria.

It should be noted that the Department of Sustainability and Environment commenced a project into levees several years ago with a view to resolving issues such as responsibility, ownership, maintenance, liability and other legal matters. The project was never completed however the information collected should be reviewed.

Levees will not be managed appropriately until legal responsibility for their operation, maintenance, renewal and management is resolved and appropriate funding and resources provided.

### 4.2.3 Maintenance

The Victorian Office of Water state on their web page at


that *maintenance* of levees are the responsibility of the following:

- Private landowners are responsible for maintaining levees on their land. They may be required to obtain a planning permit to undertake works from their local Council.
- Local councils and/or Melbourne Water are responsible for maintaining levees which protect urban communities.
- There are a smaller number of levees on public land built many decades ago which have no clear ownership responsibility.

In the third bullet point, it is not clear why it is stated that levees on public land “have no clear ownership”. Firstly it would seem reasonable that a levee on public land would be the responsibility of the public land manager to *maintain*, in a similar fashion to the owner of private land being responsible to maintain levees constructed on their land, as indicated in bullet point one. It also raises the question as to whether there are any government funded levees on private land that should not be up to the private land owner to maintain. Secondly it would seem reasonable that any levee of long standing that is on public land is the responsibility of the Government Department that is the public land manager and they should either, maintain it, modify it or remove it. Of course appropriate resources would be required, such as funding to undertake an investigation into the levee’s history, perhaps engineering investigations to determine the integrity of the levees, and maintenance and renewal funding.

As indicated earlier, the levee system built around Echuca was constructed as part of a formal scheme initiated by the former State Rivers and Water Supply Commission following the floods in the 1970’s. The scheme indicates that Council is responsible for “ongoing management”. Council has undertaken routine maintenance as part of this obligation but it is not clear how far “ongoing management” extends. Does it include renewal at the end of its life?
The responsibility for maintenance and management of the section of levee constructed on Coliban Water land which protects the water treatment plant needs to be clarified. This land also contains a gate valve which needs to be accessed during a flood to protect the local urban area. The valve prevents flood waters flowing up the stormwater pipe system operated by Council.

As mentioned above, additional funding should be provided through the NCCMA in the short term to undertake any essential maintenance on levees located on public land until responsibilities can be clarified.

4.2.3 Other

Amendments should then be made to the Water Act, the Local Government Act and the Catchment and Land Protection Act to clarify responsibilities and liabilities in regard to maintenance, renewal, management and ownership of levees.
Response

1. Funding for the renewal of urban levees at the end of their lives needs to be resolved and a renewal funding program developed which involves Councils and the State and Federal Governments.

2. Additional funding should be provided through the North Central Catchment Management Authority to undertake essential levee maintenance in the short term.

3. The ownership of levees (or who is legally responsible) needs to be resolved, and appropriate funding and resources provided, to ensure they are managed appropriately.

4. The State government may have constructed levees in the region, some on private land and some on public land, from the start of the century up until the 1960’s in which case it could have some responsibility for the operation, maintenance and renewal of these levees.

5. The North Central Catchment Management Authority should be sufficiently resourced to take a strategic overview of all levees including mapping of levees, determining if they provide appropriate protection to property and land, assessment of the design flood recurrence interval and design flood height achieved, and whether the standard of construction and maintenance is appropriate. Cross border issues should also be included.

6. The Department of Sustainability and Environment commenced a project several years ago into levees across the State and, although the project was never completed, the information collected at that time should be reviewed.

7. It would seem reasonable that any levee of long standing that has been constructed on public land is the responsibility of the Government Department that is the public land manager and that they should either, maintain it, modify it or remove it. They should be resourced accordingly.
8. In regard to the levee system built around Echuca as part of a formal scheme initiated by the former State Rivers and Water Supply Commission where the scheme indicates that Council is responsible for “ongoing management”, it is not clear how far “ongoing management” extends. For example, does it include the levee built around the water treatment plant operated by Coliban Water? Does it include renewal at the end of its life or just maintenance? These responsibilities should be clarified.

9. Amendments should then be made to the Water Act, the Local Government Act and the Catchment and Land Protection Act to clarify responsibilities and liabilities in regard to maintenance, renewal, management and ownership of levees.

10. The responsibility for regional drainage in rural areas needs to be prescribed.
Section 4.3: Waterways Management

Waterways management, including the nature and extent of vegetation clearing activities within waterways and their general maintenance.

The flood event which caused the most damage in the Shire occurred on the Campaspe River in January 2011. In particular, it caused wide spread flooding of houses and properties in Rochester and the rural area between Rochester and Echuca. In Echuca a number of properties were inundated with a limited number of houses with above floor inundation.

As a result of the flooding in Rochester there was significant damage to buildings and their surrounds. Gardens and lawns were covered in silt. In some cases gardens were destroyed from prolonged inundation. Buildings had damage to electrical and gas systems, plaster board, floor coverings, furniture and fittings, under floor air conditioning ducts, etc. Roads, footpaths, nature strips and medians were also covered in silt and the river side reserves were again affected with trees becoming unstable and park furniture and paths being damaged.

The Army undertook a Rapid Impact Assessment (RIA) on 20 and 21 January 2011 in Rochester. The assessment found the following:

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Damage Code</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caravan</td>
<td>Damaged Habitable</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Damaged Uninhabitable</td>
<td>4</td>
</tr>
<tr>
<td>Caravan Total</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>House</td>
<td>Damaged Habitable</td>
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</tr>
<tr>
<td></td>
<td>Damaged Uninhabitable</td>
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</tr>
<tr>
<td></td>
<td>Undamaged</td>
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</tr>
<tr>
<td>House Total</td>
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</tr>
<tr>
<td>Other</td>
<td>Damaged Habitable</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Damaged Uninhabitable</td>
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</tr>
<tr>
<td></td>
<td>No Data</td>
<td>1</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>Other Total</td>
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</tr>
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<td>Shop/Business</td>
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<td>Damaged Uninhabitable</td>
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<td></td>
<td>Undamaged</td>
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<tr>
<td>Shop/Business Total</td>
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</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td>1021</td>
</tr>
</tbody>
</table>

Ultimately it was determined that over 250 properties had above floor inundation in Rochester and that all businesses in the town were directly affected.

In Echuca the Rapid Impact Assessment undertaken by the CFA, Parks Victoria and Department of Sustainability and Environment crews on the night of 17 January 2011 indicated that around 80 properties had inundation on the block with some having shedding inundated. Ultimately it was determined that less than ten houses were inundated.
The North Central Catchment Management Authority (NCCMA) has jurisdiction over the Campaspe River along with other rivers in the region including the Avon-Richardson, Avoca, and Loddon.

The NCCMA has a diverse range of activities that it is required to undertake to protect and improve rivers and the natural environment.

These activities include:
- undertaking projects to restore river health;
- funding on-ground works to protect and improve the environment;
- overseeing the use of environmental water to improve the region's rivers and wetlands;
- using the best available science in all projects;
- investing in biodiversity improvement along rivers and other sites with high environmental value.

Over many decades the riparian zone on the Campaspe River has been degraded by development including agricultural activities, particularly stock grazing.

In general the NCCMA doesn’t clear native vegetation from waterways to “improve” the flow. They are more likely to be clearing invasive species and replanting with indigenous species.

It has, in more recent times, undertaken re-vegetation along the riparian zone to restore previous damage.

There has been recent research which indicates that clearing the riparian zone can have the effect of increasing the peak flow and the peak height in a flooded river and that re-vegetation reduces the peak height and flow ie it reduces the risk of flooding but extends the duration.

It has been assumed in the past that clearing waterways reduces the risk of flooding. This belief partly arises from the fact that for many decades landholders were encouraged to clear streams to “improve flow”. In fact clearing waterways can have the opposite effect. The case for this is outlined in the Australian Government Land and Water Australia publication Principles for riparian lands management, Chapter 5, Managing the effects of riparian vegetation on flooding by Ian Rutherfund, Brett Anderson and Anthony Ladson February 2007. This can be viewed at:


Its conclusions include, in part:

- Adding or removing large wood (snags) in streams has little effect on the height and duration of large floods.
- At catchment scale, the cumulative effect of riparian revegetation is to increase flood stage[height] and duration in headwater streams (where flooding is usually not a problem anyway), but decrease flood stage in larger streams, further downstream, where flooding may in the past have been a problem (local-scale versus network-scale effects).
- Although the effect of riparian vegetation on flooding is modest in comparison to the effects of dams and river regulation, it should be considered in planning major revegetation works. The effect is largely positive for downstream catchments, where riparian vegetation will reduce the depth of flooding. The decreased flow depth comes at the cost of slightly longer flood durations.

Clearing of waterways to “improve flow” and “reduce flooding” may have the opposite effect. Careful consideration should be given to any adverse effects of clearing waterways before any works are undertaken.
**Response**

1. Clearing of waterways to “improve flow” and “reduce flooding” may have the opposite effect. Careful consideration should be given to any adverse effects of clearing waterways before any works are undertaken.
Section 5: Appendices
Appendix 1 – Photographs

A disc with photographs showing flooding in various areas in the Shire is included for information.
Appendix 2 – 1 in 100 Year Flood Maps

A number of maps showing the predicted 1 in 100 year flood along the Campaspe River are included for information. The extent shown approximated the actual flooding in January 2011.
Appendix 3 – Communique from Engineers Australia

The attached communiqué was an outcome of a forum convened by Engineers Australia and supported by the Institute of Public Works Engineering Australia and Consult Australia which reviewed the experiences of the January 2011 floods in Victoria. It was attended by representatives from local government, government agencies, private firms and politicians all affected by the floods.
January 2011 Floods Debrief Forum

Communique

15th – 16th March 2011

Contact: Kathryn Hurford
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Summary

A Forum, convened by Engineers Australia, supported by the Institute of Public Works Engineering Australia (IPWEA) and Consult Australia, has reviewed the experience of the January 2011 floods in Victoria and developed a seven-point plan to be considered for the improvement of future flood planning and management in Victoria.

The Forum noted that the performance of Government agencies, Local Government, community groups, and private bodies during the floods had been very good, overall, with a low level of injury and only one lost life. This was despite the unprecedented scale of the floods, which meant there were few benchmarks by which to frame the management response.

Nevertheless, such a massive event provides many opportunities to learn and prepare for future events. The Forum’s seven-point plan was prepared with this in mind, and comprises:

1. Improvements to risk-based planning for disaster management at State, Catchment and Local Government levels, including planning flood pathways through communities and particularly new subdivisions, that minimise damage;
2. A communication strategy during flood events that delivers timely, more relevant, and better targeted information to the community, by more effective use of technology; that gives more relevance in flood level prediction reporting;
3. A streamlined, upskilled chain-of-command, with clearer team accountabilities and increased resources and training for both professional and volunteer staff;
4. Infrastructure improvements to the warning systems, especially to the network of flood gauges;
5. More flexibility for Councils to respond to the needs of recovery, including in procurement of goods and services during both the disaster and the recovery and options for 'building back better' rather than simply replacing assets with like infrastructure that proved inadequate during the flood; an appreciation that in many Rural Councils, contractors are not available and Councils have the resources to rapidly restore community infrastructure;
6. Better knowledge resources including better catchment flood models for flood planning and clearer responsibilities for, ownership and operation of, water assets and particularly levees; and flood control infrastructure; and
7. Improving public understanding of disaster risk management and factoring potential flood liabilities into any assessment of approvals for land use, especially for urban development and farm settlements.
Background

The purpose of the Forum was to review the recent experience of the unprecedented 2011 Victorian floods and draw out lessons for the future. Participants included Council Engineers, Asset Managers and Agency Representatives.

While Council Engineers do not always have lead responsibility for disaster planning and response, they do manage engineering works and public assets and advise Councils on planning and development issues for private assets. Engineers therefore, have a major stake in the effectiveness of the response to floods and other natural disasters and make key inputs to the planning, management and recovery of disaster events.

The Echuca Forum, held 15-16 March was attended by 50 participants from 16 Councils and other involved Agencies. The Program for the Forum, provided in Appendix A, comprised presentations from all Councils represented, Government Agencies and relevant Consultants. The presentations will be available at a later date.

Following the presentations, discussions at the Forum identified seven key areas for action. These are outlined below.
**Action 1: Improving risk-based planning for floods**

The Forum noted that, unlike bushfires, floods had a high degree of predictability of areas likely to be affected. The response to floods should, in principle, therefore be far better planned. Yet, floods still cause far more damage than bushfires.

The Forum concluded that planning for future floods should be risk-based, with assets identified both in terms of their exposure to the extent of flooding and the value of the asset. This would facilitate planning for protection of key assets and minimisation of total economic, environmental and/or community loss.

Specifically, the Forum recommended that:

1.1 The State Government should review the broad, State-wide flood management plan to provide more detailed plans prepared by Catchment Management Authorities (CMAs). The plans developed by CMAs should be audited, with the risk-based flood plan developed by Melbourne Water used as the 'best-practice' model.

1.2 This flood plan should also identify 'flood pathways' that provide known-volume capacities for taking floodwaters. Best practice approaches are available in the Netherlands, where 30% of land is subject to flooding. Commercial, industrial or residential development on these flood pathways should only be undertaken if the benefits outweigh, and can finance, the flood risk that the development incurs.(see Action 7).

1.3 All existing levees should be identified the historical purpose of the levee should be reviewed and then a long term associated plan developed for the maintenance and/or re-engineering of the levee system within a catchment to optimise overall water management, including future floods. The responsibility for this infrastructure should be clearly defined.

**Action 2: More effective communication during flood events**

The Forum noted that while communication problems could be expected in a disaster situation, many towns had good notice of the impending floods but many in the community were uninformed both on the progress of the flood and on the measures they should take for defending against or evacuating from the flood.

There were also many instances of misinformation, either because of misinterpretation of information provided or rumours that started in the absence of definitive information.

The Forum identified measures for better targeting of information in language that gave clear instructions to affected people, as well as better use of communication technologies, including:

2.1 More precise geographic targeting of information - using the risk-based plan developed under Action 1 to target specific neighbourhoods rather than simply broadcasting about whole towns being under threat. This would also facilitate more direct and relevant advice to individuals.
2.2 State Emergency Service (SES) staff should practice greater use of local knowledge in formulating communication plans, including targeting not only neighbourhoods at risk but also identifying special needs households such as the elderly or socially-isolated.

2.3 Using the Internet to provide real-time information on the progression of the floods, including updates from the VicRoads website on the status and threats to roads. The websites provided in North-eastern NSW provide a best-practice model for this. Responsibility for information provided to the VicRoads site should be shared with the SES and CFA, as the underlying geographic data can be shared. A more relevant Map Based Reporting system should be developed, to enable the Public to more easily plan safe routes of long distance travel in times of flood.

Action 3: Clearer chain of command and organisational co-ordination and capacity

Although the overall flood response had been good, many Councils felt that the current divide between the Incident Control Centre, Divisional Command and the Municipal Emergency Coordination Centre (MECC) that coordinates municipal resources could be improved. Community capacity to respond to the disaster had been patchy, with skills and systems less well-developed than for bushfires.

3.1 A Local Government Liaison Officer should be automatically represented at the Incident Control Centre, Divisional Command to ensure efficient and effective use of municipal resources and knowledge during operations.

3.2 Streamline decision-making and communication. Processes between the MECC and the Incident Control Centre (ICC) to ensure that limited Local government and Agency resources, are used effectively and effort is not duplicated.

3.3 SES should be resourced to provide enhanced training of key individuals in disaster response, including Agency staff, elected officials (especially Mayors) and volunteers. SES and Councils, where flooding is an identified risk, should be audited to ensure that they hold regular exercises/drills in responding to flood disasters. The availability of training through the Australian Emergency Management Institute, Mt Macedon Civil Defence Training College should be made more accessible and affordable, to Local government staff.

3.4 SES and CFA should collaborate on flood exercises, especially in smaller municipalities where limited personnel may be common for many disasters.
**Action 4: Maintaining Flood Warning Infrastructure**

The Forum noted that some flood gauges had failed during the flood. Communities also had difficulty extrapolating flood level warnings to their local neighbourhoods - it wasn't clear, for example, how, for example, a 2m flood level at the gauge (vs AHD) would translate to individual households well distant from this measuring point. The use of AHD level reporting for all flood reporting would be more relevant. Households in potential flood areas, should have clearly identified AHD levels for floor levels. There is also some confusion over where responsibility for water assets (levees, channels etc) and 'orphan assets' were among the first to fail during the floods.

4.1 CMAs should be responsible for ensuring a network of appropriate flood gauges is maintained and functional - where third party gauges with multiple uses are included in the Network, CMAs should have responsibility for ensuring their operability to AHD standard.

4.2 Flood levels should be indicated at neighbourhood level - eg 2m flood could be indicated on a local power pole - to allow householders and local businesses to relate the threat directly to their properties. This has been implemented successfully in some areas.

4.3 Ownership of all water assets should be made clear - either via legislation covering different classes of assets or audited registers of assets, with responsibility for those assets agreed between State agencies, CMAs, Councils and private owners.

**Action 5: Flexibility during response and recovery and building back better**

During the disaster and the recovery, sometimes the easiest way to respond is for Councils to use their own staff and equipment rather than external contractors. But this is currently discouraged because State and Federal government grants do not fund work undertaken by Council staff, even if it is clearly disaster related. They fear Councils are 'double-dipping', although it usually means that other Council work is delayed and so contractors will subsequently be needed to make up the lag on routine work. In many local Government Areas, contract options may not be available, delaying reinstatement and significantly increasing costs.

5.5 Councils and State/Federal authorities should develop procedures that allow Council resources to be used and funded for disaster-related work where this leads to the best long term community outcomes, with safeguards against Councils using this to their own financial benefit. State and Federal funding bodies also usually only provide funding for the replacement of an asset with an equivalent asset destroyed during a flood. But the failure of these assets during a flood may mean that it makes more economic or environmental sense to upgrade rather than just replace them. The possibility of 'building back better' should be available. Consequently, the Forum recommended that:

5.6 Councils and State/Federal agencies should develop guidelines to allow for destroyed assets to be 'built back better' where this makes economic or environmental sense, with an equitable sharing of additional costs.
Action 6: Developing the knowledge base

Given that floods are far more predictable in terms of the area likely to be affected than other natural disasters, their impact could be significantly reduced through the capture and application of knowledge on flood behaviour. The Forum recommended that the knowledge base could be upgraded by the following measures:

6.6 CMAs should be funded by the State Government to upgrade flood models to provide enhanced prediction of flood behaviour.

6.7 The Department of Sustainability and Environment should produce a reference document or web resource on best practice flood management for use by all responsible bodies.

Action 7: Public understanding and responsibility for flood liabilities

As floods occur with irregular frequency, including long periods without flooding, the community soon forgets the experiences and effects. The continued building and development on flood plains means that economic loss is inevitable. Many households and businesses do not take out flood insurance but expect government and community support when disaster strikes. This undermines those who do go to the expense of flood insurance.

To provide more systematic assessment of flood impacts in the planning and development process, the Forum recommended that:

7.7 The risk-weighted costs of floods be included in the economic, environmental and social assessment of development proposals and that where these are significant, the developer/proponent should be required to contribute to future flood damage liabilities.

7.8 Owners of public and private assets identified as at-risk in the flood management plan should be required either, to knowingly accept the risk, either by implementing their own mitigation measures, or to take out flood insurance.
Appendix 1: January 2011 Floods Debrief Forum Program
Engineers Australia, supported by IPWEA, are convening a 1 ½ day debriefing session to enable Local Government Engineers and other Regional Operatives to discuss the events of the January floods.

This event will be an opportunity for Engineers to come together to share common experiences and will also allow for preparation and planning strategies for future natural disaster events in order to prevent similar incidents.

A Communiqué capturing lessons learnt will be developed at the end of the Forum.

**Venue**
Port of Echuca Motel and Conference Centre
465 High Street, Echuca T (03) 5482 5666
info@qualityinnechuca.com.au www.qualityinnechuca.com.au

**PROGRAM DAY 1 : TUESDAY 15 MARCH**

**12pm – 2pm: Welcome and Registration**
Meet and greet over a light luncheon

**2pm – 5pm: Open Forum**
“Share your January, 2011, flood management experiences with like minded engineers and operatives.”

An opportunity for each Municipality to outline their experience – what worked, what did not. Presentations will be made by:
- Campaspe Shire
- Hindmarsh
- City of Geelong
- Central Goldfields Shire
- Horsham Rural City
- Pyrenees Shire
- Gunnawarra
- VicRoads
- Followed by a presentation by the Department of Treasury and Finance on Funding and Disaster claims issues and processes (with Q&A).
6:30pm: Forum Dinner
Guest Speakers: John Forrest MP, Mr Mal Kersting
Semi casual dinner, allowing for further networking and consideration of issues. Guest speaker John Forrest, Federal Member for Mallee and Fellow of Engineers Australia, will present on the implications of the January 2011 Flood Events. A second guest speaker will be Mr Mal Kersting, Regional Director, VicRoads Northern Victoria.

PROGRAM DAY 2: WEDNESDAY 16 MARCH

8:30am – 10:30am: Emergency Management Issues
Andrew Gissing, Director of Emergency Management and Communication, SES, Dr Andrew Barton, GM Water and Dan Midford, North Central Catchment Management Authority will present. Information on emergency plans and flood planning will be discussed.
“Find out what worked and what did not work in the Flood Events.”

10:30am – 11:15am: State Flood Management Strategy
Nick Ronan will present on the Department of Sustainability.

11:15am – 12:30pm: Open Forum (Part 1)
“What do we all have to do for better preparedness and management, next flood or storm event.”

12:30pm – 1:30pm: Lunch

1:30pm – 3pm: Open Forum
“What do we all have to do for better preparedness and management, next flood or storm event.”

3pm – 3:30pm: Communiqué
Preparation for Communiqué capturing lessons learnt for release by Engineers Australia, IPWEA and Consult Australia.

3:30pm: Close
Enjoy afternoon tea and prepare to conclude the trip.
Appendix 4 – Non-compulsory Purchase of Flood Prone Properties

Attached is an aerial photograph showing the properties coloured that have been previously purchased in Echuca as part of the scheme arising from the floods of the 1970’s. Land shown coloured green is Crown land and land shown hatched in blue has been transferred to Council.
LEGEND
Crown land coloured green
Council land coloured blue