VICSES Gippsland
Regional Earthquake Emergency Plan

A sub-plan to the VICSES Gippsland - Regional Emergency Management Plan

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Version 1.0 November 2013

This plan is produced by the Victoria State Emergency Service Gippsland and is a sub plan to the VICSES Gippsland Regional Emergency Management Plan. Ensuring the information it contains is accurate and current would not be possible without the contributions and assistance of many people from the various organisations identified within its pages.

VICSES Gippsland understands and accepts its roles and responsibilities as described in the Emergency management Manual Victoria (EMMV).

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SECTION 1 – GENERAL

1. Introduction

Gippsland in Victoria's south-east is exposed to earthquake risk from a web of fault lines that sit below Gippsland. The highest identified risk is focused on three distinct fault lines which are described in the risk section of this plan.

In order to ensure the communities of Gippsland are appropriately prepared for emergency response to an earthquake event, VICSES, in partnership with support agencies and organisations, will work together to ensure all elements of preparedness, response and recovery are effectively managed.

The collective knowledge, capacity and resources of VICSES, support agencies and organisations identified in this plan will integrate to ensure an effective and professional emergency response on behalf of the community.

2. Purpose and Objectives of This Plan

The purpose of this plan is to describe the emergency management arrangements in place which enable an awareness of risk and guide the effective management of earthquake events in Gippsland. The objectives of the plan are to identify the:

- roles and responsibilities of agencies and organisations that have a role in preparing for, responding to and recovering from an earthquake event;
- Victorian earthquake response framework that details a planning hierarchy and describes the elements that should be considered for emergency planning at State, Regional and Incident levels;
- dissemination of timely information to the community to minimise the threat and impact to people, property and the environment, as a result of an earthquake event; and
- regional response and co-ordination arrangements including strategic control priorities.

3. Activation of This Plan

This plan is active at all times and will be implemented / executed as required by VICSES for an earthquake event requiring any form of emergency activity.

4. Authority

The authority to produce this plan for VICSES Gippsland is contained under the Emergency Management Act 1986, Emergency Management Manual Victoria and the Victoria State Emergency Service Act.

5. Associated Reading

This Earthquake Emergency Plan is a Sub-Plan to the VICSES Gippsland Regional Emergency Management Plan (REMP) and should be read in conjunction with that plan, the VICSES State Earthquake Response Plan and other VICSES Regional and/or State arrangements as listed in *Appendix C – Associated Reading*.

SECTION 2 – PREVENTION

6. Risk Assessment Process for Region

Following the Moe Earthquake in June 2012, VICSES commissioned *Risk Frontiers* to determine the short to medium term seismicity of the Latrobe Valley area, perform a risk assessment and provide risk mapping for the worst case scenario. The results of that work are included in this document and in *Appendix I - Gippsland Earthquake Intelligence Cards.*

Each of the six Municipalities in Gippsland have conducted a risk assessment for earthquake for their area providing the following results.

Local Government	Risk Rating
Wellington Shire	Moderate
East Gippsland Shire	N/A
Latrobe City	Moderate
South Gippsland Shire	High
Baw Baw Shire	N/A
Bass Coast Shire	N/A

7. Earthquake History in Gippsland

Although Gippsland is located away from geologically-active plate boundaries, it has experienced earthquakes in the past. The table below provides detail of the 13 earthquakes recorded in Gippsland since 1963 with some detail of some events listed below the table.

MG	MMI	Date		Location	Depth (km)
4.4		2012	July 20	Moe (aftershock)	0
5.4		2012	June 19	Moe	10
4.4		2011	July 5	Korumburra	2
4.6		2009	March 18	Korumburra (cluster)	15
4.6		2009	March 6	Korumburra (cluster)	15
4.0		2002	September 24	Fish Creek	3
4.2	V	2000	August 29	Boolarra South	18
5.0	VI	1996	September 25	Thomson Dam	11
5.4	IV	1982	November 21	Wonnangatta Valley	33
5.0		1969	June 23	Boolarra (aftershock)	0
5.3		1969	June 20	Boolarra	19
5.7		1966	May 4	Mt Hotham	24
4.8		1963	June 14	Welshpool	2

7.1. Moe Earthquake - 2012

On the night of 19 June 2012, a magnitude 5.4 earthquake occurred near Thorpdale about 10km south of Moe. This earthquake was followed by a normal aftershock sequence with the largest aftershock reaching a magnitude 4.4. The hypocentre was at a depth of approximately 10km. The earthquake was felt up to 250km away with minor to moderate property damage reported in areas of Moe, Morwell, Trafalgar and the Latrobe Valley. It is believed this earthquake was on the Rosedale fault line.

7.2. Korumburra Earthquake Sequence - 2009

The Korumburra earthquake sequence began on the January 4, 2009 with a small earthquake of magnitude 1.5 followed on January 12 with a magnitude 3.5 earthquake. The largest events of the sequence were two events of magnitude 4.6 occurring on March 6 and March 18. This sequence did not fit the typical mainshock-aftershock pattern with each of the three largest events having its own aftershock sequence but no identifiable mainshock. The Korumburra earthquake sequence is best described as a swarm or cluster. The earthquake on March 6 had an epicentre approximately 96kms south east of Melbourne, north of Korumburra at a depth of around 15km. This earthquake was felt throughout the Gippsland region and as far as 200km away. The subsequent earthquake on March 18 had an epicentre about 5km north of Korumburra at a depth of 15km.

7.3. Boolarra Earthquake - 2000

The Boolarra earthquake was a magnitude 5.0 earthquake and occurred on 29 August 2000 just west of Boolarra in Gippsland and 130km southeast of Melbourne. There were unconfirmed reports of minor damage in Gippsland where it was felt strongly. It was felt in all suburbs of Melbourne. It had only one recorded foreshock of magnitude 2.6 and an aftershock with a magnitude of 1.5.

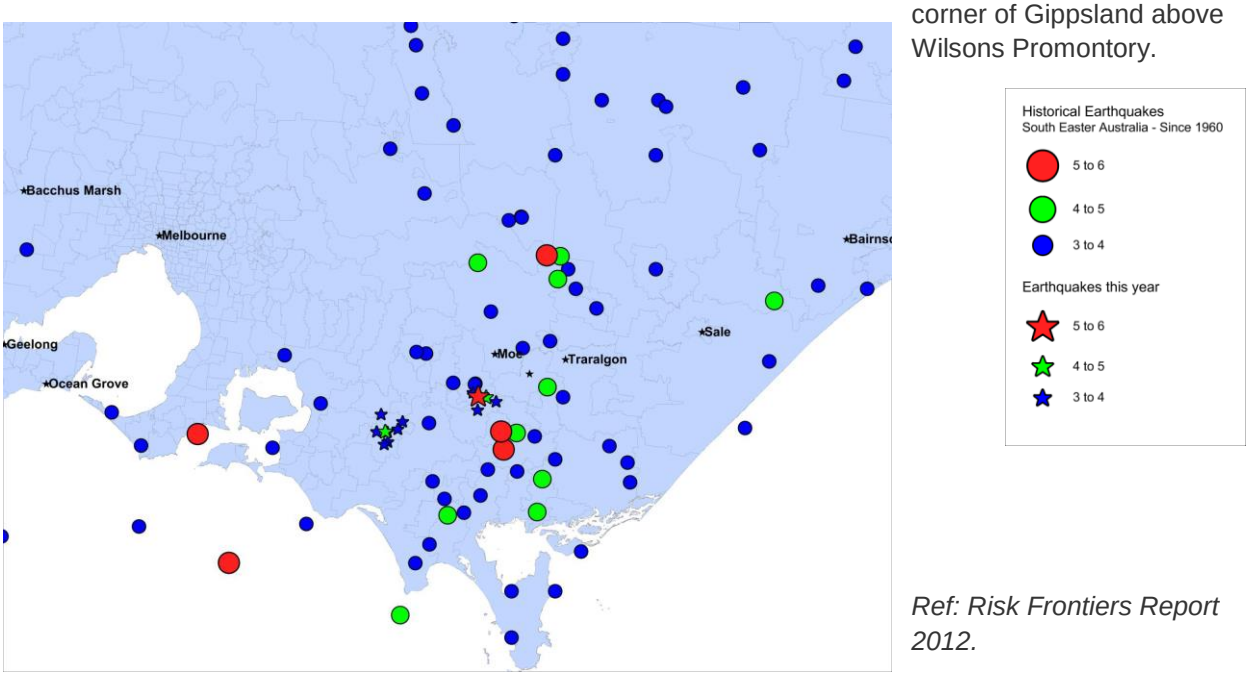
7.4. Wonnangatta Earthquake - 1982

On 21 November 1982 a magnitude 5.4 earthquake occurred near the town of Wonnangatta in East Gippsland.

7.5. Boolarra Earthquake - 1969

On 20 June 1969 a magnitude 5.3 earthquake occurred in a similar location and was of a similar magnitude to that of the June 2012 Moe Earthquake. The intensity maps of these earthquakes were also similar. The largest aftershock was on 23 June at a magnitude of 5.0.

The image on the next page gives an indication of the clustering of those earthquakes in the south western corner of Gippsland above Wilsons Promontory.



Ref: Risk Frontiers Report 2012.

8. Earthquake Threat in Gippsland

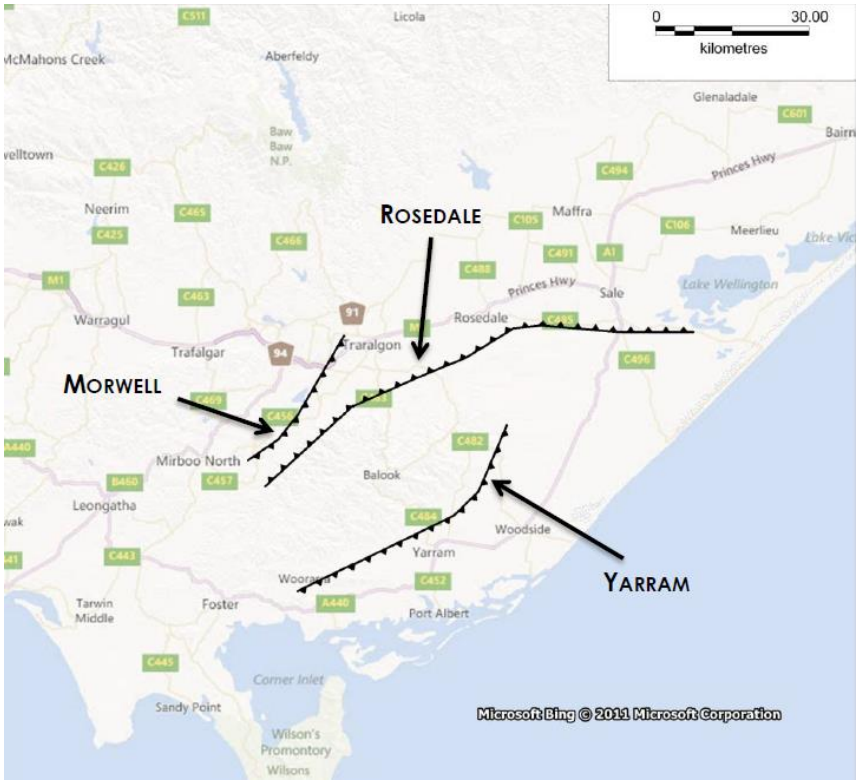
According to the Risk Frontiers Report 2012, Traralgon and the Latrobe Valley are considered the highest earthquake risk in Victoria over the next decade.

There are three (3) main fault lines which pose the greatest threat of earthquake in Gippsland. They are referred to in this document as

- Morwell;
- Rosedale; and
- Yarram.

There are other identified fault lines in Gippsland but no threat analysis has been conducted on these faults.

The Rosedale and Yarram fault lines run generally in an east-west direction to the north and south of the Strzelecki Ranges. The Morwell fault line runs in a north east direction from Mirboo North to Traralgon.



Both the Moe earthquake and the Korumburra earthquake swarm lie within what is referred to as the Morwell Hotspot earthquake source. The Morwell Hotspot has an assumed maximum earthquake magnitude of 6.0.

Based on the work completed by Risk Frontiers, the most likely scenario for a damaging earthquake in the Latrobe Valley in the next few months to years would be a magnitude 6 earthquake in the Morwell Hotspot. The worst case scenario would be an earthquake as large as magnitude 7.5, but has a much lower probability of occurrence.

Risk Frontiers statistical model for earthquake probability, which is based on historical seismicity and can have large uncertainties, identifies the area in Victoria with the highest earthquake probability as around Latrobe City Council.

Earthquakes up to magnitude 6 may be significantly more likely in the Latrobe Valley than in neighbouring regions due to the presence of the “hot spot”, which also means earthquakes larger than magnitude 6 have a much lower likelihood of occurrence.

9. Earthquake Impacts

An earthquake (also known as a quake, tremor, temblor or seismic activity) is the result of a sudden release of energy in the Earth's crust that creates seismic waves. The community recognises the occurrence of these events through the resulting shaking /vibration of the Earth's surface.

The effects of an earthquake depend on many factors, such as the distance from the epicentre and the local ground conditions.

The **size** of an earthquake is commonly measured using the Richter Scale whereas the **intensity** of an earthquake is measured using the Modified Mercalli Scale (MM). Basically the Richter Scale measures the heights of the seismic waves whereas the MM Scale measures the impacts or effects likely to be observed or felt by people at ground level. *Appendix D – Richter Scale* details the occurrence, return rate, movement and impact associated with the Richter Scale. *Appendix E –Modified Mercalli Scale* details the impacts for each intensity.

In eastern Australia, earthquakes occur to depths of about 20km. Less than 5km are regarded as shallow, while those at depths greater than 15km are deep. Shallow earthquakes cause much damage, but deep earthquakes rarely cause damage. An earthquake exceeding magnitude 7 occurs somewhere in Australia every 100 years or so.

For the very shallow earthquakes common in Gippsland, with a focal depth of less than 10km, people who are near the epicentre and on average ground will usually experience the maximum MM intensities in the table below.

Magnitude	MM Intensity
1.2	II
2.0	III
3.0	IV
4.0	V-VI
5.0	VI-VII
6.0	VII-VIII
7.0	VIII-IX

In Australia, earthquakes with magnitudes of less than 3.5 seldom cause damage, and the smallest magnitude earthquake known to have caused fatalities is the magnitude 5.6 Newcastle earthquake in 1989. However, magnitude 4.0 earthquakes occasionally topple chimneys or result in other damage which could potentially cause injuries or fatalities.

Apart from causing shaking, earthquakes of magnitude 4.0 or greater may also trigger landslides. The larger the magnitude of the earthquake, the bigger the area over which landslides may occur.

Specific earthquake impacts in Gippsland, including **state significant** impacts, are detailed in *Appendix I - Gippsland Earthquake Intelligence Cards.*

SECTION 3 - PREPAREDNESS

10. Planning

10.1. Planning Context

The development of this plan is based on a whole of government and community approach that recognises the interdependencies of prevention, preparedness, response and recovery activities and that none of these activities are mutually exclusive. Community awareness and education is integral to effective response arrangements, as response activities will be far more effective if the community has taken measures to minimise property damage and is aware of the inherent dangers of earthquakes.

10.2. Regional Planning

The successful response to an earthquake in Gippsland is dependent upon the strong relationships with key partners, each having responsibility for elements of overall earthquake management activities.

VICSES Gippsland will establish and lead the Regional Earthquake & Tsunami Committee and liaise with Victoria Police and DHS in relation to the respective Regional Emergency Management Planning Committee (RREMPC). This Plan is a sub plan to VICSES Gippsland Regional Emergency Management Plan (REMP) and will be endorsed by the VICSES Gippsland Regional Manager and VICSES Chief Officer Operations.

VICSES Gippsland will conduct a multi-agency earthquake exercise in Gippsland at least every two years test preparedness and response, unless an earthquake event has occurred in that period.

Agencies that may be involved in response to an earthquake should develop a Business Continuity Plan to address their continued ability to respond based on the consequences resultant from a serious earthquake.

10.3. Municipal Planning

Where earthquake is identified through the municipal emergency risk management process as a high risk to a community, VICSES will provide advice and support to that Municipality to ensure the Municipal Emergency Management Plan (MEMP) contains at a minimum, local arrangements for the response to an earthquake event based on all-hazards and all-agency response and earthquake specific information to address that risk.

10.4. After Action Review

VICSES will lead an After Action Review process following significant regional events which will be conducted by the Manager Regional Operations and Readiness (MROR) as detailed in the VICSES Gippsland REMP.

11. Readiness

VICSES operates an Operational Capability Information Framework (OCIF) which details the readiness and resource requirements to respond to earthquake events in Gippsland. Training, resource acquisition and membership recruitment and retention plans are targeted to achieving and maintaining these identified levels of readiness.

The locations of Regional Specialised Resources are listed in the VICSES Gippsland Regional Emergency Management Plan.

The locations of State Specialised Resources are listed in the “State Specialised Resource Location Table” which will be maintained by the State Duty Officer (SDO).

12. Community Resilience

Targeted community awareness and education programs play an integral part of effective management of earthquakes in Gippsland.

VICSES Gippsland actively encourages partnerships with key stakeholders in the delivery of education programs such as *QuakeSafe* to reduce the impact of earthquake events on the community.

QuakeSafe is a community education program designed to educate the community regarding risks associated with earthquake hazards and how to prepare for and respond to these phenomena when they occur. The program is capable of being tailored to the needs of individual communities, recognising the importance of engaging with communities regarding risks within their local area.

Community Resilience Co-ordinators are available within the region to engage with communities and organisations in the rollout and communication of earthquake risk and arrangements in place through the QuakeSafe program.

SECTION 4 – RESPONSE

13. Concept of Operations

VICSES is the Control Agency for all earthquake events in Victoria. Operational response arrangements are generally described within the *VICSES Operations Management Manual 2013*. Other agencies are to support operations as detailed in this Plan.

As the Control Agency for earthquake, VICSES has the responsibility to issue warnings to the potentially affected community and to other agencies. The possibility of aftershocks following an earthquake event should be considered for inclusion in warnings.

There may be multiple events resulting from an earthquake (e.g. fire, building collapse, hazmat, dam failure, flooding). The designated Support Agency for any consequential emergencies is required to manage that emergency and may assume control at the incident tier.

Control and coordination of an earthquake event should be carried out at the lowest effective level of control. However, control may be established at Area of Operations tier as defined in the State Emergency Response Plan (EMMV Part 3).

As the consequences from an earthquake are varied, Incident Controllers will be appointed from appropriate agencies (based on the predominant consequential emergency arising from the earthquake) to lead incident control at the incident site and/or local level (e.g. a building collapse, fire or dam failure).

Incident Controllers at all times should ensure the occupational health safety of emergency service personnel; this includes ensuring that adequate risk treatments are implemented in the event of earthquake aftershocks.

14. Management of the Response

The VICSES Gippsland REMP clearly outlines the VICSES response to any emergency event in Gippsland. Those arrangements remain in force during the response to an earthquake event in line with the Regions all hazard approach to emergencies. As detailed above, the general operational conventions followed will be in accordance with the *VICSES Operations Management Manual, 2013*.

14.1. Regional Emergency Management Team (REMT)

The Gippsland REMT will be kept up to date with regular briefings when notifications of earthquake activity have been received. The REMT will have information disseminated via a number of means and no single means will be used to ensure that the event information has some certainty of delivery; these include;

- Teleconference (Chaired by VICSES);
- Email;
- SMS messaging;
- In person at the RCC; and
- Pager (where appropriate).

Information for updating the REMT contact list should be forwarded to the VICSES Gippsland Manager Regional Operations and Readiness.

14.2. Area of Operations Control Centre (AOCC)

The State Earthquake Response Plan requires VICSES Region's to identify suitable Area of Operations Control Centre (AOCC) locations. In the event of an earthquake the following locations have been identified as AOCC's:

- Gippsland Regional Control Centre, Level 1, 181 Franklin Street, Traralgon;

- Multi Agency ICC Facility, Princes Highway Pakenham; and
- DEPI (DSE), Main Street, Bairnsdale.

It is understood the nature of a major earthquake may see widespread damage and it is likely that many facilities will be affected. Traralgon and the Latrobe Valley are considered the highest earthquake risks in Gippsland (and in Victoria) therefore two alternative sites have been identified. All sites may have access restrictions to either Melbourne or the impact zone depending upon the epicentre location.

A guide to when an AOCC might be activated is included in *Appendix G – ICC Preparedness Levels / Response Matrix.*

14.3. Incident Control Centre

The decision to activate an ICC rests with VICSES and can occur due to public requests for assistance or assessed risk to the community. A guide to when an ICC might be activated is included in *Appendix G – ICC Preparedness Levels / Response Matrix.*

VICSES Gippsland will advise the EMT and Unit's (via SMSer, Pager, Email or Teleconference as needed) that the ICC is to be activated, when it will be activated and the location it will operate from; including contact numbers and who the Incident Controller will be.

Pre-established and designated ICC's within Gippsland have been identified and are listed in the VICSES Gippsland REMP.

14.4. Divisional / Sector Command Points and Units

Pre-determined Divisional Command Points are listed in the VICSES Gippsland REMP.

15. Response Actions & Responsibilities

This plan has been separated response into two (2) definitive stages:

- Immediate Response (24 hours); and
- Sustained Response (Day 2-7).

Actions and responsibilities in each stage are discussed below.

15.1. Activation and Tasking

VICSES Gippsland Units will generally be activated for emergency response by the Emergency Services Telecommunications Authority (ESTA). The community should call 132 500 if they require assistance with earthquake impacts. It is noted however that 000 and 132 500 are likely to be overloaded during the initial earthquake response given the natural concerns which are raised from such a no-notice event.

The Unit Duty Officer (UDO) is responsible for identifying the response capacity of the Unit for incidents that occur locally by advising the Regional Duty Officer (RDO). The requirements for UDO's to notify the RDO are detailed in VICSES Standard Operating Procedure *(SOP) 004.2 – Unit Duty Officer Aide Memoire*.

16. Immediate Response (24 hours)

There are many parts to the immediate response to an earthquake incident however there are 8 critical components:

- Incident Control;
- Impact Assessment;
- Urban Search and Rescue (USAR);
- Mobilisation & Logistics;

- Public information;
- External assistance;
- Initial Medical Response; and
- Essential Services.

16.1. Incident Control

VICSES will establish an appropriate incident control structure away from the critical impact zone. All levels of control will need to adapt the existing arrangements and principles or develop alternatives to best fit the situation given the following considerations.

- A detailed common operating picture may not be achievable for 24 – 48 hours, or longer. Response will have to begin without detailed knowledge of the situation.
- Availability of EM personnel, including non-ESO agencies will depend on the time and day the event occurs.
- Fires will probably be the main hazard immediately following an event and resources may be limited due to damage caused by the earthquake and aftershocks.
- The number of fatalities may exceed the capacity of the Coroner's Office if it is operable.
- Triple Zero, if operating, will be overloaded.
- Traffic congestion will be significant due to road damage.
- Helicopters may be needed to support operational and logistical needs.
- The level of community preparedness is insufficient to significantly reduce the reliance for government and agency assistance.
- Hospitals may not have the capacity to meet the surge in patient demand.
- Due to 'just-in-time' ordering and associated logistic methodology shortage of critical items such as medical supplies are likely.
- Damage to water infrastructure may impair fire fighting.
- Weather conditions may increase the number of people in need of immediate shelter.
- Spontaneous shelters will likely be established by private entities or citizens that will not be coordinated by government or other agencies.
- The number of people seeking shelter may exceed the capacity of Relief Centres
- Social Media will be extremely active.
- Missing Persons reports could number in the hundreds or thousands.
- Private sector resources and spontaneous volunteers will require coordination to effectively and efficiently assist response and recovery.
- Donated goods will require coordination and suitable storage.
- Critical Incident Management resources e.g. ICC, RCC, AOCC, SCC, Call Centre's etc may have limited or no serviceability depending on impact areas.
- Critical Incident Management personnel at State, Regional and local levels, including responders may be unavailable due to injury or death of family or themselves, or significant damage to personal assets.
- Critical Incident Management personnel may be unable to attend Control Centres for hours or days due to gridlock and/or damage to transport infrastructure.
- Emergency Management Teams (EMT's) at State, Area of Operations and Incident levels may require members from agencies not traditionally involved in emergency management e.g. peak bodies from

public health, trade organisations or unions, civil / structural / earthquake engineers, earthmoving contactors etc.

- Agencies and agency personnel may be required to carry out roles in areas / functions in which they have not been previously involved.

16.2. Impact Assessment

It will be essential to co-ordinate the reconnaissance of affected areas to ensure the following information is collected:

- status of key infrastructure & transport routes;
- capabilities of response agencies;
- numbers and locations of injured and displaced; and
- resource shortfalls.

VICPOL have the responsibility to coordinate impact assessments which will usually be achieved in consultation with all levels of control. Early activation of this process will ensure this data is collected and communicated to all levels of government and supporting organisations, in a timely manner.

VICSES UDO's are required to report earthquake damage to the RDO as per VICSES SOP's 046 & 004. Contact with UDO's in the first instance will provide a good source of local initial impact information which will assist in decision making around establishing appropriate levels of command and control.

Aircraft will be utilised in the initial phase to collect information about the worst impacted areas. Ground observation teams will be used to undertake intelligence gathering within areas once they have been deemed safe.

Large events will require the use of dedicated Impact Assessment (IA) teams located within ICCs to co-ordinate the collected data and dedicated IA teams in the field collecting and verifying information.

16.3. Urban Search and Rescue (USAR)

The Incident Controller will task USAR resources from various agencies as detailed in the Victorian USAR Response Arrangements. *VICSES SOP 032 – Operations Involving Structure Collapse (USAR)* also details protocols for initiating USAR Cat 1 and Cat 2 personnel teams.

USAR cache locations are detailed in the State Specialised Resource Location Table which is maintained by the SDO. *VICSES SOP 048 – State Specialised Resources* details the deployment protocols for these resources. They are also listed in *VICSES SOP 032*.

If further resources are required from interstate or internationally, requests will be made by the IC in consultation with the Regional and State Controller.

16.4. Mobilisation and Logistics

The logistics function within the ICC will need to ensure considerations around the establishment of a transport and logistics system to provide resources to impacted areas and enable access to and from isolated areas. Air support may be required into isolated areas for rescue and/or supply of medical services or resupply. The VICSES Gippsland REMP provides a list of airfields that can be utilised for this purpose.

16.5. Public Information

Earthquakes can happen anywhere and at any time. Accordingly and given the unpredictable nature of earthquakes, there will be no opportunity to warn the community of an impending earthquake.

Public Messaging should commence as soon as is practicable after the earthquake. VICSES will lead public information and media management strategies to ensure the provision of timely and accurate information to the community. This is the responsibility of the State Controller, Regional Controller and/or Area of Operations Controller (where established), who may delegate this role to the Information Unit.

A list of information to include in initial warnings and key messages is at *Appendix F – Community Messaging for Earthquakes*.

Earthquake aftershock information will be based on information from Geoscience Australia.

The VICSES Earthquake Information Line (1300 VICSES / 1300 842 737) will be available to assist with public information for significant earthquake events.

All agencies will use the designated radio system with the VICSES High Frequency (HF) Radio Network utilised to maintain communications if required as a redundancy.

Messages may be sent utilising the Standard Emergency Warning Signal (SEWS) as per Appendix 14, part 8 of the EMMV or via Emergency Alert.

Methods of dissemination of public information may include:

- Emergency broadcasters (ABC radio, Sky Channel, commercial and community media outlets);
- EAS paging system;
- SMSer;
- Email;
- Internet via the SES website www.ses.vic.gov.au;
- Social media;
- VICSES Flood & Earthquake Information Line;
- Community Meetings;
- Local Government telephone or sms based warning systems;
- Emergency Alert messaging; and
- Standard Emergency Warning Signal (SEWS).

In the event that communication facilities are unavailable, alternative dissemination strategies should be considered such as:

- Doorknocking (only when safe to do so);
- Sirens;
- Mobile & Fixed Public Address Systems;
- Low flying aircraft equipped with public address systems;
- Two-way radio;
- Marine Satellite Phone; and
- Variable Message Signs.

16.6. External Assistance

Local resources may lose capacity due to damage or being overwhelmed, dependent upon the extent of the earthquake. The relevant ICC can request additional resources from the relevant RCC, AOCC or SCC.

The procedure for obtaining additional resources is to be undertaken in accordance with the State Emergency Response Plan (EMMV Part 3).

The IC will clarify responsibility through the ICC to oversee requests for and the co-ordination of assistance external to the region.

The Sale RAAF Base and Fulham Correctional Facility are located within the region and can be requested to assist during significant events. Refer the VICSES Gippsland REMP for details on how to access this assistance.

16.7. Initial Medical Response

The response to a significant earthquake is likely to require a co-ordinated medical response. The Regional Health Commander will co-ordinate the health response in consultation with the Regional / Area of Operations Controller / IC.

16.8. Essential Services

It is critical to restore essential services as soon as possible in impacted areas.

When intelligence indicates that communities / households may have their energy or water supply disrupted, the providers of essential services will lead the communications on service outages. VICSES will be informed from essential services providers during the response to earthquake events and support these messages through its own communications processes.

Owners and managers of community infrastructure essential to the functioning of communities should ensure that they communicate any threats likely to cause infrastructure disruption to VICSES.

16.9. Intelligence

The predicted impact of earthquakes in Gippsland is minimal and what intelligence exists is based on estimates. Information regarding probable impacts based on size of earthquake and which fault line is included at *Appendix G – Gippsland Earthquake Intelligence Card.*

A future threat assessment will conducted specifically taking into account:

- **Aftershocks** - aftershocks will continue throughout the affected area and may do so for several months. Aftershocks are likely to cause further landslides on unstable slopes, affecting construction and clearance operations and posing a hazard to unstable buildings.
- **Severe Weather** - Depending on the time of year, there is a chance of severe weather over the affected area during the initial response. Severe weather is likely to increase the number of sick and injured and to hamper initial response activity. The effects on people in emergency and temporary accommodation will include increased sickness rates and a lowering of morale. Response activities such as clearance operations, air supply and beach landing operations could be adversely affected and slowed. Landslides on unstable slopes, the formation of debris dams and flooding will present additional hazards to an already dangerous situation. Rainfall may also be beneficial in areas with damaged water distribution networks. Public information should include advice on storing rainfall, to lessen the burden on water providers.
- **Water & Wastewater** - In the long term, lack of potable water and poor sanitation may be a hazard. In addition lack of water/wastewater will severely impact lifeline utilities and facilities and reduce their effective operation. Effective public health surveillance will be necessary to mitigate the risk of a higher incidence of disease.
- **Housing** - Once the initial concern over earthquake casualties has passed, the main focus is likely to be on the large numbers of people in the affected area still in emergency or temporary accommodation. While this will be addressed below the national level of the initial response, actions taken in the first few days may become the norm for months to come. This is certain to be a critical area of concern in the medium to long term of a response and recovery programme.

16.10. Evacuations

Following an earthquake, buildings should be assessed for their structural integrity. This can be implemented through Local Government and networks of building engineers / inspectors. Where buildings have been made uninhabitable, occupants should be evacuated.

The decision to recommend that people evacuate will be made by the IC in consultation with VicPol and other expert advice, unless time constraints prevent this consultation. VicPol then have responsibility to manage the process of evacuation (withdrawal and return). Regional guidance documents have been produced by VicPol which support evacuation for all hazards.

It expected that in a large event self-evacuation will occur on a very wide scale, with many people and families moving to areas or locations they consider safer. Initially, self-evacuation will be ad hoc and uncontrolled.

Information to the community regarding appropriate locations, routes and methods for evacuation will be disseminated through the Public Information Unit.

VicPol will provide Evacuation Managers at relevant control structures as required.

16.11. Movement Control

Identified roadways which may pose a risk to communities within the earthquake affected area will be managed by the relevant Council and VicRoads. However during events ICC's will be expected as part of their intelligence gathering, to contact VicRoads, Local Governments and Victoria Police on a regular basis to gather information regarding road closures / conditions.

Establishment of air and sea transport links to bypass blocked roads may be required to reach isolated communities.

VicPol will co-ordinate the restriction of access to areas as directed by the Incident Controller to prevent the movement of unauthorised people and traffic into the affected area.

If it is necessary to exclude persons from an area due to the size, nature or location of an emergency, an emergency area may be declared in accordance with the Emergency management Act 1986 and Part 3 of the EMMV.

If an emergency constitutes a significant and widespread danger to life or property which justifies the enabling of the Coordinator in Chief (or delegate) to exercise extraordinary powers, a State of Disaster may be declared in accordance Emergency Management Act 1986.

16.12. Communications

A communications plan to bypass disrupted landline and cellular networks will be produced.

16.13. Disaster Victim Identification, Registration & Enquiry

In response to mass fatalities, VicPol and the Coroners Court of Victoria will administer the handling and investigation of deceased persons and their subsequent removal as defined in the EMMV. The Australian Red Cross may be requested to activate the National Registration and Inquiry Service in support of VicPol.

16.14. Aircraft Management

The State Aircraft Unit (SAU) will coordinate aircraft on behalf of VICSES. CFA and DEPI may be requested to support aircraft management including the management of airbases and through the provision of air observers or SAU officers at relevant control structures.

16.15. Animal Welfare

Matters relating to the welfare of companion animals and livestock and matters relating to the welfare of wildlife will be referred to DEPI.

17. Sustained Response (Day 2- 7)

- Ongoing immediate response – plus

17.1. Engineering Assessments

In the first instance, Incident controllers should seek engineering advice through the local Council. Engineering advice will be required to undertake the following:

- Assess building structural stability
- Support USAR activities; and
- Support damage control to limit risks to public safety

17.2. Damage Control

In the immediate aftermath of a significant earthquake there may be some scope for action to be taken to limit danger to the public through identifying damage. Damage control operations will be directed from the relevant ICCs. The activity will only be undertaken when it does not conflict with rescue and recovery priorities. Damage control tasks may include:

- Removal of dangerous debris and shoring up of structures to reduce danger to the public; and
- Tarping of structures to prevent the ingress of rainwater.

Damage control operations will not include any restoration or reconstruction tasks.

17.3. Debris Removal

In the first instance, IC's should seek assistance for debris removal through the relevant Council.

18. Earthquake Notifications

Geoscience Australia (GA) has a series of remote sensing stations throughout Australia. They are responsible for monitoring earthquakes and seismic activity within Australia and providing data to relevant agencies.

At present there is no predictive earthquake capability.

For earthquake activity measuring 2.5mg and above, Geoscience Australia will notify the VICSES State Duty Officer (SDO) in the first instance.

The VICSES SDO will notify the VICSES Gippsland Duty Officer.

The VICSES Gippsland Regional Duty Officer (RDO) will notify the following:

- Gippsland Regional Emergency Management Team;
- Regional Emergency Response Coordinator (RERC);
- Regional Recovery Coordinator;
- VICSES Gippsland Units; and
- Other relevant agencies and service providers where deemed necessary.

19. Relief

Through the Impact Assessment process DHS and Local Council MERO's / MRM's will be notified by VicPol, and/or the Regional Controller / Area of Operations Controller / Incident Controller as soon as information identifying significant damage is available.

This will ensure processes are implemented which will provide initial relief for affected persons. Providing this information will assist in the smooth transition to recovery activities within affected communities.

Municipal Councils will activate Emergency Relief Centres as required as listed in the relevant Municipal Emergency Management Plan (MEMP). It should be noted that some Relief Centres may not be available due to earthquake damage and ad hoc arrangements may have to be made.

All Relief Centres must be checked by a qualified structural engineer before being opened.

Indicative quantities of water and food that may be required in the event should be based on an estimated 20 litres of water and 2kg of food per person per day.

SECTION 5 – RECOVERY

20. Transition to Recovery

The transition from response to recovery will be conducted in accordance with the existing arrangements. However, it is expected that recovery will commence planning from the first notification of an earthquake.

The response element can be considered to continue at least until the following conditions are met:

- All rescues have been accomplished;
- All injured have been attended to;
- The homeless have been provided with shelter;
- Essential services such as water, power and waste management have been restored;
- Communications have largely been restored; and
- Temporary repairs have been made to critical buildings.

VICSES is will ensure that a “transition from response to recovery” document is produced in consultation with DHS and signed off accordingly. Municipalities will have detailed recovery arrangements as part of their respective MEMP’s.

21. Recovery

Recovery activities will commence with response when an emergency occurs to ensure high levels of understanding and cooperation between response and recovery coordinators at each of the levels of operation. The Incident Management Team (IMT) will ensure that there is a seamless approach and transition from response to recovery.

SECTION 6 – APPENDICES

Appendix A – Acronyms

Appendix B – Definitions

Appendix C – Associated Reading

Appendix D – Richter Scale

Appendix E – Modified Mercalli Scale

Appendix F – Community Messaging for Earthquakes

Appendix G – ICC Preparedness Levels / Response Matrix

Appendix H – Possible Impacts of an Earthquake

Appendix I – Gippsland Earthquake Intelligence Card

Appendix J – Earthquake Impact Maps

Appendix A – Acronyms

ABC	Australian Broadcasting Corporation
ADF	Australian Defence Force
AIIMS	Australian Inter-Service Incident Management System
AVCG	Australian Volunteer Coast Guard
BBSC	Baw Baw Shire Council
BCSC	Bass Coast Shire Council
BoM	Bureau of Meteorology
C Wx	Central Weather District
CAD	Computer Aided Dispatch
CFA	Country Fire Authority
DCP	Divisional Command Point
DEPI	Department of Environment and Primary Industry
DHS	Department of Human Services
DIIRD	Department of Innovation, Industry and Regional Development
DoJ	Department of Justice
DPI	Department of Primary Industries
DSE	Department of Sustainability & Environment
EAS	Emergency Alerting System
EG Wx	East Gippsland Weather District
EGSC	East Gippsland Shire Council
EMA	Emergency Management Australia
EMLO	Emergency Management Liaison Officer
EMMV	Emergency Management Manual Victoria
EMT	Emergency Management Team
EPA	Environmental Protection Authority
ESO	Emergency Service Organisation
ESTA	Emergency Services Telecommunications Authority
EVS	Emergency Vehicle Status
GA	Geoscience Australia
GIS	Geographic Information System/s
ICC	Incident Control Centre
ICS	Incident Control System
IMT	Incident Management Team
LandSAR	Land Search and Rescue
LCC	Latrobe City Council
LHQ	Local Head quarters
MAV	Municipal Association of Victoria
MECC	Municipal Emergency Co-ordination Centre

MEMPC	Municipal Emergency Management Planning Committee
MERC	Municipal Emergency Response Co-ordinator
MFB	Metropolitan Fire Brigade
MFPO	Municipal Fire Prevention Officer
MMIS	Modified Mercalli Intensity Scale
MoU	Memorandum of Understanding
MRM	Municipal Recovery Manager
NE Wx	North East Weather District
NRIS	National Registration and Inquiry System
OESC	Office of the Emergency Services Commissioner
OH&S	Occupational Health and Safety
OIC	Officer in Charge
OIMS	Operations Incident Management System
PPE	Personal Protective Clothing and Equipment
PPRR	Prevention, Preparedness, Response and Recovery
PWC	Personal Water Craft
RAV	Rural Ambulance Victoria
RDO	Regional Duty Officer
Red Cross	Australian Red Cross Victoria
REMP	Regional Emergency Management Plan
REEP	Regional Earthquake Emergency Plan
RERC	Regional Emergency Response Co-ordinator
RHQ	Regional Head quarters
SAR	Search and Rescue
SCP	Sector Command Point
SDO	State Duty Officer
SEMO	Senior Emergency Management Officer
SERC	State Emergency Response Co-ordinator
SERCC	State Emergency Response Communication Centre
SERCC	State Emergency Response Co-ordination Centre
SEWS	Standard Emergency Warning Signal
SGSC	South Gippsland Shire Council
SMH	Snowy Mountains Hydroelectricity
SITREP	Situation Report
SOP	Standard Operating Procedure
SRW	Southern Rural Water
UC	Unit Controller
UDO	Unit Duty Officer
UHF	Ultra High Frequency
USAR	Urban Search And Rescue
VBI	Victoria Bushfire Inquiry
VEMC	Victoria Emergency Management

VHQ	Victoria Headquarters
VICPOL	Victoria Police
VICSES	Victoria State Emergency Service
VWA	Victorian Work Cover Authority
WSAR	Water Search and Rescue
WSC	Wellington Shire Council
WSG Wx	West and South Gippsland Weather District
Wx	Weather

Appendix B – Definitions

Active Fault	A fault that is likely to have another earthquake sometime in the future. Faults are commonly considered to be active if they have moved one or more times in the last 10,000yrs.
Amplitude	The amplitude is the size of the wiggles on an earthquake recording.
Aftershocks	Aftershocks are earthquakes that follow the largest shock of an earthquake sequence. They are smaller than the mainshock and within 1-2 rupture lengths distance from the mainshock. Aftershocks can continue over a period of weeks, months, or years. In general, the larger the mainshock, the larger and more numerous the aftershocks, and the longer they will continue.
Earthquake	Earthquake is a term used to describe both sudden slip on a fault, and the resulting ground shaking and radiated seismic energy caused by the slip, or by volcanic or magmatic activity, or other sudden stress changes in the earth.
Epicentre	The epicentre is the point on the earth's surface vertically above the hypocentre (or focus), point in the curst where a seismic rupture begins.
Fault	A fault is a fracture along which the blocks of crust on either side have moved relative to one another parallel to the fracture.
Focal Depth	The focal depth refers to the depth of an earthquake hypocentre.
Foreshocks	Foreshocks are relatively smaller earthquakes that precede the largest earthquake in a series, which is termed the mainshock. Not all mainshocks have foreshocks.
Fault Plane	The fault plane is the planar (flat) surface along with there is slip during an earthquake.
Ground Failure	The term ground failure is a general reference to landslides, liquefaction, lateral spreads and any other consequence of shaking that affects the stability of the ground.
HAZUS	Hazus is a nationally applicable standardized methodology that contains models for estimating potential losses from disasters.
Hypocentre	The hypocentre is the point within which the earth where an earthquake rupture starts. The epicentre is the point directly above it at the surface of the Earth. Also commonly termed the focus.
Intensity	The intensity is a number (written as a Roman numeral) describing the severity of an earthquake in terms of its effects on the earth's surface and on humans and their structures. Several scales exist, but the ones most commonly used in the United States are the Modified Mercalli scale and the Rossi-Forel scale. There are many intensities for an earthquake, depending on where you are, unlike the magnitude, which is one number for each earthquake.
Landslide	A landslide is a movement of surface material down a slope.
Liquefaction	A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking.
Magnitude	The magnitude is a number that characterizes the relative size of an earthquake. Magnitude is based on measurement of the maximum motion recorded by a seismograph. Several scales have been defined, but the most commonly used are (1) local magnitude (ML), commonly referred to as "Richter magnitude," (2) surface-wave magnitude (Ms), (3) body-wave magnitude (Mb), and (4) moment magnitude (Mw). Scales 1-3 have limited range and applicability and do not satisfactorily measure the size of the largest earthquakes. The moment magnitude (Mw) scale, based on the concept of seismic moment, is uniformly applicable to all sizes of earthquakes but is more difficult to compute than the other types. All magnitude scales should yield approximately the same value for any given earthquake.

Mainshock	The mainshock is the largest earthquake in a sequence, sometimes preceded by one or more foreshocks, and almost always followed by many aftershocks.
Modified Mercalli Intensity Scale	Refer Intensity
Richter Scale	The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Appendix C – Associated Reading

- Legislation http://www.legislation.vic.gov.au/
  - Victoria State Emergency Services Act 2005
  - Emergency Management Act 1986
  - Occupational Health & Safety Act 1985
  - Victorian Water Act 1989
  - Catchment & Land Protection Act 1994
  - Meteorological Act 1955
  - Essential Services Act 1958
- State Documents
  - Victoria State Emergency Services Regulations – 2006
  - Emergency Management Manual Victoria www.oesc.vic.gov.au/emergencymanual
  - State Emergency Response Plan www.oesc.vic.gov.au/emergencymanual
  - State Emergency Relief and Recovery Plan www.oesc.vic.gov.au/emergencymanual
  - Victorian Urban Search & Rescue (USAR) Response Arrangements
  - State Health Emergency Response Plan
  -
- VICSES Documents www.ses.vic.gov.au
  - State Earthquake Response Plan www.ses.vic.gov.au/prepare/em-planning/state-plans
  - VICSES Operations Management Manual 2013
  - Gippsland Regional Emergency Management Plan
  - Policy 010 - Emergency Planning for Flood, Storm, Tsunami and Earthquake
  - Standard Operating Procedures (SOP's)
    - 004 – Incident Notification Procedure
    - 007 – State Duty Officer Roles and Responsibilities
    - 015 – Operational Assistance from Other Agencies
    - 032 – Operations Involving Structure Collapse (USAR)
    - 046 – Notification process for Earthquake Events
    - 048 – State Specialised Resources
    - 052 – Regional Duty Officer Roles and Responsibilities
- Other Documents
  - Latrobe Valley Earthquake Scenario Report, Prepared by Risk Frontiers for VICSES, September 2012

Appendix D – Richter Scale

The most common method of describing the size of an earthquake is the Richter magnitude scale, ML. this takes the logarithm of the ground displacement as measured by a seismograph and applies a correction which varies with the distance from the earthquake to the seismograph.

Events between magnitudes of roughly 2.0 and 3.4 may be felt within a few kilometres of the epicentre. It is likely that earthquakes in Gippsland will not exceed magnitude 7.25.

Generally for locations near the epicentre, the following effects may be observed.

Richter Scale	Occurrence	Return Rate	Movement	Impact
1.0	daily	minute	small	Insignificant
2.0	daily	hour	Small	Low
3.0	daily	day	small	Minor. Usually felt by only a few people near the epicentre
4.0	daily	week	moderate sudden	Moderate. Felt by people who are indoors and some outdoors; vibrations similar to a passing truck
5.0	monthly	10 years	strong sudden	Intermediate. Felt by everyone; dishes swing, unstable objects overturn break and doors
6.0	monthly	30 years	strong sudden	Noteworthy. Some damage to buildings; plaster cracks, bricks fall, chimneys damaged
7.0	monthly	50 years	severe sudden	High. Much building damage; houses move on their foundations, chimneys fall, furniture moves
7.25				Serious damage to buildings; bridges twist, walls fracture, many masonry buildings collapse
7.5				Causes great damage; most buildings collapse
8.0	yearly	100 years	very severe	Far Reaching. Causes extensive damage; waves seen on the ground surface
9.0	yearly	300 years	very severe	Outstanding
10.0	rarely	1000 years	extreme	Extraordinary

Appendix E – The Modified Mercalli Scale

The effects of earthquake waves at the surface can be measured using an intensity scale. The most common intensity scale used in Australia is the 12 point Modified Mercalli scale. On this scale, intensities up to 5 are felt but cause no damage, while intensities from 6 to 12 cause increasing amounts of damage.

Generally for locations near the epicentre, the following effects may be observed.

MMI Intensity	Description of Effect
I	Not felt by humans. Recorded by seismographs.
II	Rarely felt, usually only on top floors of high buildings.
III	Felt indoors, like a passing light truck.
IV	Generally noticed indoors, but not outside. Very light sleepers may be awakened. Windows, dishes and doors rattle. Like a passing train.
V	Felt by all. Small objects upset.
VI	Books off shelves. Trees shake. Isolated damage.
VII	General alarm. Difficulty experienced in standing. Many poorly constructed buildings damaged.
VIII	Significant damage. Branches broken from trees.
IX	General panic. Serious damage. Ground cracking.
X	Most buildings masonry structures destroyed. Some well-built wooden buildings and bridges seriously damaged. Dams, dykes, and embankments seriously damaged. Railway lines slightly bent. Cement and asphalt roads and pavements badly cracked or thrown into waves. Large landslides on river banks and steep coasts.
XI	Wooden frame structures destroyed. Great damage to railway lines. Great damage to underground pipes.
XII	Damage virtually total. Practically all works of construction destroyed or greatly damaged. Large rock masses displaced. Lines of slight and level distorted. Visible wave-motion of the ground surface reported. Objects thrown upwards into the air.

Appendix F – Community Messaging for Earthquakes

During an Earthquake / Aftershock

- DROP, COVER AND HOLD ON - If indoors, stay there (keep clear of falling debris outside). Shelter under (and hold onto) a sturdy table, bench or interior doorframe.
- Keep clear of windows, chimneys and overhead fittings. In high-rise buildings, stay clear of windows and outer walls. Get under a desk.
- Don't use lifts because you may become trapped.
- In crowded areas or buildings, don't rush for the doors. Move clear of overhead fittings and shelves.
- If outside, keep well clear of buildings, overhead structures, walls, bridges, power lines and trees.
- In a city street, shelter from falling debris under strong archways or doorways of buildings. Don't stand under awnings or parapets because they may collapse.
- In a vehicle, stop in an open area until the shaking stops. Beware of fallen power lines, damaged roads including overpasses, bridges; and landslides.
- Listen to your car radio before moving.

After an Earthquake / Aftershock

- Watch for hazards and tend to injuries.
- Turn off electricity, gas and water. Don't light matches. Check for fuel leaks and damaged wiring and pipes.
- Check for injuries. Apply first-aid. Don't move the seriously injured unless in immediate danger.
- Check for broken water, sewerage, gas or electrical mains or lines.
- Don't use the phone immediately (to avoid congestion) unless there is a serious injury or fire.
- Check for cracks and damage in the roof, walls and chimneys.
- Expect aftershocks, so evacuate if the building is damaged.
- Listen to the local radio and heed warnings or advice on damage, service disruptions and evacuation.
- Don't waste food or water because the supply may be interrupted.
- Avoid driving unless for an emergency (keep the streets clear for emergency services).
- Don't go sightseeing or enter damaged buildings.
- Stay calm and help others if possible.

Key Public Messages

- We are continuously gathering information and talking to each other.
- Plans are in place.
- Those plans are being activated and we are responding.
- People and agencies are supporting each other.
- We are providing advice and information as best we can, via websites, media, social media and public announcements.

Detailed Messages

- Frequently updated (if cannot be updated, then frequently repeated) advice to people in the affected areas about what they can (or should not) do, the response and the situation.
- Emergency household sanitation and hygiene.
- Emergency use of mobile communications (if available) ie SMS rather than voice, internet, social media etc
- Emergency First Aid.
- Evacuation of the community or parts thereof, to safer areas or locations.

Appendix G – ICC Preparedness Levels Matrix - Earthquake

TRIGGER	CONTROL LEVEL	RDO / ICC ACTIONS
Preparedness Level A		
• Business as usual • < 2.5mg • III MMI	• 24/7 RDO / RC roster • ICC not activated • ICP as required by # RFA's	• RDO maintaining situational awareness • Notify SDO if local intelligence indicates an earthquake has occurred.
Preparedness Level B		
• 2.6 – 5.4mg • >III - VI MMI	**Incident** • ICP as required by # RFA's • Consider establishing IMT structure as below. • CORE IMT on 60 minute standby • Expanded IMT on 180 minute standby **Regional** • Heightened RDO watch • Maintain 24/7 RDO function	• Acknowledge notification with SDO • Alert RM; RERC • Notify Local Units • RDO maintaining situational awareness eg monitor OIMS / Twitter
Preparedness Level C		
• 5.5 – 6.4mg • VII MMI	**Incident** • ICC location identified & activated • IC appointed • CORE IMT in place ASAP post notification • Expanded IMT on 120 minute standby **Regional** • RCC on standby • Maintain 24/7 RDO function	**Initial RDO Actions** • Acknowledge notification with SDO • Alert:- RM; RC; RERC; REMT; EMT • Open ICC • Alert Local Units • Collect initial impact intelligence • Alert state air recon. teams via SDO • Alert state USAR resources via SDO • Initial public info disseminated by SDO **Initial ICC Actions** • Initial Impact Assessment • Identify local resourcing • Information to REMT • Establish transport/logistics to impact area • Establish initial medical response • Restore essential services
Preparedness Level D		
• 6.5+ mg • VIII+ MMI	**Incident** • ICC location identified & activated • IC appointed • Incident EMT formed and briefed • CORE IMT in place ASAP post notification • Expanded IMT on 60 minute standby **Regional** • RCC and RCT active • Regional Controller appointed • Regional EMT formed and briefed • Maintain 24/7 RDO function at RCC	**Initial RDO Actions** • Acknowledge notification with SDO • Alert:- RM; RERC; REMT; EMT • Open ICC • Alert Local Units • Collect initial impact intelligence • Request state air reconn. teams via SDO • Request state USAR resources via SDO • Request external assistance • Initial public info disseminated by SDO **Initial ICC Actions** • Initial Impact Assessment • Identify external assistance • Information to REMT • Establish transport/logistics to impact area • Establish initial medical response • Restore essential services

Appendix H – Possible Impacts of an Earthquake

The effects of an earthquake depend on many factors, such as size of the earthquake and distance from the epicentre. The following possible impacts are based on the report “Earthquake Scenario Assessment for Melbourne” by Geoscience Australia Professional Opinion for Attorney-Generals Department 2009/14.

Building damage

It can be assumed that individual structures that have experienced 25% damage are no longer habitable.

Casualty

Injuries occur to occupants of damaged buildings with injury severity dependent on the extent of the building damage. Often in large earthquakes, the full extent of the damage and casualties is not known for several days following an event because communication networks fail and transport networks are severely impacted and become impassable.

Geological Effects

There may be up to 3-4 m of vertical displacement across the surface trace of a fault. There may be liquefaction and/or lateral spreading in saturated, non-consolidated sediments (e.g. Coode Island sediments, reclaimed land, ports). Localised minor tsunami waves along the Gippsland and Otway coasts may result.

Transport Access

There may be severe disruptions to traffic. Road bridges affected by the ground shaking will sustain various degrees of damage. Assumed average repair times, based on US experience, are 230 days for complete damage, 75 days for extensive damage and 2.5 days for moderate damage. In addition to the loss of any bridges, road surfaces crossing the fault scarp will also be affected by a vertical step of up to 4m. Access for heavy vehicles will be particularly limited.

Utility Damage

Transformers will trip out. Each transformer would need to be visited by a technician to reset, even if undamaged, requiring significant resources. Substations closer to the epicentre would probably sustain damage to their transformers, other equipment and control buildings. Significant power disruption may occur. Longer term loss of generational capacity from the older power stations may also result. Copper network telecommunications, water supply and sewerage may be extensively disrupted near the epicentre. Mobile phone coverage will likely be saturated. There may be fires owing to broken gas mains that may be difficult to extinguish if the water utility infrastructure has been compromised.

Consideration should also be given to:

- The shaking of the ground which in turn shakes buildings, causing objects to fall and structures to collapse partially or totally;
- The ground shaking may damage the soil and foundation materials under structures, their subsequent destruction a result of ground failure;
- Subsequent threat of fire;
- Land or mud slide;
- Ground displacement along a fault;
- Tsunami;
- Floods from dam and levee failure and subsidence;
- Toxic contamination; and
- Rail lines warped.

Appendix I – Gippsland Earthquake Intelligence Card

General Consequences and Impacts

Power Generation and Supply Lines

- A large earthquake located in the vicinity of the power plants in the Latrobe Valley would cause serious interruption of energy supply to the whole state of Victoria.
- The power generators in Gippsland provide 97% of Victoria's power needs. There will be impact to output capacity and possibly to transmission lines.
- The damage to the main power plants in the region has been estimated and is in the intelligence card below. These are optimistic figures as they are based on the Californian and Japanese experience where the facilities are built with seismic risk firmly in mind.

Gas Supply

- The Longford Gas Plant and distribution lines which supply Melbourne and the Eastern Gas Pipeline which supplies NSW might also be impacted.

Health Sector

- The Latrobe Regional Hospital is the central health facility in Gippsland. There are a number of hospitals dotted around Gippsland however Latrobe Regional Hospital is the main health provider. This hospital may well be affected as it is within the Latrobe Valley area.

Roads

- Major slips, and closures are likely on the Princes Freeway, South Gippsland Highway and Bass Highway
- Damage is likely on local road networks around the Latrobe Valley or South Gippsland

Detailed Consequences and Impacts

- The following information is based on the Risk Frontiers report prepared on behalf of VICSES in 2012.
- The North-South Fault is a modelled fault line emulating the intensity patterns of the 1969 & 2012 events and are fictitious however provide approximations around potential consequences and impacts.
- The time of day plays an important role in determining human casualties

GIPPSLAND EARTHQUAKE INTELLIGENCE CARD					
FAULT LINES	ROSEDALE	MORWELL	YARRAM	WEST NORTH SOUTH	EAST NORTH SOUTH
MAGNITUDE 5.50 MMI VI					
CASUALTIES					
▷ Total	0	0	0	37	60
PROPERTY LOSS ($ MILLIONS					
▷ Total	0	0	0	269	404
MAGNITUDE 6.00 MMI VII					
CASUALTIES					
▷ Total	69	280	55	209	340
▷ Injured	64	243			291
▷ Deceased	5	37			49
PROPERTY LOSS ($ MILLIONS					
▷ Total	464	1,515	374	1,192	1,743
▷ Residential	303	1,212			1,430
▷ Commercial	18	83			91
▷ Industrial	8	28			47
POWER NETWORK CAPACITY					
▷ Immediate	38%	40%	50%	48%	18%
▷ 10 days	98%	90%	98%	97%	92%
▷ Days to 100%	80	140			130
LATROBE REGIONAL HOSPITAL					
▷ Nil significant damage	Y	Y	-	-	-
▷ Slight to Minor damage	-	-	-	-	Y
▷ Extensive	-	-	-	-	Y
HAZUS PGA > 0.1					
▷ Hospitals	3	4			
▷ Ambulance Stations	4	5			
▷ Police Stations	4	5			
▷ Fire Stations	52	56			
▷ Kindergartens	21	27			
▷ Schools	100	139			
▷ Tafe	2	6			
▷ University	1	1			
▷ TV Stations	24	19			
▷ Radio Stations	7	3			
▷ Radio/TV Exchanges	24	27			
MAGNITUDE 6.25 MMI VII					
CASUALTIES					
▷ Total	122	503	102	385	606
PROPERTY LOSS ($ MILLIONS					
▷ Total	779	2,482	656	1,990	2,769
POWER NETWORK CAPACITY					

GIPPSLAND EARTHQUAKE INTELLIGENCE CARD					
FAULT LINES	ROSEDALE	MORWELL	YARRAM	WEST NORTH SOUTH	EAST NORTH SOUTH
▷ Immediate	32%	28%	38%	38%	15%
▷ 10 days	96%	85%	97%	96%	85%
MAGNITUDE 6.50 MMI VII-VIII					
CASUALTIES					
▷ Total	223	880	195	684	1,052
PROPERTY LOSS ($ MILLIONS					
▷ Total	1,332	3,929	1,184	3,209	4,257
POWER NETWORK CAPACITY					
▷ Immediate	25%	22%	28%	30%	14%
▷ 10 days	95%	80%	96%	94%	76%
MAGNITUDE 6.75 MMI VIII					
CASUALTIES					
▷ Total	428	1,341	414	1,259	1,871
▷ Injured	374	1,353			1,525
▷ Deceased	54	288			346
PROPERTY LOSS ($ MILLIONS					
▷ Total	2,338	6,263	2,268	5,273	6,540
▷ Residential	1,581	4,777			5,187
▷ Commercial	97	335			334
▷ Industrial	40	127			173
POWER NETWORK CAPACITY					
▷ Immediate	20%	19%	22%	24%	13%
▷ 10 days	92%	78%	93%	88%	66%
▷ Days to 100%	130	150			160
LATROBE REGIONAL HOSPITAL					
▷ Nil significant damage	-	-	-	-	-
▷ Slight to Minor damage	-	Y	-	-	-
▷ Extensive	-	-	-	-	-
HAZUS PGA > 0.1					
▷ Hospitals		14			
▷ Ambulance Stations		12			
▷ Police Stations		17			
▷ Fire Stations		165			
▷ Kindergartens		51			
▷ Schools		320			
▷ Tafe		8			
▷ University		1			
▷ TV Stations		38			
▷ Radio Stations		19			
▷ Radio/TV Exchanges		103			

GIPPSLAND EARTHQUAKE INTELLIGENCE CARD

FAULT LINES	ROSEDALE	MORWELL	YARRAM	WEST NORTH SOUTH	EAST NORTH SOUTH
MAGNITUDE 7.00					
MMI VIII		**MAX**			
CASUALTIES					
▷ Total	870		899	2,289	3,165
PROPERTY LOSS ($ MILLIONS					
▷ Total	4,263		4,276	8,376	9,460
POWER NETWORK CAPACITY					
▷ Immediate	18		18	18	12
▷ 10 days	87		86	82	57
MAGNITUDE 7.25					
MMI VIII - IX			**MAX**		
CASUALTIES					
▷ Total	2,084			3,800	4,618
▷ Injured	1,721			-	3,711
▷ Deceased	363			-	907
PROPERTY LOSS ($ MILLIONS					
▷ Total	7,900			12,582	13,018
▷ Residential	4,704			-	10,302
▷ Commercial	279			-	667
▷ Industrial	99			-	340
POWER NETWORK CAPACITY					
▷ Immediate	17%			16%	11%
▷ 10 days	86%			76%	47%
▷ Days to 100%	100			-	165
LATROBE REGIONAL HOSPITAL					
▷ Nil significant damage	-			-	-
▷ Slight to Minor damage	Y			-	-
▷ Extensive	-			-	Y
▷ Complete	-			-	Y
HAZUS PGA > 0.1					
▷ Hospitals	14			-	17
▷ Ambulance Stations	13			-	14
▷ Police Stations	18			-	21
▷ Fire Stations	212			-	214
▷ Kindergartens	61			-	60
▷ Schools	388			-	391
▷ Tafe	11			-	11
▷ University	1			-	1
▷ TV Stations	43			-	53
▷ Radio Stations	20			-	19
▷ Radio/TV Exchanges	112			-	122

Earthquake Impact Maps

- A series of earthquake impact maps exist and are available from VICSES