Mid West (Grampians) Region

Emergency Response Plan

SES

Landslide Sub Plan

Published by Victoria State Emergency Service

Melbourne, 30 September 2018.

This publication is intended to be consistent with the State Emergency Response Plan (SERP), published by Emergency Management Victoria (EMV) in 2016.

Authorised by the Victoria State Emergency Service (VICSES), 168 Sturt Street, Southbank.

An electronic version of the plan can be obtained at: www.ses.vic.gov.au.

Version Control

Title	Version Date	Nature of amendment
Clare Mintern	V0.1 August 2019	Draft for consultation
Clare Mintern	V1.0 September 2019	Incorporated input/feedback; finalised

Mid West (Grampians) Region Emergency Response Plan – Landslide Sub-plan Certification

The Mid West (Grampians) Region Emergency Response Plan – Landslide Sub-plan deals with response to landslide incidents within the Mid West (Grampians) area of responsibility.

The following plan is intended to provide the framework for the Mid West (Grampians) Region to effectively and efficiently respond to future emergencies caused by landslides, and will remain current until rescinded by authority of the Victoria State Emergency Service Chief Officer Operations.

_____ Date: _____

Tim Wiebusch
Chief Officer Operations

This plan is produced by VICSES and has been adapted from the SERP – Landslide Sub-plan. All information contained in this plan was current at time of publication.

VICSES would like to acknowledge the significant contribution of key stakeholders to ensure the content contained within this plan is of a high quality to support response activities.

For further details about this plan, please contact the Mid West (Grampians) Region:

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State Emergency Management Priorities

The State Emergency Management Priorities are:

Protection and preservation of life is paramount. This includes:

- Safety of emergency response personnel.
- Safety of community members including vulnerable community members and visitors/tourists.

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

Protection of critical infrastructure and community assets that support community resilience.

Protection of residential property as a place of primary residence.

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

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

Table of Contents

1. Introduction

1.1 Purpose

The purpose of this plan is to provide strategic guidance for the effective emergency management of a landslide in the Mid West (Grampians) Region.

1.2 Objective

The objective of the Mid West (Grampians) Region Emergency Response Plan – Landslide Sub-plan is to outline the arrangements for ensuring an integrated and coordinated approach to the management of landslide events across the Mid West (Grampians) Region, in order to reduce the impact and consequences of these events on the community, infrastructure and services.

1.3 Scope

This Mid West (Grampians) Region Emergency Response Plan – Landslide Sub-plan includes:

Description of potential risks and consequences of landslides to the social, built, agricultural and natural environments.

Regional-specific emergency management arrangements for the management of landslides. Links to sources of information where the reader can obtain further detail.

1.4 Authorising environment

The *Emergency Management Act (1986 and 2013)* is the empowering legislation for the management of emergencies in Victoria.

The Emergency Management Manual Victoria (EMMV) contains policy and planning documents for emergency management in Victoria, and provides details about the roles different organisations play in the emergency management arrangements.

The State Emergency Response Plan (Part 3, EMMV) identifies Victoria's organisational arrangements for managing the response to emergencies.

Part 7 of the EMMV outlines the VICSES as the Control Agency for landslide emergencies. In this role, VICSES is responsible for providing protection of life, property and the environment.

The State Landslide Hazard Plan outlines overarching arrangements for the management of landslide emergencies, but does not replace arrangements in the State Emergency Response Plan.

This plan has been approved by the Victoria State Emergency Service (VICSES) Chief Officer of Operations.

Other relevant legislation includes:

Victoria State Emergency Service Act 2005

Victoria State Emergency Service Act 2005

- *Section 5(a) and (b) of the VICSES Act 2005 details VICSES' role in landslide planning and response.*

Essential Services Act 1958

Planning and Environment Act 1989

Local Government Act 1989

Water Act 1989

Catchment and Land Protection Act 1994

Meteorological Act 1955 (Commonwealth)

Roads Management Act 2004.

1.5 Activation of the plan

The arrangements in this plan apply on a continuing basis and do not require activation.

1.6 Audience

The audience for this plan comprises the Victorian government, local government and agencies within the emergency management sector in the Grampians Region, including business and community groups with a significant role in the management of the emergency.

Although the wider community is not the primary audience, community members may find the contents of this plan informative.

1.7 Linkages

This plan reflects current legislation, the arrangements in the State Emergency Response Plan (SERP), the State Landslide Hazard Plan, the State Emergency Relief and Recovery Plan, the strategic direction for emergency management in Victoria and the accepted State practice for managing emergencies.

The arrangements in the SERP and State Emergency Relief and Recovery Plan have not been repeated unless necessary to ensure context and readability. Both plans can be accessed at www.emv.vic.gov.au/policies/emmv.

Arrangements for the management of secondary consequences related to landslide are contained in the following:

Flooding – State Emergency Response Plan - Flood Sub Plan

Health response – State Health Emergency Response Plan (SHERP).

Rescue response – Victorian Urban Search and Rescue (USAR) Response Arrangements.

1.8 Exercising and evaluation

This plan will be exercised within one year from the date of approval and once every three years thereafter as part of a phased cycle. The exercise will be evaluated and, where improvements to the emergency management arrangements in this plan are required, the plan will be amended and a revised version issued. Exercises will be conducted in accordance with the AIDR Managing Exercises Handbook, available here: www.knowledge.aidr.org.au/resources/handbook-3-managing-exercises.

Any operational activity in the Mid West (Grampians) Region requiring the management of a landslide event will be regarded as exercising of the plan. The event is to be evaluated and reviewed, as outlined above.

1.9 Review

This plan was current at the time of publication and remains in effect until modified, superseded or withdrawn.

This plan will be reviewed and updated every three years. Consideration will be given to an earlier revision if the plan has been applied in a major emergency or exercise, or following a substantial change to the relevant legislation or arrangements.

2. Landslide risk within the Mid West (Grampians) Region

2.1 Region description

The Mid West (Grampians) Region of Victoria covers 48,620 square kilometres, and is the second largest region in the state, encompassing many communities that are culturally rich and diverse.

Geographically this area is diverse and includes:

- A population of more than 200,000 people from approximately 50 nationalities.
- Approximately 100,000 private dwellings.
- The Grampians National Park, attracting more than 1 million tourists per year, encompasses a number of culturally sensitive sites.
- Mount Arapiles, internationally renowned rock climbing destination attracting an estimated 90,000 visitors annually. With over 3,000 documented rock climbs at 58 climbing areas.
- Werribee Gorge and Lerderderg State Park, estimated 120,000 visitors and growing annually, a popular running, bushwalking and rock climbing destination.
- Most of the state's grain growing production.
- Borders South Australia.

The Region contains eleven local government areas, including West Wimmera, Hindmarsh, Yarriambiack, Horsham, Northern Grampians, Pyrenees, Ararat, Hepburn, Ballarat, Moorabool and Golden Plains. Refer to map below of the Grampians Region.

The Mid West (Grampians) Region comprises six Bureau of Meteorology (BOM) weather districts (Mallee, Wimmera, South West, Northern Country, Central and North Central) and four Catchment Management Authorities (CMAs) (Glenelg Hopkins, Corangamite, Wimmera and North Central).

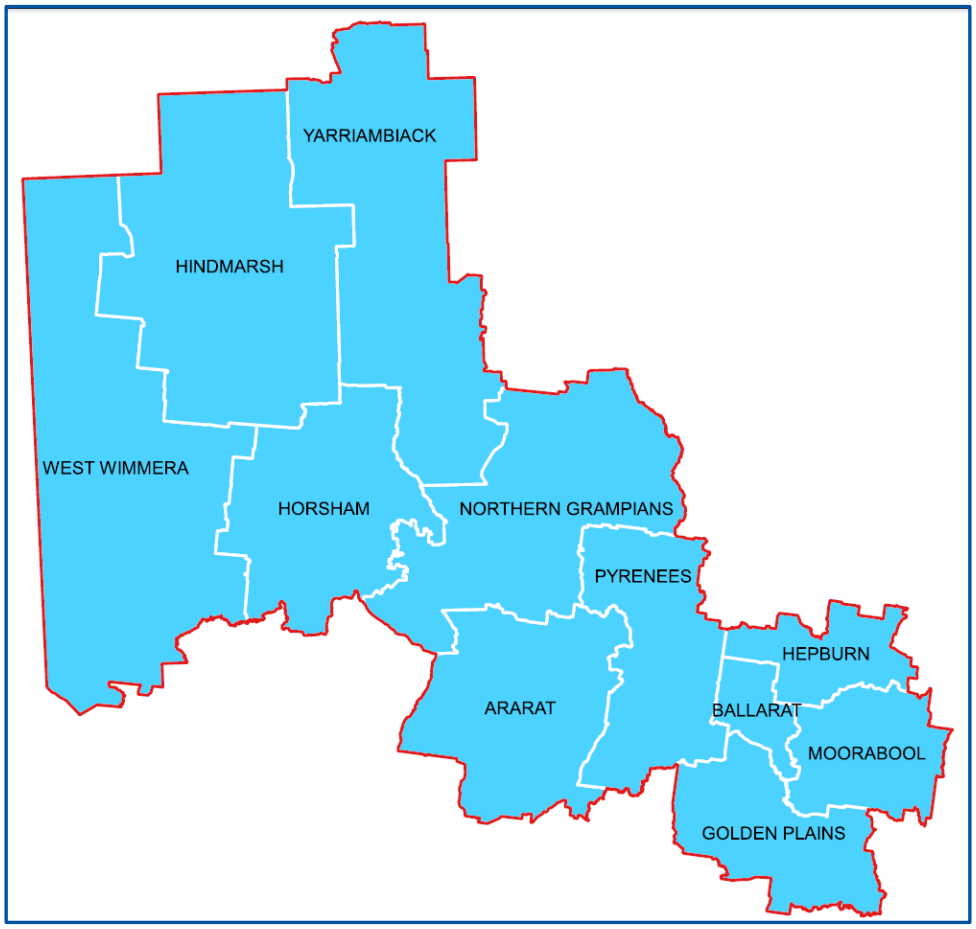


Figure 1. Grampians local government areas.

2.2 Landslide and sinkhole definition

A landslide is “the movement of mass rock, earth or debris down a slope” (AIDR Manual 24 on ‘Reducing the Community Impact of Landslides’). Landslides may result from a failure of the materials which make up the hill slope and are driven by the force of gravity.

A sinkhole is a cavity in the ground. This is caused by water erosion, which provides a route for surface water to disappear underground. The sinkhole term is also commonly used within the community to reference when surface areas collapse and create deep subsurface holes. This can also occur from erosion, such as underground water pipes or the collapse of mines.

2.3 The landslide hazard

Landslides within the Mid West (Grampians) Region have the potential for localised impacts, affecting the economy, business continuity and possible future development opportunities for the regions communities.

As indicated in figure 2 below, the landslide risk within the Grampians Region is identified as being moderate for the Mount Arapiles and high for the Grampians National Park.

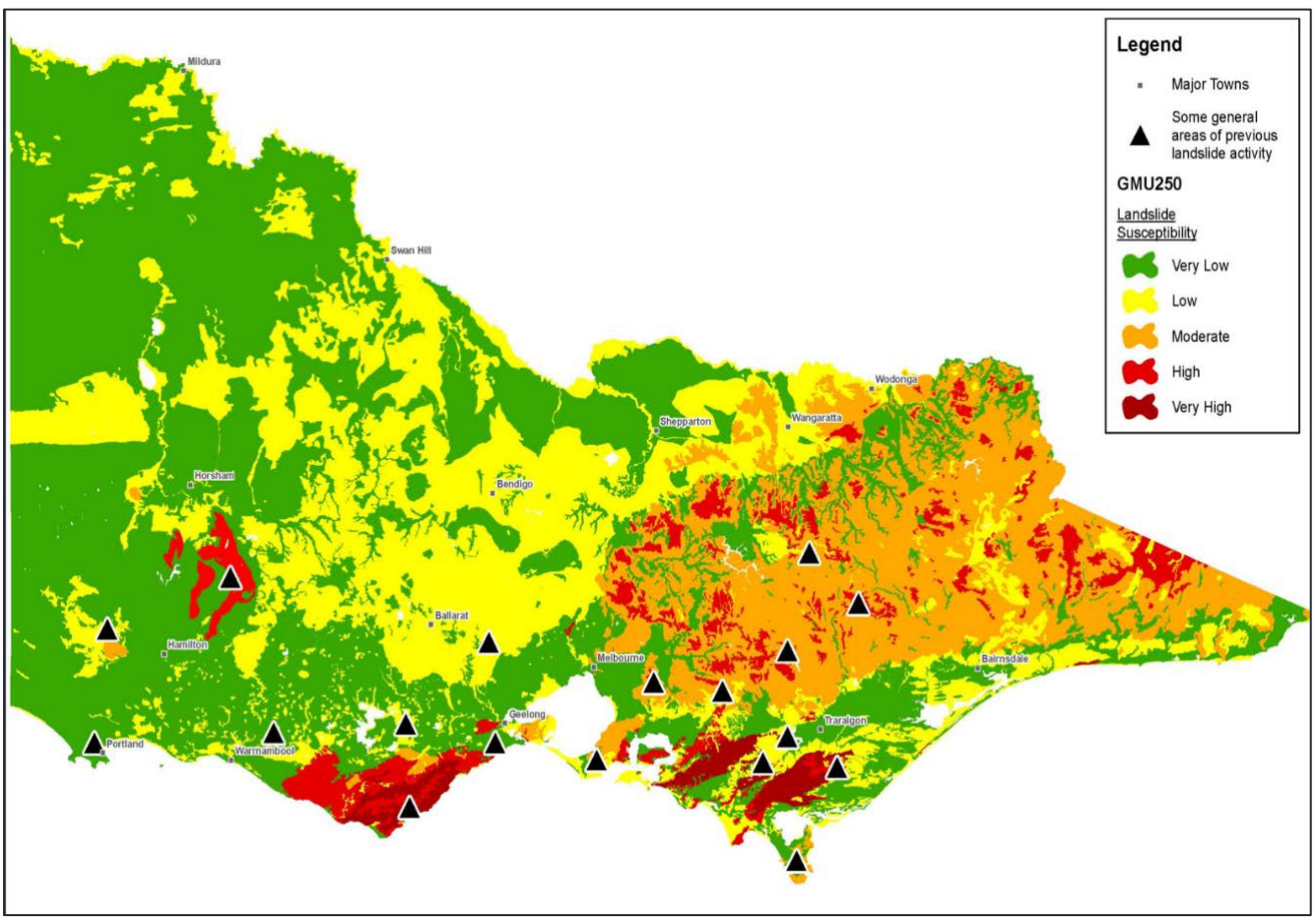


Figure 2. Landslide susceptibility (source: Department of Economic Development, Jobs, Transport and Resources 2018)

According to the Geoscience Australia, there have been over 60 occurrences of landslides in the Mid West (Grampians) Region. These incidents occurred at Mount Arapiles (near Natimuk), Ballarat, Bacchus Marsh, Greendale, Lal Lal, Parwan Valley, and the Grampians National Park (near Halls Gap).

These higher risk areas generally fall under two of the following categories:

- Human mechanisms: locations that have in some way been disturbed by mines, earth works, etc.
- Natural: locations that have been formed naturally over time by nature, for example river embankments, mountainous terrain etc.

3. Historic events

A summary of the Mid West (Grampians) Region landslide and sinkhole events and sinkhole susceptible areas are provided in the map and table below. This summary was developed using data sourced from the Geoscience Australia landslide and sinkhole database, the GHD Halls Gap Landslide Susceptibility Report (GHD 2011) and newspaper sinkhole reports (refer to section 4 of this report).

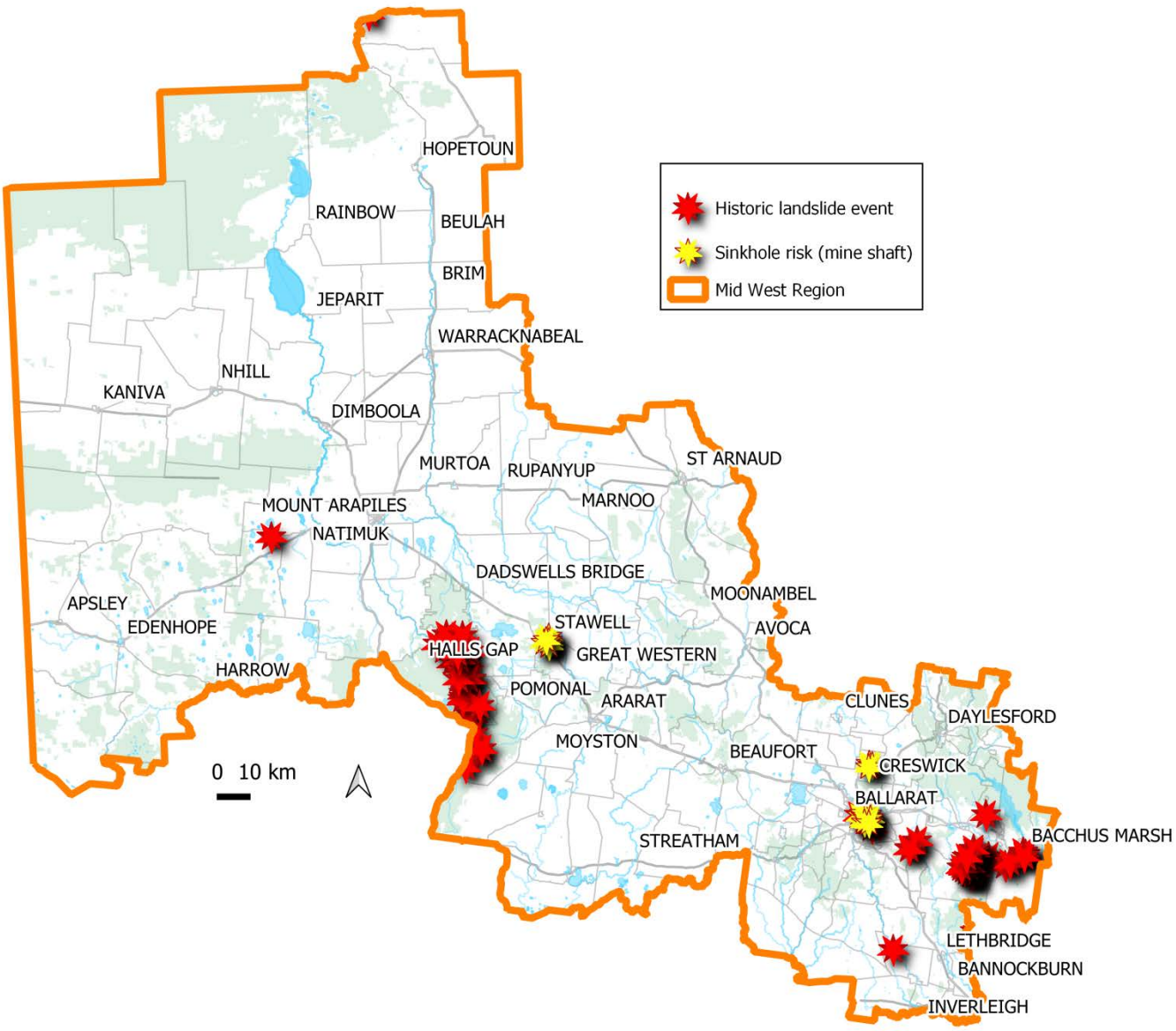


Figure 3. Mid West (Grampians) Region landslide events and sinkhole risk locations.

Table 1. Mid West (Grampians) Region landslide and sinkhole events.

Year	Date	Hazard	Location	Description
1881	2 Aug	Sinkhole	Ballarat	Ballarat, above the old shaft of the British Lion Mining Company. The site of an old mine shaft subsided by about 50m in the back yard of a residence. A lot of washing machinery was lost in the subsidence which is believed to be related to the careless filling in of the old mine shaft (source: Geoscience Australia).
1916	3 Nov	Landslide	Grampians National Park	A landslide a mile in length occurred on October 22nd from the summit of Little Redman to the end of Long Gully, south of Pomonal. Caused by heavy rainfall (source: GHD 2011).
1916	24 Oct	Landslide	Grampians National Park	A landslide occurred near Belfield destroying fencing and covering the road with several feet of sand and silt on private property. Approximately 140mm fell in 24 hours (source: GHD 2011).
1933	1 May	Landslide	Ballarat	A sudden fall of earth at Mount Pleasant reserve, Ballarat, killed one man and injured another (source: Geoscience Australia).
1936	8 Nov	Landslide	Grampians National Park	Archibald's Orchard in the foothills of the Grampians was impacted when soil and debris washed down the hillside covering the orchard to a depth of several feet. Pomonal 201 pts in 30 minutes, with 270 pts in Halls Gap (source: GHD 2011).
1939	-	Landslide	Grampians National Park	Landslide in the market garden area south of Pomonal causing silting up of dams after the 1939 fires (source: GHD 2011).
1952	5 Sept	Landslide	Bacchus Marsh	Intense rainfall saturating soils was the cause of an extensive landslide at Bacchus Marsh, which carried away 300-400 feet of concrete water channel from the Bacchus Marsh High level Channel, on the Werribee River (source: Geoscience Australia).
1970's	-	Landslide	Grampians National Park	Rock fall from Sundial Peak behind the old golf course (current Valley View Motel) resulted in rocks coming to rest just before the buildings (source: GHD 2011).
1976	1 Jan	Landslide	Greendale	This landslip occurred at Greendale in Palaeozoic sedimentary or volcanic rock (source: Geoscience Australia).
1998	9 June	Landslide	Bacchus Marsh	Anthony's Cutting, near Bacchus Marsh, several tonnes of rock and soil slipped on to the outbound lane of the Western Highway at about 5.30 pm, partially blocking the road (source: Geoscience Australia).
2011	5 – 14 Jan	Landslide	Grampians National Park	Extensive landslides, debris flows throughout the Grampians National Park, including Hals Gap (source: GHD 2011).
-	-	Landslide	Lal Lal	This earthflow near Ballarat has apparently been moving for some time, since several young trees have been planted on it in an attempt to prevent further movement (source: Geoscience Australia).
-	-	Landslide	Parwan Valley	1km south west of The Bluff, this site is one of the worst sites of mass movement in Victoria (source: Geoscience Australia).
2017	15 Sep	Landslide	Werribee Gorge State Park	Several medium landslides of shale and scree along the Werribee River, breaching the historic Bacchus Marsh High Level Channel and cutting the river walking trail in several locations (source: Parks Victoria)
-	-	Sinkhole	Gordon Wallace Bacchus Marsh Blackwood	In recent years sinkholes have occurred in Gordon, Wallace, Bacchus Marsh and Blackwood (Moorabool Shire Council pers. comm.)

3.1 2011 landslide events

Within the Mid West (Grampians) Region, the Grampians National Park has the highest landslide risk. Although the Grampians National Park has a long history of landslide events occurring, the largest landslide event occurred in January 2011 as a result of an extreme rainfall event. This rainfall event triggered over 200 landslides in the Grampians National Park causing damages costing of over $400 million (Federation University 2014). Hall Gap recorded a total January rainfall of 297 mm, with 146.6mm falling on the 14th of January (Water Technology 2017).

Some of the 2011 landslides were over 200m wide and over 3km long. Huge boulders were dislodged and moved vast distances (refer to photos below), large trees were uprooted and washed away like matchsticks, and bridges, culverts, drains, roads, houses, private land, waterways, fences, walking tracks and picnic facilities were destroyed.

Photo 1. Photos of large boulders that were dislodged in the January 2011 landslides that damaging main roads within the Grampians National Park (source: Parks Victoria).

The majority of landslides occurred on the eastern slope of the Mount Difficult Mountain Range, refer to figure 4 below.

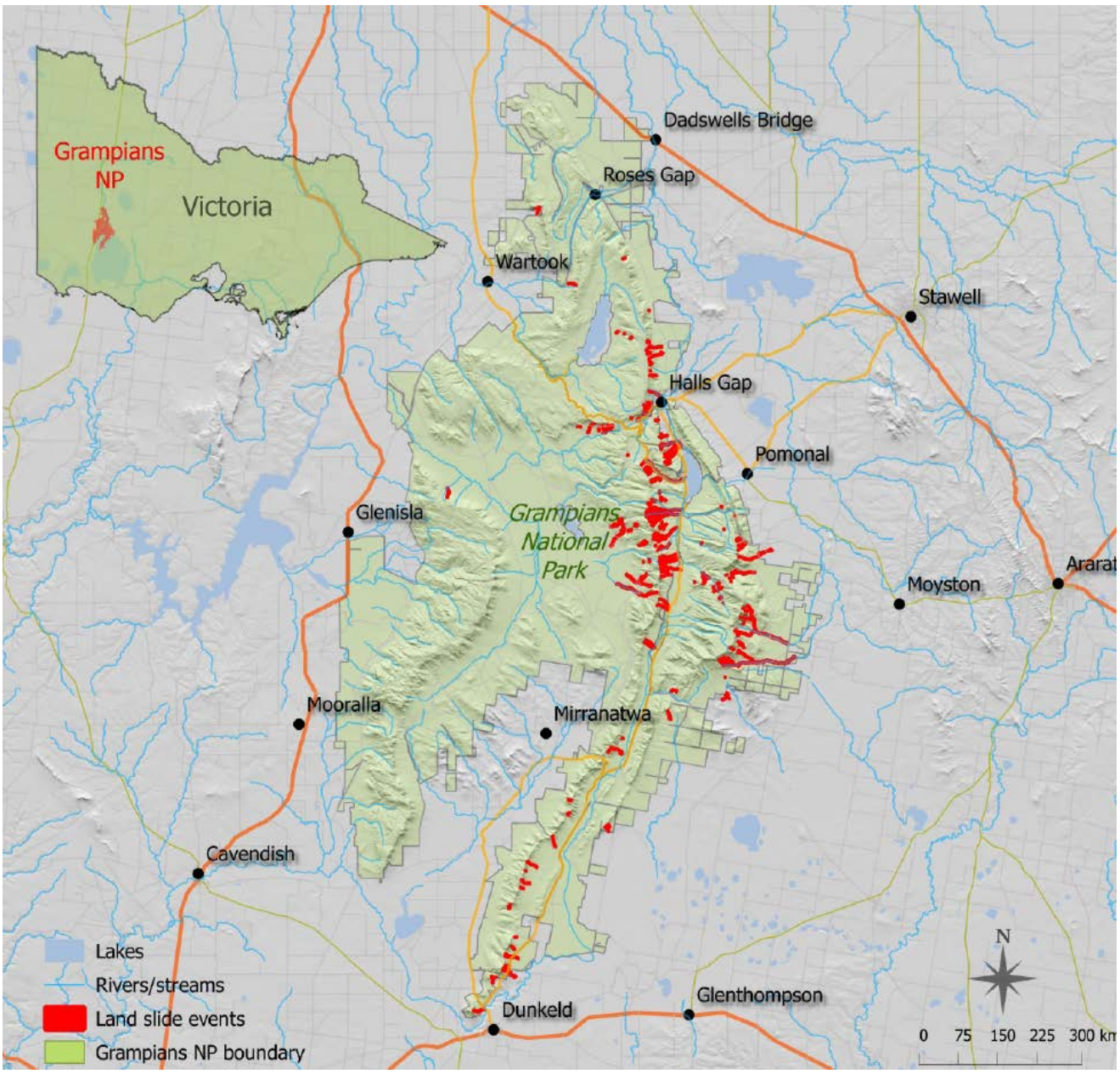


Figure 4. Location of the January 2011 landslide events (source: Federation University 2014).

Three arterial roads were closed by landslide debris and damage: Grampians Road (refer to photo 2 below) , Mt Victory Road and Silverband Road (refer to photo 3 below). The landslides cause significant damage to roads, where large sections of roads and walking tracks were swept away (refer to photos below). Vic Roads estimated the volume of debris removed to reinstate the road network was in excess of 12,000m^3 (Federation University 2014).

Photo 2. Grampians Road, southern section of the Grampians National Park (source: Parks Victoria).

Photo 3. Damage to Silverband Road and culvert damage caused by January 2011 landslides (source: Vic Roads).

Public and private property was damaged by large boulders, trees, debris and mud. Some houses were surrounded by debris and outbuildings, fences, gardens, and fields were damaged, refer to photos 4 to 6 below. Within the Grampians National Park alone buildings, roads, 68 walking tracks, fences, 1 vehicle bridge and 21 pedestrian bridges were damaged.

Photo 4. Landslide debris surrounding private property near Halls Gap (source: Parks Victoria).

Photo 5. Impact on Zumsteins picnic ground (source: VicRoads).

Photo 6. Landslide in Halls Gap, 5th January 2011 (source: GHD 2011).

Urban and agricultural water supplies were impacted, mainly by increased turbidity levels in Lake Belfield, a 78,560ML water storage, critical for potable water supply for the GWM Water region. Regionally the landslides damaged the water supply and wastewater infrastructure by debris build-up and blockages, erosion around water pipelines and infrastructure, and channels. The estimated repair cost was $2.2 million.

For further information refer to Appendix 2 for the Halls Gap landslide triggers, landslide susceptibility mapping and the Halls Gap and the Grampians National Park Landslide Intelligence Card.

3.2 Recent sinkhole events

Ballarat, Creswick and Stawell were constructed on top of a network of gold mine tunnels. Some mines have been identified, but there are an unknown number which could lead to the development of sinkholes. There are a number of cases where building construction has led to the uncovering of an old mine tunnels which had not previously been identified.

There have been numerous occurrences of sinkholes in and surrounding Ballarat, Creswick and Stawell, refer to photos below.

Photo 7. December 2017, a truck stuck in a sinkhole in Duncan Street, Ballarat (photo source: The Courier).

Photo 8. June 2018, a mine ventilation shaft collapsed in Elsworth Street, Mt Pleasant (source: The Courier).

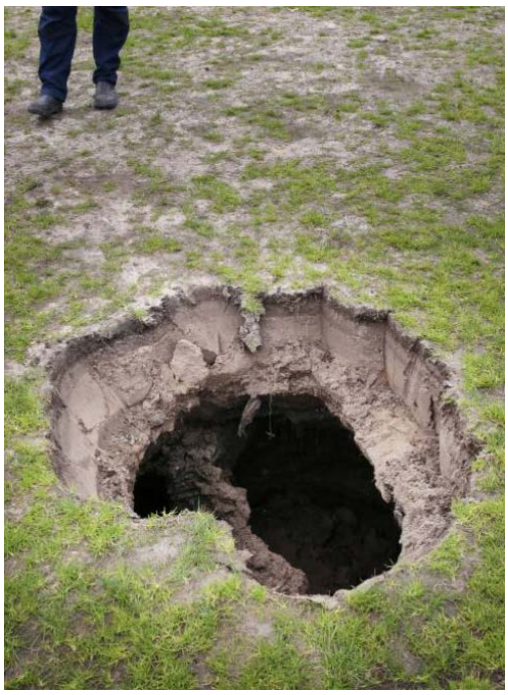


Photo 9. September 2016, a sinkhole opens up in the Buninyong Community Reserve Oval (source: The Courier).

4. Landslide Consequence Overview

4.1 Scenario 1 – Dislodged boulder from the upper section of Mt Arapiles

Category:	S3
Location:	Mt Arapiles
Triggers:	High intensity rainfall (e.g. 47.5mm in 1 hour, 100 year ARI) on a wet catchment or a rock climber.
Description of potential physical impacts:	▪ Risk to life or injury to rock climber/s and/or bushwalkers.
Consequences:	**Wellbeing:** ▪ Possible risk to life or injury to rock climbers and bushwalkers. **Liveability:** ▪ Potential to have an impact on the local community due to risk of further occurrences. ▪ Potential to restrict access to specific areas or walking tracks within the Park **Sustainability:** ▪ Economic impacts due to potential reduction in tourism due to increased level of community anxiety of further occurrences. ▪ Local climbing businesses impacted due to reduced bookings based on fear of further occurrences.
Transfer of control:	This level of incident is a level 1, managed by the Incident Controller at the Incident Control Point.

4.2 Scenario 2 - Landslide across Grampians Road, Halls Gap.

Category:	S3
Location:	Gully line on eastern side of Mount Difficult Range, Grampians Road, Halls Gap
Triggers:	High intensity rainfall (47.5mm in 1 hour, 100 year ARI) on a wet catchment (source: BOM Halls Gap Intensity- Frequency -Duration table).
Description of potential physical impacts:	▪ Potential land movement. ▪ Risk to life for bushwalkers, cyclists, drivers. ▪ Road access is cut.
Consequences:	**Wellbeing:** ▪ Possible damage to vehicles and/or injury. ▪ Restricted access to Halls Gap and the Grampians National Park due to damage to main access road. ▪ Increased level of community anxiety due to possible road restrictions and possible disruption to services, ▪ Possible reduction in number of tourists due to anxiety of future landslides occurring. ▪ Possible delays transporting health related patients via road. **Physical Impacts:** ▪ Potential to have an impact on the local community due to loss of services including power, water and sewerage. **Liveability:** ▪ Transport routes and roads may be closed for some time. Alternate routes would be available, although at a reduced speed affecting travel times of tourists and local traffic. ▪ Public transport delays. **Sustainability:** ▪ Economic impacts due to transportation disruption. ▪ Tourism impacts due to restrictions on road and public transport. Localised business and social impacts caused by disruption to services. **Viability:** ▪ Minor disruption to freighting of goods, due to delays with the main access road. ▪ Road damage sustained in landside area and excessive use of secondary roads that is an economic (road repair) and liveability impact for local residents. **Community Connectedness:** ▪ Some restricted and/or altered access to communities due to disruption of road.
Transfer of control:	Normally this level of incident would remain under local control. There are circumstances where an incident should be managed by an Incident Controller based in an ICC and supported by an IMT with specialist skills and equipment, rather than by a field-based Incident Controller. Refer to Joint SOP J03.15 for full details.

4.3 Scenario 3 – 5m diameter sinkhole in the Western Freeway, Brown Hill, Ballarat

Category:	S3
Location:	Western Freeway, Brown Hill, Ballarat.
Triggers:	Prolonged heavy rainfall / earthquake / underground mining activity in the area.
Description of potential physical impacts:	▪ Potential land movement in the area of an existing mine shaft. ▪ Risk to life of drivers.
Consequences:	**Wellbeing:** ▪ Possible damage to vehicles and/or injury. ▪ Restricted access to major centres due to freeway damage. ▪ Increased level of community anxiety due to possible highway restrictions and possible disruption to services. ▪ Possible delays transporting health related patients via road. **Liveability:** ▪ Transport routes and roads may be closed for some time. Alternate routes would be available, although at a reduced speed affecting transport of goods from Melbourne to western Victoria. ▪ Public transport delays. **Sustainability:** ▪ Economic impacts due to transportation disruption. ▪ Some minor tourism impacts due to restrictions on road and public transport. Localised business and social impacts caused by disruption to services. **Viability:** ▪ Minor disruption to freighting of goods, due to delays with the freeway, linking Melbourne to western Victoria. **Community Connectedness:** ▪ Some restricted and/or altered access to communities due to disruption of the freeway.
Transfer of control:	Normally this level of incident would remain under local control. There are circumstances where an incident should be managed by an Incident Controller based in an ICC and supported by an IMT with specialist skills and equipment, rather than by a field-based Incident Controller. Refer to Joint SOP J03.15 for full details.

5. Regional Landslide Arrangements

This section of the plan outlines the specific arrangements for managing landslide emergencies in the Mid West (Grampians) Region. Arrangements differ depending on the scale of the landslide emergency. This section of the plan relates to landslides deemed to be an emergency, which are generally S1 – S4 landslides, as outlined in the State Landslide Hazard Plan.

5.1 Arrangements for S1 – S4 Landslide Emergencies

This section describes the arrangement for managing large to very large landslide emergencies, with the following attributes:

Category	Relative Size	Volume of Failure (m3)	Typical Dimension (LxWxD) metres	Individual block size	Overall debris scale
S1	Very Large	>20,000	50 x 100 x 10	Individual block size >1.0m	Around the size of the MCG stadium or greater
S2	Large	2,000 to 20,000	25 x 60 x 7	0.5m-1.0m minimum dimension	Around the size of a local football oval
S3	Medium	200 to 2000	10 x 25 x 4	0.2 to 0.5m minimum dimension	Around the size of a house
S4	Small	20 to 200	5 x 10 x 2	0.2m minimum dimension	Around the size of a semi-trailer truck

5.2 IMT Footprints, Structures and Resourcing

Refer to the map and below for the pre-determined ICCs footprint and locations within the Mid West (Grampians) Region.

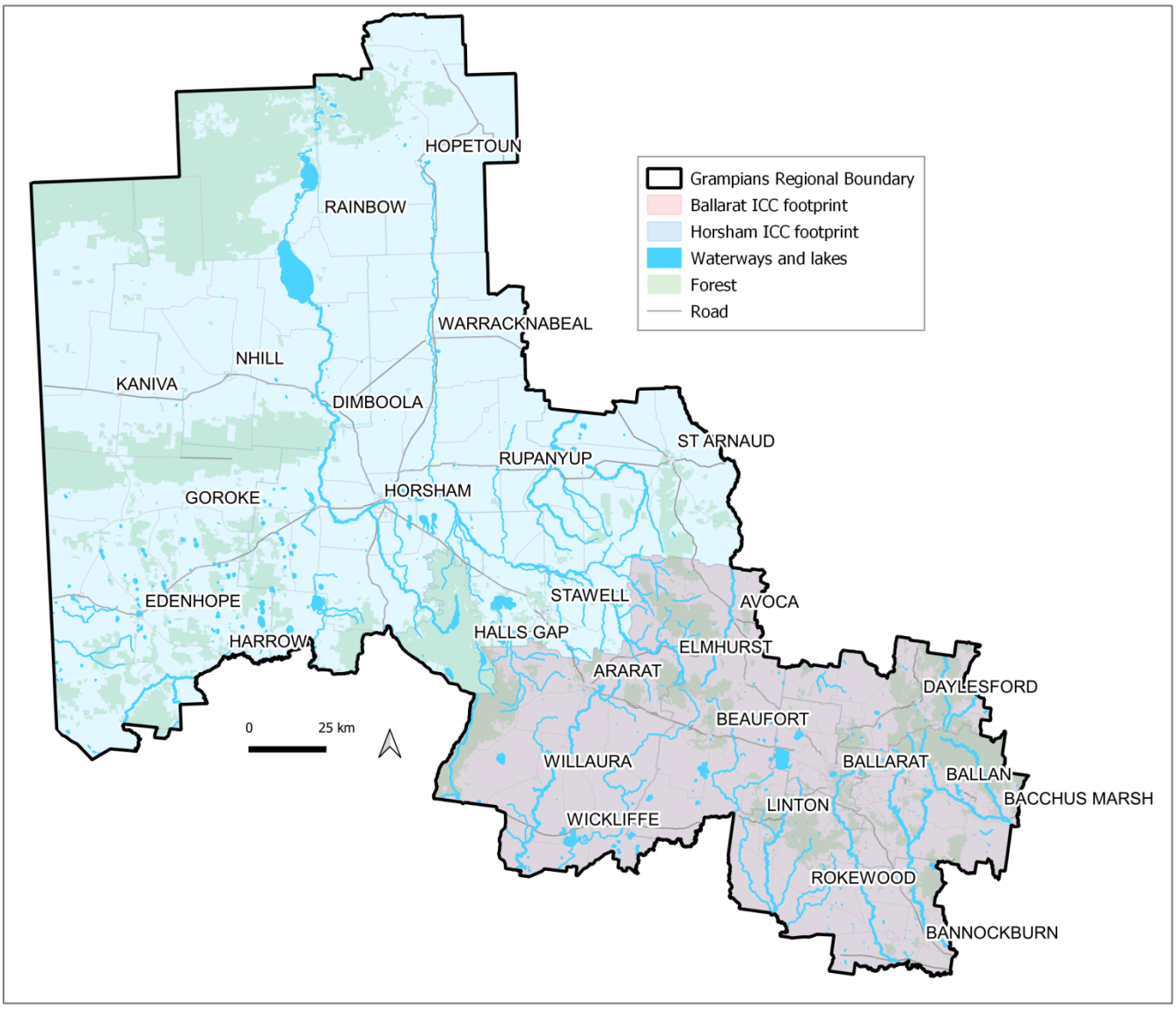


Figure 5. Mid West (Grampians) Region ICC boundaries.

Table 3. Mid West (Grampians) Region ICC locations.

ICC Location	Local Government Areas
Horsham ICC, 110 Natimuk Road, Horsham	West Wimmera, Hindmarsh, Horsham, Northern Grampians, Ararat, Yarriambiack.
Ballarat ICC, 25 Vickers St, Sebastopol	Pyrenees, Ballarat, Moorabool, Golden Plains, Hepburn.

5.3 Divisional Command Points

Identified VICSES endorsed Divisional Command Locations within the Mid West (Grampians) Region are contained in VICSES SOP 070 this can be found at: www.ses.vic.gov.au.

Note: Other suitable facilities may be utilised at the discretion of the Incident Controller.

The table below provides details of current predetermined Divisional Command locations.

Table 4. Mid West (Grampians) Region Divisional Command Locations.

DCP Location	VICSES Units Within Footprint	Local Government Areas
Horsham CFA Office, 19 McLachlan Street Horsham	Nhill / Dimboola	Hindmarsh Shire
Stawell Unit	Stawell / St Arnaud	Northern Grampians Shire
	Kaniva / Goroke / Edenhope	West Wimmera Shire
	Warracknabeal / Dunmunkle	Yarriambiack Shire
	Horsham	Rural City of Horsham
Ballarat Unit	Ballarat	City of Ballarat
CFA Bacchus Marsh	Bacchus Marsh	Moorabool Shire
Hepburn Shire Unit	Hepburn	Hepburn Shire
Ararat Unit	Ararat	Ararat Rural City

Divisional Command Location footprint maps can be located at https://hub.ses.vic.gov.au under My State > Operations > Command and Control facilities.

Pre-determined Control Structures

Control structures for landslide emergencies are determined according to the Landslide Readiness and Activation Trigger Considerations (Attachment 1).

Local Intelligence Sources

Intelligence Type and Description	Location
VicRoads Traffic Camera Dashboard Provides live intelligence (video) about impacts to traffic on major arterials/freeways.	EM-COP > Desktop > Information Displays > Traffic Melbourne
Geoscience Australia	www.ga.gov.au

Mid West (Grampians) Regional Resource Table

No	Unit	Unit No	Heavy Rescue	Medium Rescue	Light Rescue	Transport 4WD	Storm trailer	Community Education Trailer	Welfare Trailer (Kitchen)	ATV (All Terrain Vehicle)	Sandbag Filling Machine (hopper)	Rescue Boat	Land Based Swift Water	Steep Angle Rescue	High Angle Rescue	Lighting Trailer	Litter Mules	Motorbikes	EPA Air Monitoring	Logistic Truck	USAR Trailer	Mobile Control Vehicle	Fork Lift	Handheld Radio's RDO Kit	Staging Area Cache	Mass Casualty Cache	Portable Radios in VRN Cache	Satellite Phone	EMLO Laptop Kit
1	Ararat	770	1		2	2						1	Y	1		1														
2	Bacchus Marsh	771	1		1	2	1					1	Y			1		4												
3	Ballarat	772		1		3	2		1	1		2	Y			1	1	2	1											
4	Ballarat RSU	773																	1										3
5	Dimboola	774	1			1	1									1														
6	Dunmunkle	780		1		1	1																							
7	Edenhope	775	1			1	1									1														
8	Goroke	776				2	1																							
9	Hepburn	786		1		2	1					1				1														
10	Horsham	777	1			2	1					1			1				1											
11	Kaniva	778	1			2																								
12	Nhill	779	1			1	1																							
13	St Arnaud	781	1			1	1																							
14	Stawell	782	1			3	1	1			1	1	Y		1	1	1		1										1	
14	Warracknabeal	783	1			1	1																							
15	Mid West Ballarat	784	1			1		1		1		1										1	1	2	1	1	6	1		
16	Mid West Horsham	787				1		1																2				1	1	
		TOTAL	11	3	3	26	13	3	1	2	1	8	4	1	2	7	2	6	3	1	0	1	1	4	1	1	6	3	4

5.4 Pre-determined Control Structures

Control structures for landslide emergencies are determined according to the Landslide Readiness and Activation Trigger Considerations (Attachment 1).

5.5 Inter-agency Agreements

Currently there are no inter-agency agreements.

For detailed maps and search and rescue plan arrangements for Mt Arapiles and the Grampians National Park, refer to reports;

- Mount Arapiles – Tooan State Park Search and Rescue Plan, May 2019
- Grampians National Park Search and Rescue Plan

5.6 Local Intelligence Sources

Sources of local intelligence are listed below.

Table 5. Mid West (Grampians) Region local intelligence.

Intelligence Type and Description	Location
VicRoads Traffic Camera Dashboard Provides live intelligence (video) about impacts to traffic on major arterials/freeways.	EM-COP > Desktop > Information Displays > Traffic Melbourne
Mt Arapiles Parks Victoria staff (local observers)	Parks Victoria after hours State Duty Officer 13 1963
Grampians National Parks Victoria staff (local observers)	Parks Victoria after hours State Duty Officer 13 1963
DELWP Wimmera District Duty Officer	5362 0720
Victoria Police 251 Supervisor Western Region Division 4	5355 1572
Victoria Police SAR Coordination Centre	03 9399 7503

5.7 Regional Resources

Councils in Mid West (Grampians) Region are signatories to the Municipal Association of Victoria (MAV) resource sharing protocol.

Resources are available through existing Regional and Municipal Emergency Management Plans.

5.8 Traffic Management Arrangements

No specific traffic management plans have been developed for the Mid West (Grampians) Region. If TMPs are required for an event, these will be arranged by the Incident Controller in consultation with the Emergency Management Team (EMT) at the time.

5.9 Public Information and Warnings Roles and Responsibilities

Public Information and Warnings Triggers

VICSES will only issue community notifications if a landslide is determined to be an emergency and VICSES takes active control of the incident, as explained in Section 2.6 of the State Landslide Hazard Plan.

VICSES will consider issuing a community notification based on scale, category and actual or potential community consequences. Further guidance is available in the VICSES Landslide EM-COP Public Publishing Business Rules, available in the IMT Toolbox (Public Information) via EM-COP.

When issuing landslide community notifications, personnel should contact the VicRoads emergency services priority phone line on 1300 107 778 to ensure the incident is listed on VicTraffic website.

Business as Usual

This refers to the responsibility for delivery and coordination of public information and warnings during business as usual operations, or when an ICC has not yet been established remains with the Regional Duty Officer (RDO) and Regional Agency Commander (RAC).

Line of Control

This refers to the responsibility for delivery and coordination of public information and warnings when formal Line of Control is active or when an ICC is activated. This rests with the Public Information Section of the relevant ICC with authorisation through the Incident Controller.

References

Federation University, 2014, Understanding the 2011 Grampians Natural Disaster, addressing the risk and resilience Executive Summary (report link: http://maynard.cerdi.com.au).

GHD, 2011, Halls Gap Landslide Susceptibility Zoning Report.

Water Technology, 2017, Halls Gap Flood Study Report (report link: www.wcma.vic.gov.au).

Halls Gap Landslide Interim Guidelines, 26 May 2011. Prepared by the Halls Gap Community Safety Committee.

Glossary

AEP	Annual Exceedance Probability
AIIMS	Australasian Inter-Service Incident Management System
ARI	Average Recurrence Interval
BOM	Bureau of Meteorology
CFA	Country Fire Authority
DCP	Divisional Command Point
DELWP	Department of Environment, Land, Water and Planning
EM-COP	Emergency Management – Common Operating Picture
EMLO	Emergency Management Liaison Officer
EMMV	Emergency Management Manual Victoria
EMV	Emergency Management Victoria
ICC	Incident Control Centre
IEMT	Incident Emergency Management Team
ICP	Incident Control Point
IMT	Incident Management Team
JSOP	Joint Standard Operating Procedure
MEMP	Municipal Emergency Management Plan
MFEP	Municipal Flood Emergency Plan
RAC	Regional Agency Commander
RC	Regional Controller
RCC	Regional Control Centre
RDO	Regional Duty Officer
REMT	Regional Emergency Management Team
SCC	State Control Centre
SCT	State Control Team
SERP	State Emergency Response Plan
SOP	Standard Operating Procedure
USAR	Urban Search and Rescue
VICSES	Victoria State Emergency Service

Attachment 1 – VICSES Landslide Readiness and Activation Trigger Considerations

LANDSLIDE READINESS AND ACTIVATION TRIGGER CONSIDERATIONS - V3.3 - March 2018

Readiness Level	RL 1- LOW TO MODERATE	RL 2 - HIGH	RL 3 - Very High (A)	RL 3 - VERY HIGH (B)	RL 4 - SEVERE	RL 5 - EXTREME
Category/Scale	S6	S5	S4	S3	S2	S1
FDI	0 - 11	12 - 24	25 - 34*	35 - 49*	50 - 74	75 - 99
	THUNDERSTORM FORECAST CHART [TFC] issued daily			SEVERE WEATHER INTELLIGENCE BRIEFING [SWIB] issued TUE & FRI		
Landscape Observation	Trees leaning on an angle Hand size rocks falling on road, small cracks in roadways Less than 1m wide sinkhole Sinkhole data is lost in here *S6 may have little or no impacts on the community and not require specific warnings to be provided except through relevant agency channels (e.g. VicRoads)*		Potential or observed land movement (slump or minor landslide) Head size rocks falling, cracks in roadways that are increasing Sink hole that is over 1m wide but not increasing, small debris flow	Potential or observed land movement that will impact community Isolated or impact to dwellings Is this correct wording Rock and/or debris on road closing the road for up to 6 hours, cracks in roadways that require traffic management Sink hole that is over 3m wide and increasing, debris flow in creeks	Potential or observed land movement with direct community impact including people trapped Significant rock and/or debris on road closing the road for greater than 24 hours, road damage that requires road closure Sink hole that is over 7m wide and increasing, multiple debris flows impacting communities	Potential or observed land movement with direct community impact in multiple locations and possible multiple trapped people Rock and/or debris on road closing the road for greater than 72 hours, road damage that requires road rebuilding Sink hole that is consuming infrastructure and increasing, multiple debris flows impacting communities
Approximate Size And/or	Wheelbarrow < 2 Tonnes 1m (L) x 3m (W) x 0.3m (L)	Small Car 2 to 20 Tonnes 2m (L) x 4m (W) x 1.2m (L)	Semi-Trailer Truck 20 to 200 Tonnes 5m (L) x 10m (W) x 2m (D)	House 200 to 2000 Tonnes 10m (L) x 25m (W) x 4m (D)	Country Football Oval 2,000 to 20,000 Tonnes 25m (L) x 60m (W) x 7m (D)	Large Stadium (e.g.: MCG) >20,000 tonnes 50m (L) x 100m (W) x 10m (D)
Susceptibility with Weather Areas identified as known risks are: Grampians Halls Gap Otway National Park Great Ocean Road Wye River Great Alpine Road Great Alpine National Park Snowy River National Park Dandenong ranges, Frankston			SWW - Heavy Rainfall leading to flash and/or riverine flooding across Districts considered 'Likely'. Significant chance of Thunderstorms and hail likely. Chance of Flash flooding likely. Predicted rainfall over 50mm of rain in an hour. Catchment areas identified saturated with little initial losses.	SWW - Heavy Rainfall leading to flash and/or riverine flooding across Districts considered 'Very Likely" Significant chance of Thunderstorms and hail likely. Chance of Flash flooding likely. Predicted rainfall of up to 80mm of rain in an hour. Catchment areas already identified as saturated with little initial losses. Particular interest should be taken in recent fire damaged areas.	SWW - Heavy Rainfall leading to flash and/or riverine flooding across Districts considered 'Very Likely' Significant chance of Thunderstorms and hail likely. Predicted rainfall of up to 150mm of rain in 6 hours. Catchment areas already identified at capacity, unable to retain further moisture. Particular interest should be taken in recent fire damaged and known mapped landslide risk areas.	SWW - Heavy Rainfall leading to flash and/or riverine flooding across Districts considered 'Very Likely' Potential Dangerous thunderstorm warnings issued. Thunderstorms and hail certain. Predicted rainfall above 200mm of rain in 6 hours. Catchment areas already identified at capacity, unable to retain further moisture. Particular interest should be taken in recent fire damaged and known mapped landslide risk areas.
	VICSES - Business As Usual Operations			JSOP 2.03 LINE OF CONTROL		
Readiness (State)	SCC Level White	SCC Level White	SCC Level White/Blue	SCC Level BLUE or When ICC activated	SCC Level ORANGE Multiple ICCs activated or multi region	SCC Level RED Multiple ICCs activated or multi region
	SAC and SDO (monitor)	SAC and SDO (monitor)	SAC and SDO (actively monitoring)	SDO and SAC In Place	SDO and SAC In Place Consider Day/Night	SDO and SAC In Place Day and Night
Readiness & Activation (Regional)	RDO (monitor)	RAC (monitor)	Regional Command IN PLACE	RCC OPEN: with BASE RCT in place	RCC OPEN: RCT in place, some agencies available on immediate recall	RCC OPEN: Full RCT/most REMT In Place
	RAC (aware)	RAC (aware)	RAC/RDO attends Regional Office	RC, RAC, RDO at RCC	RC, RAC and RDO In Place at RCC	RCT, RAC and RDO In Place at RCC
Readiness and Activation (Incident)	RDO (monitor)	RDO (monitor)	RDO - RAC IN PLACE Resource Officer (Stby) Management Support (Stby)	BASE IMT (In Place)	CORE IMT (In Place)	FULL IMT (In Place)

Impact	Potential Consequences		
People	Some minor inconvenience around local roads.	Increased number of roads being impacted, traffic management plan likely to be in place. May require formal landslide warnings to be issued. Potential individual properties relocation and evacuations. Inconvenience to normal transport routes, delays on road network could be expected, school bus routes may require change. Local Regional / State and National Parks may be closed for short periods.	Significant number of roads impacted traffic management plan is required, some major roads closed for extended periods. Formal landslide warnings issued, evacuations likely to be undertaken, potential prolonged relocations. Local, Regional / State and National Parks closed for a number of days. Disruption to communities daily routines, increased traffic, schools closed, community requiring support to remain functioning. Injuries and potential for deaths due to landslides.
Remote communities	May have minor local inconvenience only	Some isolation and loss of utilities of individual properties or remote communities are likely. May require additional support to maintain community routine, including consideration for groceries, medication etc.	Community isolation and loss of food/ medical supplies potential with resupply requirements dependant on time of power or access outages. Ongoing requirement to assist isolated communities for extended periods, may require additional support services to be deployed to areas.
Health	Little impact expected some local issues might be encountered but managed locally within own facility Plan	Consideration for review and familiarisation with facility Plan - VICPOL and DHHS to review Vulnerable persons list, potential to engage community networks to ensure additional vulnerable people support.	Likely vulnerable people impacted require relocation. Communities without utilities for days needing support. Hospitals and nursing homes may require additional management for increased patient care.
Power	Possible power disruptions	Likely short term power disruptions	Power disruptions almost guaranteed likely with potential long term outages in affected areas. Will require management for short term solutions.
Water utilities	Little impact expected some local issues might be encountered but managed locally.	Increased potential for infrastructure damage and disruption but still managed locally. Sewerage and potable water may be affected. May take days to restore connections. Silt and drinking water quality concerns.	Likely that some infrastructure will be impacted, water authorities should develop or initiate their plans to address issues. Significant potential for pollutants including sewerage in water and loss of power will exasperate the impacts.
Telecommunications	Unlikely to impact network but may have some local damage	Potential impact for communities, isolation from communications networks. May take days to restore connections.	Significant impact with loss of landlines and mobile towers which will affect people's capacity to receive warnings and information. Commercial/Business impacts with loss of phone services. NBN impacts with loss of power and data. Potential for infrastructure damage for cable/ fibre.
Gas	Little impact expected some local issues might be encountered but managed locally.	Increased potential for infrastructure damage and disruption but still managed locally. Sewerage and potable water may be affected. May take days to restore supplies	Likely that some infrastructure will be impacted, supply authorities should develop or initiate their plans to address issues. Significant potential longer term supply restrictions.
Road Network	Unlikely to impact network but may have some local road damage/ impacts	Some minor roads may be impacted with possible disruption to critical needs supplies such as milk and transport routes. Roads could be closed up to 2 hours with mitigation works required.	Likely for roads to be cut and egress and access impacted. Major roads potentially cut in some locations traffic diversions in place for extended periods. Infrastructure such as bridges destroyed. Potential rescue of trapped persons in vehicles highly likely. Expected impact on rail routes. Economic impact likely with loss of power and utilities supply for lengthy period.
Public Transport	Limited impact on public transport routes	Impact to public transport routes may occur with diversions possible and some delays experienced	Public transport impacts will occur with roads and rail lines cut and no alternative route available - significant disruption to people movement likely in affected areas.
Critical infrastructure	Nil impact	Requires preparatory work and discussion with owner of infrastructure, potential for damage to infrastructure	Significant work likely to be required to protect critical infrastructure - Contingency plans put in place if loss of the infrastructure occurs.
Public Infrastructure /Essential Community Infrastructure	limited impact	Some disruption to community areas and infrastructure - Potential damage of essential community infrastructure	Significant damage to community infrastructure and community facilities. Long term closure of essential community facilities likely.
Education	Unlikely impact	Some impact expected traffic management plan for school buses should be considered.	Some school and preschools may be impacted by utilities loss and damage to infrastructure and school bus routes closed for period of time in affected areas.
Public Events	Unlikely to impact	Some public events may need to be cancelled or rescheduled due to safety of patrons either whilst at event or travelling to or from.	Public events impacted likely cancellation of major events due to damage and risk, and potential direct impact on venue or ability to attend or leave event.
Tourism	Unlikely that event will be impacted but consideration must be given to any event occurring to ensure it is safe to continue.	Potential impact on tourist locations if area not safe to visit or isolated due to road closures and landslide impact areas. Economic impacts due to isolated areas from road closures/ transport etc.	May impact on high value tourist locations and facilities with long term impacts in the social and economic environment of communities.
Agriculture/Animal welfare	No impact likely with landowners managing any localised issues.	Potential impact with losses to live stock, fencing and crops including high intensive farming of produce and tree farms	Substantial impact to crops, including high intensive produce farming (vegetables and fruit) and tree farms with short and long term impacts due to loss of crops. Economic impact to area. Social impact to area.
Environmental	Minimal impact	Stream erosion and loss of vegetation around watercourses potential. Minor tree damage, vegetation displacement and local parks infrastructure damage, silt and water quality concerns. Potential for new river or creek flow paths to develop - change in flood risk.	Stream erosion and loss of vegetation around watercourses expected. Tree damage, vegetation displacement and local parks infrastructure damage, silt and water quality concerns. Potential for new river or creek flow paths to develop - change in flood risk.
Cultural Heritage	Minimal impact likely	Some disturbance or damage along watercourses and sacred areas may occur. Potential for destruction of cultural heritage sites.	Potential for impact on historical structures and features. Damage along watercourses and sacred areas may occur. Likely destruction of cultural heritage sites.
Relief and Recovery	Relief and recovery activity unlikely may be some local issues.	Increased potential for relief and recovery activity but likely to be managed locally by LGA with support of DHHS	Formal arrangements put in place for relief and recovery activity Regional Recovery Commander appointed. Health Commander in place and demands on relief and recovery to be substantial and potentially long term. Requirement for transition to recovery to be implemented.

Attachment 2 – Halls Gap and Grampians National Park Landslide Triggers, Susceptible Mapping and Landslide Intelligence Card.

The Halls Gap and the Grampians National Park Landslide Intelligence Card below outlines landslide triggers;

- When the forecast rainfall reaches a 50 year ARI, this is the activation trigger for monitoring an readiness (3A trigger).
- When the forecast rainfall reaches a 100 year ARI, this is the activation trigger for setting up an ICC (3B trigger).

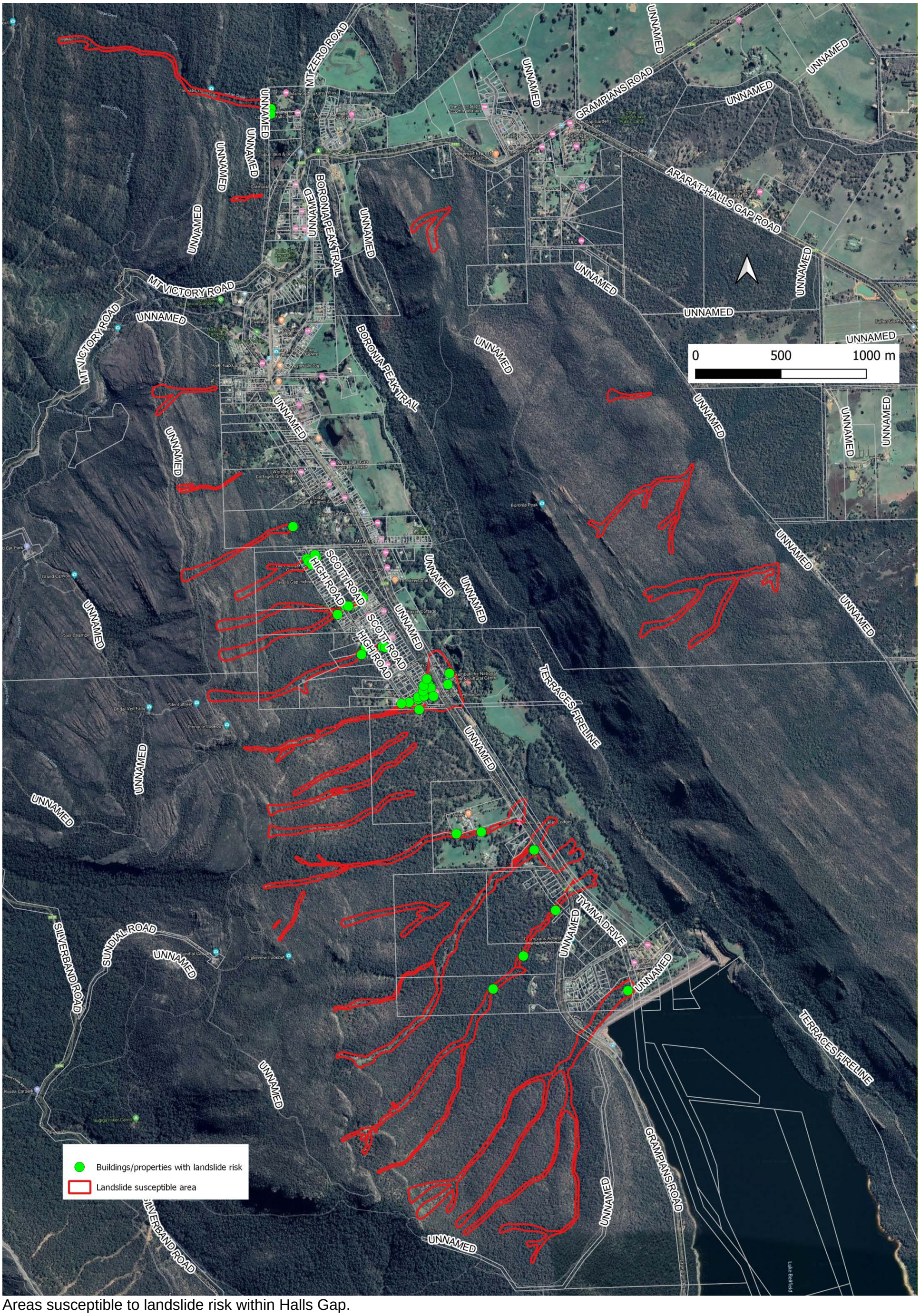
The closest rainfall gauge to Halls Gap is located at Mount William. An important factor to consider when using rainfall intensity to determine the likely occurrence of landslides is the saturation of the catchment (wetness). The forecast or observed rainfall is more likely to translate to flooding and landslides if it occurs on a wet catchment, if streamflow is present along the waterways before the rainfall event. If rainfall occurs on a dry catchment, a significant percentage of rainfall is likely to be lost to infiltration, and will not translate to runoff and flooding.

Refer to the Halls Gap and the Grampians National Park Landslide Intelligence Card and Halls Gap landslide susceptibility mapping below.

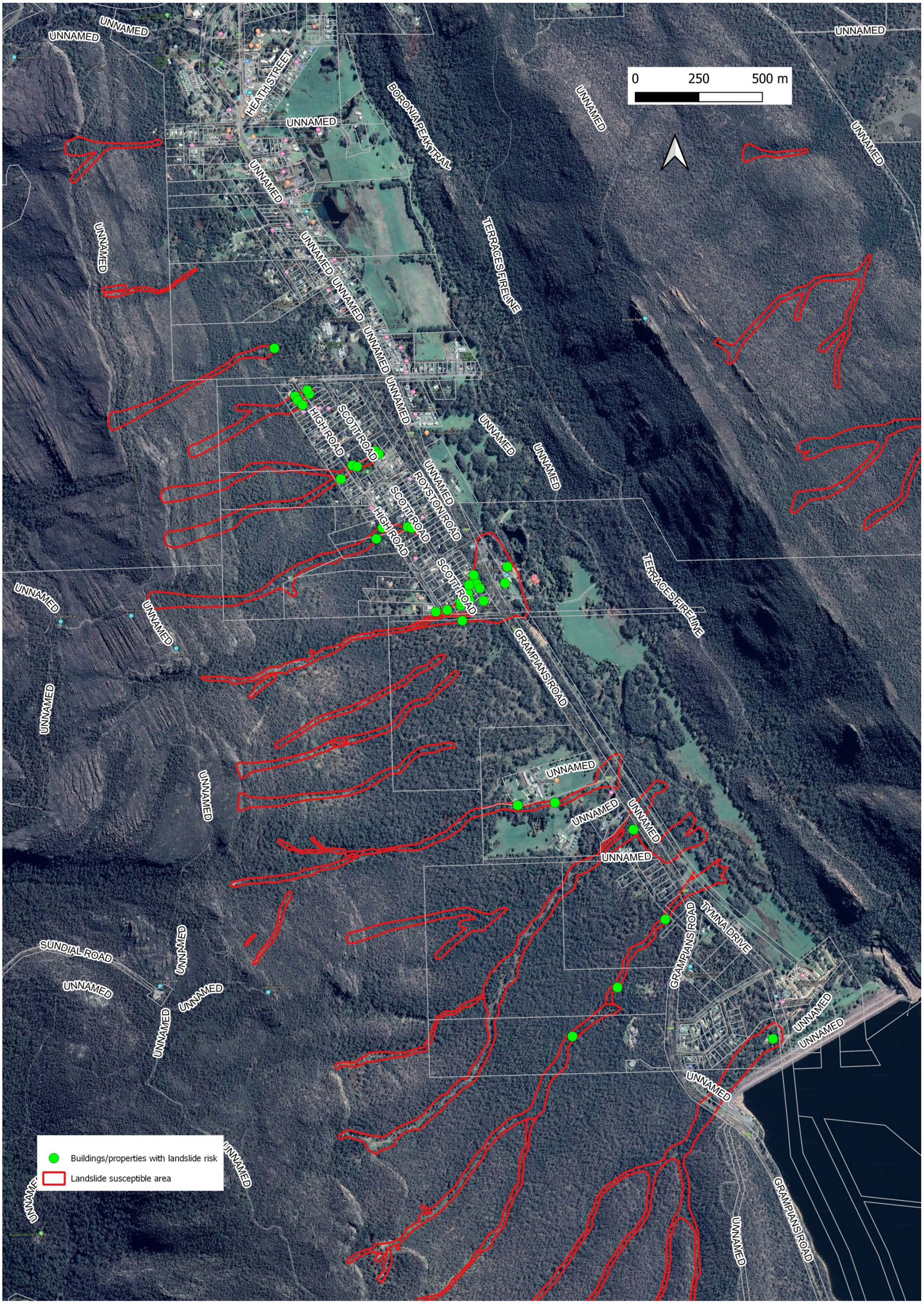
Halls Gap and the Grampians National Park Landslide Intelligence Card.

Halls Gap						Time from start of rain to steep rise in floodwater 2 - 4 hours Time to peak 3 - 6 hours Riverine flooding duration: 1 day	
Observed rainfall in Halls Gap (mm) Water Tech 2017	**Average Recurrence Interval (ARI)**	**Halls Gap flood damages total number properties flooded (above floor)**	**Flood consequences/ Impacts**	**Buildings / properties susceptible to landslide impacts**	**Roads impacted by landslides**	**Landslide consequences/ Impacts**	**Actions**
~62 mm in 12 hours to ~80 mm in 24 hours	5		Halls Gap and Mount William rainfall gauges and flood observers along Stoney Creek shops are the best indicator for flooding in Halls Gap. Fast flowing breakouts occur from Stony Creek upstream of Halls Gap School Road. These breakouts result in flooding of that part of the Halls Gap Caravan Park located between the Halls Gap Primary School and Grampians Road.				
~71 mm in 12 hours to ~92 mm in 24 hours	10		Flooding of the Brambuk Cultural Centre has occurred during small flood events. The town oval is quickly surrounded by fast flowing water at least 250mm deep even though the centre of the reserve appears to remain dry even in large events. Not a good assembly location in times of flash flooding as access / egress quickly becomes difficult and dangerous. As velocities are high, the risk to campers is substantial, if there is risk of flooding all Halls Gap caravan parks should be evacuated.				
~84 mm in 12 hours to ~108 mm in 24 hours	20		Buildings in close proximity to gully lines are at risk of flooding. Due to the steep nature of Mt William and Mt Difficult, inundation along the gullies is relatively similar across the design events. During high frequency events flow remains in channel, but when the channel capacity is exceeded water flows overland rapidly at shallow depth.				
~101 mm in 12 hours to ~130 mm in 24 hours	50		Potentially buildings in the main shopping complex area and the Halls Gap Caravan Park are at risk of flooding.				The trigger to activate monitoring and readiness has been met. VICSES to actively monitor stream flow and the potential for landslide impacts in Halls Gap. Activate ground observers to provide local

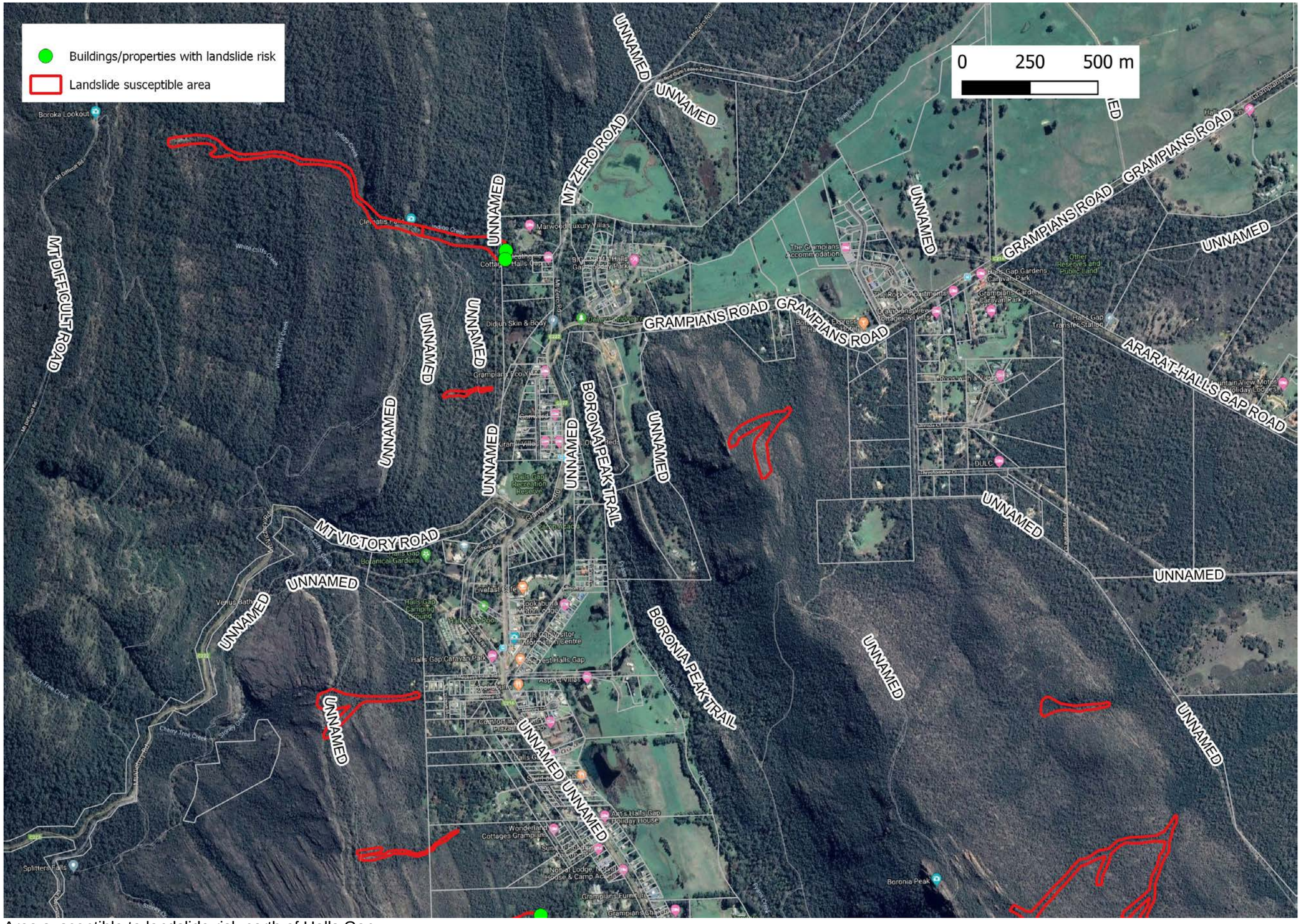
							flood observations to build situation awareness.
~115 mm in 12 hours to ~148 mm in 24 hours	100		The Police Station car park. There are 7 sewer pump stations in Halls Gap. It is considered likely that a large flood will inundate the following pump stations: - At the junction of Sundial Avenue and Tymna Drive - Adjacent to No 5 Tandara Road - At the Halls Gap Hotel (2262 Grampians Road)	Approximately 36 buildings/properties are susceptible to landslide impacts: x12 High Road (1, 4, 5, 8, 10, 33-37, 42, 66, 72, 94-96, 101, The Ripley Family Holiday Retreat 39), x9 Scott Road (27, 33, 54, 64, 88, 89, Pinnacle Loft 90, 92, 95), x12 Grampians Road (Norval Lodge, Norval House and Camp Acacia 204-232, 318, Gang Gang Villas 320, 322, 324, Brambuk Backpackers Hostel 330, 334, Brambuk the National Park and Cultural Centre, The Views 394-404, Halls Gap Valley Lodges 406-412, 420, 474), x2 Mount Zero Road (Marwood Luxury Villas 17, 31) and 42-56 Tymna Drive. Refer to maps below.	Grampians Road (between Halls Gap and Dunkeld), Mount Victory Road, Silverband Road (refer to photos), refer to maps below.		The trigger to activate setting up an ICC has been met. Parks Victoria close the Grampians National Park. Victoria Police consider evacuating the Grampians National Park and buildings/properties susceptible to landslide impacts.
286.8 mm over 5 days	January 2011 approx 100 year event in Water Tech 2017	20 (11)	Flooding impacted a number of buildings, including 8 shops in the Stoney Creek Shopping complex, Brambuk Cultural Centre, Parks Victoria Office Building (adjacent to Brambuk), the Grampians Caravan Park (Centre of town), Parkgate Resort Caravan Park (north Halls Gap)and buildings adjacent to gully lines, most of which were not recorded. Houses flooded above floor: x6 Grampians Road (23, 97, 124, 412, 188, 2372), 14 Warren Road, 23 Tymna Drive, 13 Thompson Street, 95 Scott Road, 26 Heath Street, x2 High Road (53, 89) and 31 Mount Zero Road. Septic tanks overflowed, urban sewer mains north of Halls Gap were cut as well as the power supply. Significant landslides blocked access to roads along Pinnacle Road, High Road and south of Lake Bellfield. There was significant reshaping to Stoney Creek.		Grampians Road (between Halls Gap and Dunkeld), Mount Victory Road, Silverband Road (refer to photos)	200 landslides costing over $400 million in damages. Some landslides over 200m wide and 3km long. Large trees were uprooted and washed away like matchsticks. Bridges, culverts, drains, roads, houses, private land, waterways, fences, walking tracks and picnic facilities were destroyed. Vic Roads estimated the volume of debris removed to reinstate the road network was in excess of 12,000m^3. Reduced water quality of Lake Bellfield, critical for potable water supply, impacting urban and agricultural water supply, estimated cost $2.2 million	
~130 mm in 12 hours to ~168 mm in 24 hours	200						
~151 mm in 12 hours to ~195 mm in 24 hours	500						
	Probable Maximum Flood		Design modelling of Lake Bellfield dam wall failure shows it would have significant impacts on the Lakeside Caravan park and a large number of buildings downstream of Lake Bellfield along the valley floor. The Failure of Lake Bellfield dam wall has a very low probability of occurring.				



Areas susceptible to landslide risk within Halls Gap.



Areas susceptible to landslide risk south of Halls Gap.



Area susceptible to landslide risk north of Halls Gap.