Landslips – a moving story (a Municipality's perspective)

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Landslips occur in varying degrees, on a regular basis, throughout our municipality. Recently the Shire of Yarra Ranges initiated a shire-wide survey, by consultant geotechnical engineers, to assess the risk of landslip. During this process approximately 11% of the Shire's rateable properties were identified in the two highest risk categories.

Municipalities provide the link between response and recovery agencies and the local community. How well a community handles an emergency is directly related to the attitude, preparedness and involvement of the local government agencies.

This article provides one municipality's experiences of identifying a potential risk to its community and how they approached the situation.

The Municipality

The Shire of Yarra Ranges is located east of Melbourne. It has an area of approximately 2,400 km^2 and an enviable reputation for its natural beauty and numerous tourist attractions (i.e. the Dandenongs, Yarra Valley, Healesville Sanctuary, Puffing Billy). Approximately one third of the municipality is comprised of Crown Land. (i.e. State or National Parks).

The natural terrain, although picturesque, can carry an enormous risk to life, property and environment from events such as fire, flood and landslips.

The Shire was formed in 1994 during the State Government's review of municipal boundaries, 211 Victorian municipalities were reduced to 78 and the Shire of Yarra Ranges was created from a combination of four former municipalities. Consequently a need was established to consolidate the four previous Shire Planning Schemes into a relevant and consistent Planning Scheme for the newly formed municipality.

Various anomalies were highlighted during this process, one being the issue of geotechnical surveys having been conducted in two of the four pre-amalgamation municipalities. This subsequently obligated the Shire to initiate a comprehensive survey of all areas within its boundaries.

The survey

A geotechnical survey was undertaken during 1998/99 by consultant geotechnical engineers, Coffey Geosciences Pty Ltd. This assessed the risk of landslip potential across the entire municipality, excluding Crown Land. The survey allowed for the creation of an Erosion Management Overlay that could be incorporated within the new Planning Scheme and the Shire's Geographic Information System (GIS). This enabled measures to be taken so that the impact of development could be properly managed in relation to landslips.

The Erosion Management Overlay divides the municipality into six categories. These categories are shown in *Table 1*.

There are approximately 55,000 rateable properties within the Shire of Yarra Ranges.

The survey identified 434 properties in the High Risk category and 5,556 properties in the M2 Medium Risk category. This translates to approximately 11% of total properties.

Involving the community

Given the large percentage of properties affected within the municipality, it was imperative that extensive community consultation was undertaken. The deliberation process on what information to provide was extensive. The services of an external public relations consultant was obtained to provide a communications strategy on how to achieve a more informed community, without instilling panic amongst affected property owners.

The objectives of the strategy were to:

- ensure that the community understood that the Shire had introduced a Landslip Overlay to protect the safety of the community
- explain that the results of the landslip study required the Council to provide a consistent set of planning controls
- highlight to the community that the Council would continue with its maintenance of roads and Council drains and revegetation of public land to retard the risk of soil erosion, which can be a major factor in triggering a landslip
- educate the community about the practical steps that can be taken to minimise exposure to landslip on individual properties

Conveying the 'right' message to the community was important. A negative reaction from the public could have had an enormous impact on Council's resources and potentially damaged its credibility. The issues of how to 'break the news gently' to residents, while 'fully' informing them, was crucial and considerable resources were channelled into ensuring that this was achieved.

The methods utilised to inform the community, included:

- briefing Councillors and staff on the potential impacts of the landslip issue within the community and the availability of an Erosion Management Overlay within the Shire's Planning Scheme

Ex	Exempt	Flat land, unlikely to be any instability, no impacts
L	Low	Landslip unlikely even though the land is gently sloping
MO	Medium Risk	Construction requires compliance with guidelines
M1	Medium Risk	Construction requires compliance with guidelines
M2	Medium Risk	Slopes>20% require a mandatory planning permit and site specific geo-technical assessment
H	High Risk	At risk of landslip without any development. A planning permit can only be issued where a geo-technical investigation shows risk is acceptable. There may be circumstances where a planning permit cannot be issued.

Table 1 : The six Municipal categories defined in the Erosion Management Overlay

- development of an extensive information kit containing various **fact sheets** on landslips. These fact sheets included:
  - landslips in the Shire
  - summary of the landslip study
  - geology of the Shire of Yarra Ranges
  - Coffey Partners landslip study
  - qualified Geotechnical Engineers consultants list
  - landslip risk categories
  - development practices that should be avoided
  - information for land owners (specifically addressing each risk category)
- private consultations made available with appropriate Shire officers to discuss specific individual requirements
- extensive media campaign conducted
- provision of a 'hot line' to enable easy access for resident enquiries
- provision of information to other interested stakeholders, i.e. real estate agents, insurance companies, Government authorities, etc.

The response

The Shire was pleased with the community's positive response to the consultation process. Initially, Yarra Ranges Service Centres received an influx of general enquiries from property owners and requests to access the mapping information in their particular areas. Generally the information kits were well received and appreciated.

Unfortunately it is hard to guess whether this response was due to:

- the comprehensive community awareness program
- apathy on behalf of property owners who may not be affected until the category assessment affects the sale/development of their property
- the lack of understanding of landslips and their potential impacts on the community

In hindsight some form of feedback process could have been included with the information kits to establish a clear indication of the level of understanding among the community.

Landslips within the Shire

Landslips are a fact of life in the Shire of Yarra Ranges and have occurred for thousands of years.

The types of landslips that occur in the Shire include falling boulders, debris flows, slow long term earth movements, small landslips up to the size of a residential block and large landslips involving entire hillsides. Some landslips move relatively frequently whereas others have not moved for hundreds, perhaps thousands of years.

Landslips can result from both natural and artificial causes. Heavy rainfall has triggered many landslips in the Shire, such as those that occurred in 1863, 1891, 1928, 1934, 1958, 1992, 1994 and 1996.

Some artificial causes of landslip include:

- excessive or poorly engineered cutting and filling
- inadequate drainage of seepage and surface water
- removal of vegetation
- construction on an old landslip or debris flow
- poor irrigation practices
- poor storm water run-off design
- inadequate ground waste water disposal

Many landslips occur then re-occur in the same location, therefore sites where landslips have previously occurred have a higher risk of future landslip.

Case studies

Case study 1

***1891 Montrose landslip**–site of significant previous landslip*

A landslip occurred in 1891 on the north western slopes of Mt. Dandenong.

To give an indication of the severity of this landslip, the Thredbo Tragedy in July 1997 involved the displacement of 2,000 cubic metres of liquefied soil, whereas this event involved the movement of 30,000 cubic metres of earth and rock—damage was recorded over at least 1.4 kilometres and the flow was said to have reached speeds of up to 40 kilometres per hour.

The extract below has been taken from the Lilydale Express, published in August 1891.

'…Twenty minutes after the gigantic mountain landslip at South Mooroolbark everything seemed to rest in tranquility, excepting the thundering noise of the rushing waters as they fought their way with vengeance down the valley scooped out by the rocks and trees in their mad career. The rain was falling in torrents, but nevertheless a good number of willing hands had gathered in order to rescue those from further harm, who so narrowly escaped with their lives from being engulfed for ever in the maddening rush of debris which swept all before it…

'…The first sign of danger occurred about 10am, when the water rushed down past the house in torrents, filling the creek in a few minutes. Mr. Jeeves, the manager, and another man named Goodwin, then tried to flog the horses, across but failed. About 1.30pm things looked bad, and Goodwin started for Abbott's house with

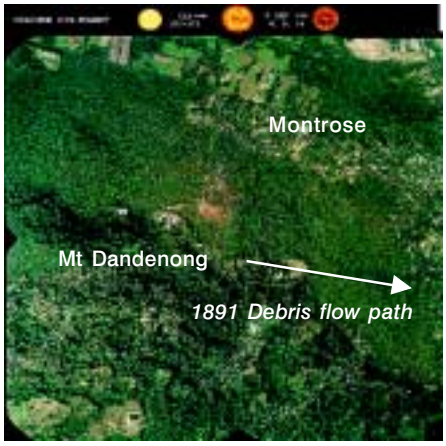

Figure 1: the Montrose landslip 1891 – 30,000 cubic metres of earth and rock moved down the slope at approximately 40km per hour.

his luggage, Mrs. Jeeves having gone a few minutes previously, with her child and the other two lads, Jeeves remaining to assist Mrs. Herschell across. Goodwin had just reached Abbott's fence when the mountain plunged down upon them with a noise like that of thunder. Goodwin received a severe shaking, but escaped serious injury. After recovering himself he said he ran down in the direction Mr. Jeeves and Mrs. Herschell had been carried. He then saw Mr. Sam Jeeves, who was covered with mud, crawl out of the debris. After searching and calling out, he saw something like an arm held up, of which he took hold. This proved to be Mrs. Herschell. After dragging the lady out of the mullock and stones, he filled his hat with water and poured it down her throat, she being nearly suffocated with mud…

'…Since then the rocks and earth have been falling in, thus, to a great extent, lessening the depth. No one as yet has given a decided opinion as to the cause of the collapse of such an immense body of earth, but as there is no solid rock foundation beneath the mountains, excepting large round to water washed boulders, which, perhaps are next to useless where the hill is so steep, all I can say for it is, as there were large openings or cracks to be seen some time back, no doubt the continual washing of the underground springs and numerous soakages, the moving of large round boulders and the continual swaying of timber by the storm had a great deal to do with it's failing after such a heavy rain. The cracks along the hill must have contained some hundreds of tons of water. The hill being so steep above the opening in the ground the water would come down with a terrible rush…

'…Mr Ellery says he and his wife were standing under the verandah when the fall of earth and water took place. He says

it bounded down the hill into the valley, then sprang up the hill on the opposite side like a thunder clap, whence it receded, and rushed straight onwards, sweeping everything like grass before it. He says he saw a large gum tree fully 10 feet through at the butt and 150 feet high, hurled 50 feet into the air, and large rocks, weighing many tons, were sent spinning into the air like footballs. When he saw Herchell's house swept down and broken into matchwood, his wife fainted at the sight, they not knowing where the inmates might be. Another eye witness stated he was shipwrecked three times, but was never so awe stricken in his life as when he saw the mountains coming down…

'…Many hundred of persons have visited the scene of the catastrophe within the last three weeks, coming from all quarters of the colony. All express the same opinion of the site, that is – 'It's something awful!' The mountain road has been completely blockaded from top to bottom, and will cost a good sum to repair it again. The exact area of the landslip is hard to define. From start to finish, it is about a mile in length. Giant trees and huge boulders have been swept from the main head, fully a mile down the valley…'

It is believed that the major contributing factor to the 1891 landslip was the heavy rainfall that continued unabated over a three day period from about midnight on Friday 10th July until Sunday 12th July 1891.

During the 1891 landslip relatively minor damage was recorded. The damage included the destruction of a house and some outbuildings in the path of the debris. Two horses were carried some 600 metres downslope and killed, two people were caught in the debris flow, narrowly escaping death, with one being buried in the debris.

In 1891 all drainage from the mountain was via natural streams and channels. Today on the steeper slopes this is still the case. On the lower slopes under road culverts have been installed and selected natural water courses have been piped. Based on available photographs and documented evidence uphill from the road (Old Coach Road) was well timbered, whereas downhill was mostly cleared and in pasture or crops. Photographs taken in 1904 suggest the timber density uphill from Old Coach Road was perhaps marginally less than exists at present.

Conditions existing in the area in 1891 were different to those in existence today. In 1891 there were only a few houses in the area and only one road which traversed the north west face of the Dandenongs.

Over the last 100 years the Montrose area has been extensively developed. Should a similar sized landslip occur today and the movement of debris follow a similar path, significant loss of life and serious injury could result. Destruction of buildings, even substantial solid brick houses, would be likely. The highest risk of damage or injury exists on the steep slopes below the area where the landslip might occur. The physical location of the Montrose landslip area is within the Dandenong Ranges National Park and subsequently no development exists on the site. The critical factor contributing to the damage potential is the resultant debris flow generated by the initial landslip, not the actual initial movement of land.

Case study 2

Blackwood Avenue – *Active landslip*

In October 1992 an active landslip in Blackwood Avenue, Warburton moved significantly causing the evacuation of houses in the immediate area and the permanent closure of the road.

Historical information leads us to believe that this landslip has been in existence for, perhaps, thousands of years. It was almost certainly well established prior to European settlement in the Warburton area. The earliest recorded movement of the landslip occurred in the early 1950's, a newspaper article quotes a resident of Blackwood Avenue who was alerted to the movement when he *'…noticed his chooks which had been locked up the night before, wandering around his back yard…'* and upon investigation found the ground beneath the chook house *'…had dropped away during the night…'*.

Floods and record rainfalls were recorded in the Warburton area in 1952. The landslip has moved every decade since the 1950's and is expected to continue moving. It is believed that total movements in the order of 20 to 30 metres have occurred since the landslip formed (based on the present slope profile and the assumed pre-landslip profile).

The Blackwood Avenue landslip lies on the north bank of the Yarra River at Warburton. The toe of the landslip is at the edge of the river. Cumulative movements up to about 1.5 metres have been measured on the Blackwood Avenue landslip in the last seven years. Concern has been expressed that this landslip may fail catastrophically, blocking the river, and this could lead to flooding of the Warburton area.

The landslip covers approximately 6 hectares. It is irregular in shape and has a maximum length of about 320 metres and a maximum width of about 230 metres.

Currently there are no occupied buildings on the landslip. Four houses were on the site until the early 1990's. They have since been demolished or permanently vacated. Four houses lie in close proximity to the edges of the landslip.

Currently parts of the landslip are used for grazing, other parts are vacant and have vegetation varying from blackberries to eucalyptus regrowth.

Figure 2: Blackwood Avenue, a sealed road extending across the widest part of the landslip, has suffered extensive damage and has been permanently closed to traffic.

No evidence has been found to suggest the landslip may have blocked the Yarra River in the geological past, let alone in more recent times. The available evidence indicates the landslip is 'slowly shuffling' along, most likely in response to heavy rainfall and that substantial movements causing the river to totally block are unlikely to occur. Irrespective, given the narrowness of the river, the uncertainties regarding the behaviour of any landslip and the events that could take place in a major storm/flood event, the consequences of the landslip blocking the river need to be considered.

In the very unlikely event of a total blockage of the river, the resulting landslip dam is likely to be made up of loose debris, which would erode quickly, particularly if over topped by the river. If the unexpected happens and the dam is not rapidly eroded, flooding will occur. This will, in turn, primarily affect infrastructure, such as the bridge spanning the Yarra River, which carries the main Highway through the township (*Figure 3*). This would result in the isolation of services such as the hospital and the volunteer fire brigade and cause flooding of a nearby caravan park. Should this occur, the consequences are considered to be manageable.

Where to now

The Victorian State Government's Emergency Management Act 1986, requires municipalities to prepare an Emergency Management Plan and to ensure the ongoing integrity of the plan, through regular auditing processes.

The basis of the Plan has been formulated by the Victorian State Emergency Service and is generic to all municipalities within the State. It must identify resources and specify details on how these resources are to be utilised during emergency prevention, response and recovery.

The Shire of Yarra Ranges has taken the initiative to incorporate into its Plan a series of sub-plans covering specific events, such as fire, flood and landslips. The aim is to have the Municipal Emergency Management Plan a 'working' document, as opposed to a 'shelf ornament'. Individual plans, directly relating to specific risks within the municipality, need to be developed using and expanding on existing documentation. These individual plans are a vital component of an all encompassing Plan, specifically designed to this unique environment.

The preparation of these Plans involves enormous amounts of time and effort. A high level of community consultation and successful links with external bodies, such as the specific controlling and support agencies, is vital in aiding us to prepare, respond, resource and recover from these events.

In order to accommodate the possibility of a landslip occurring within the municipality, we are currently in the final stages of developing a Generic Landslip Contingency Plan, as well as numerous Site Specific Plans. These are being formulated using the information obtained during the Landslip Survey conducted by Coffey Geosciences Pty Ltd.

While the initial emphasis of the Survey was community awareness and development controls, the Emergency Management focus was towards strategic landslip planning and site specific plans for known high risk or active landslips.

Contingency plans

Within Victoria the responsibility for managing a landslip emergency rests with the Victorian Police Force. Council's primary function is to facilitate the provision of resources as required. In the event of a landslip, the need for specialist equipment, resources and skills will occur. Therefore, our municipality needs to pre-empt this requirement by ensuring that we maintain a comprehensive list of resource providers.

In June 1999, the Shire of Yarra Ranges was requested to present a paper on Landslip Contingency Planning at a workshop conducted by the Australian Emergency Management Institute at Mt. Macedon in Victoria. This workshop was attended by Dr. Marion Leiba from the Australian Geological Survey Organisation and the Canterbury Regional Shire from New Zealand, along with representatives from numerous municipalities throughout Australia, including the City of Cairns, Queensland.

The proposed outcome of the workshop was to identify arrangements for:

- landslip mitigation
- landslip preparedness
- managing landslip response
- managing landslip recovery

This workshop confirmed that landslip contingency plans were basically non-existent and that the lack of specific guidelines meant that the municipality would be 'starting from scratch' when determining requirements for the development of this plan. The Shire of Yarra Ranges does not profess to be expert on landslips but relies upon the expertise and input of others to aid in the formulation of viable, comprehensive and practical plans.

We recognise that contingency plans should be clearly written, easily understood and flexible enough to enable implementation at any time. They should integrate various activities and plans and have the flexibility to cover a wide range of possible sources and levels of risk.

Some of the components of our Landslip Contingency Plans are:

- definitions
- history of landslips within the municipality
- risk analysis
- prevention/mitigation
- control agency and response
- scenarios

Figure 3: The Blackwood Avenue landslip lies on the north bank of the Yarra River at Warburton. The toe of the landslip is at the edge of the river. In the unlikely event of a total blockage of the river, infrastructure such as the bridge spanning the Yarra River could be affected.

- effects on the community (social and technical)
- resource listing
- local contact listings
- maps
- recovery aspects

Looking to the future

Given the significant number of high & medium risk landslip areas identified within the Geotechnical Survey, the ability to monitor regularly is not considered a viable option. The community awareness program and the production of the Shire of Yarra Ranges Planning Scheme, including the Erosion Management Overlay, provides the framework for the development of appropriate land management practices.

Due to the significant nature of the Montrose Landslip and the known quantity of the active landslip in Blackwood Avenue — Warburton, the Shire has undertaken steps to ensure regular monitoring occurs.

In the case of the Montrose landslip, formal survey monitoring comprising tape measurements and visual observation along several routes will be conducted. There is also the need for additional monitoring when triggered by extensive or prolonged rainfall.

The Blackwood Avenue landslip will have a completely different approach to monitoring. It is envisaged that following community consultation, adjoining property owners will play an important role in monitoring movement within the area. This is likely to take the form of a simple peg in the ground from which movement can be measured easily by an untrained observer. Formal survey monitoring will still occur, but on a more infrequent basis. Any movement detected and reported by property owners will be followed up by an immediate Geotechnical assessment.

Information sharing

It is imperative that information sharing occurs in relation to landslip activity within municipalities. Ensuring that the likes of the Australian Geological Survey Organisation (AGSO) and other relevant bodies, including the community, are informed of any activities is essential in historically documenting movements to enable a holistic picture of activity within any given area. This type of information is a vital component in the identification of areas of risk and their subsequent effective management.

During the heavy rainfalls experienced throughout the municipality in August 1996, numerous landslips occurred causing extensive damage to infrastructure and resulting in the construction of several gabion walls. There were four significant landslips recorded in various ares of the municipality, resulting in disaster funding claims in the order of $500,000. Although these incidents were all 'landslips' they were recorded as storm damage works and no information sharing occurred.

This task is very easily overlooked. Relatively minor landslips can occur on a frequent basis throughout the municipality and can be treated as routine storm damage or as a drainage system failure. Even when the word 'landslip' is associated with incidents, it is not necessarily a high priority to inform AGSO of the occurrence. Re-education of staff and the review of processes has been necessary to ensure that these types of events do not go un-recorded.

References

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Authors' contact details

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As MERO for the Shire, Lex has worked closely with the Country Fire Authority, Victoria Police and the State Emergency Service over the past few years to enhance community safety throughout Victoria. He has actively supported and contributed to the continuous improvement of Municipal Emergency Management.

Glenn Hunt is an Emergency Management Officer, employed in the Asset Management Department of the Shire of Yarra Ranges. Glenn is currently undertaking the task of developing a generic emergency management plan in relation to landslips. He is also formulating more comprehensive Site Specific plans for known landslip areas throughout the Shire.

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Conference Announcement

Victorian Flood Management Conference Traralgon, October 2001

The next Victorian Flood Management Conference will be held in Traralgon in October 2001. It will be jointly hosted by the West Gippsland Catchment Management Authority and the Latrobe City Council.

From all accounts the inaugural Victorian Flood Management Conference held in Wangaratta in September 1999 was a significant step in raising awareness of flood management.

For the first time, local government planners, floodplain managers, emergency planners, consultants and people from other disciplines were able to come together to discuss developments in flood management. Presentations were made on a wide range of issues including the Victoria Flood Management Strategy, community involvement, the Victoria Planning Provisions, flood insurance, legal liability and flood mapping.

Since the last conference was held many of these issues have continued to evolve and new ones have emerged to command our attention

In a questionnaire taken at the end of the inaugural conference, many of the 140 delegates indicated that there was a strong need for further flood conferences to be held.

The second Victorian Flood Conference will be held in Traralgon from 9th to 11th October 2001. The Conference theme is *Planning for the Inevitable*, which should remind us that that we should never be complacent about the frequency of floods or their impact. This is well illustrated by the fact that the annual cost of damages from floods in Victoria is now estimated to be greater than $56m and is continuing to grow.

The Chairman of the conference organising committee is Wayne Gilmour, Floodplain Manager with the West Gippsland Catchment Management Authority.
For more information, contact Wayne on: 03 5175 7800 (phone)

A conference brochure and call for papers will be released in the near future