

**Landslide Hazard Series**

**Background, Aim and Purpose**  
This map is one of a set of thematic maps addressing regional landslide susceptibility and hazard in Tasmania. The project is undertaken by Mineral Resources Tasmania, in partnership with Local Government and sponsored by the Natural Disaster Mitigation Programme (involving Federal and State contributions). Large tracts of land throughout Tasmania are subject to slope instability and over 60 houses have been destroyed by landslides since the 1950s with many more significantly damaged. While only minimal loss of life has occurred such events are highly dramatic to those directly affected and the financial cost to individuals, organisations and the State runs into many millions of dollars. Recent disasters such as the Thredbo Landslide in New South Wales, serve to remind us of the potential for loss of life even from relatively small landslides. In addition, landslide damage can be avoided with ground conditions are properly understood before construction proceeds and in already developed areas, this understanding can be used to mitigate the hazard through various measures.

**Method**  
A methodology has been specifically developed for this map series and is used for other areas of Tasmania. It can be downloaded from the MRT website although minor changes in approach have been made since the final data collection. Furthermore, the Australian Geomechanics Society have published guidelines for landslide zoning (AGS 2007a) and changes have been made to conform to these as much as possible.

The methodology used is based on:  
- Recording observations of land instability in- and surrounding the study area (the landslide inventory).  
- The identification of areas that control each landslide type.  
- Correlating landslide mobility that determines each of the landslide processes to predict areas that could be affected by future landslides.

**Caveats for Use**  
The information provided is in the public domain and anyone is free to use it provided they understand the purpose and limitations.  
- The following caveats apply to this map:  
- The hazards identified are based on imperfect knowledge of ground conditions and models to represent our current understanding of the landslide process. As this knowledge improves our perception of the hazard and the dependence on the map may also change.  
- These maps can be used as a guide (or flag) to the need for specific assessment in potential hazard areas.  
- These maps should not be made solely on the basis of the zones delineated on the map.  
- The scale limitations of the data should be considered at all times as exceeding this limit could lead to incorrect decisions about the hazard.  
- Site specific assessment of landslide hazard and risk should be undertaken by suitably qualified and experienced practitioners in the fields of engineering geology and geotechnical engineering.  
- Practitioners undertaking site specific assessments should read the map text and associated documents to obtain a thorough understanding of the methodology and limitations of the maps.  
- The frequency of landslides or hazards in an area can still have issues with slope instability.  
- Anthropogenic influence on slopes cannot be predicted and the occurrence of slope instability resulting from the influence of human actions is specifically excluded from these maps.  
- The identification and performance of cut and filled slopes have not been specifically considered in map production and their status is such that they often appear to be resolved on the maps. The presence of such slopes should always be considered in site specific assessments.

**Rockfall Hazards**

The rockfall susceptibility zones shown on this map apply to two types of landslide process, rockfall (rock or boulder) and topple. A rockfall is defined as the independent movement of rock or soil fragments through heaving, bouncing, rolling and sliding. They are usually sourced from cliffs or steep slopes and are a fast moving type of landslide. As long as the rockfall involves a small distance of travel, stability is an engineering problem that may develop in a rockfall if the landscape and properties of the displaced mass allow. For the purposes of the map they are modelled together and for convenience generally referred to as rockfall. It is important that third parties may be involved in some cases - rock or debris avalanches that describe the movement of a large number of boulders in a single event but this has not been witnessed in the region and is difficult to prove from available geological evidence.  
From a geomorphic perspective the major areas that are susceptible to rockfall occur in the North-West Coast area and are mostly confined to modern coastal cliffs, some steep granite hills such as the Oak Range and on artificial cliffs in urban rock types. These are the locations of rockfall in the landslide database, which is partly a reflection of the limited areas in which the process can occur but also because these features are more poorly understood in the landscape, not generally visible on aerial photographs and often not reported.

The process of rockfall modelling consists of predicting source areas and runoff paths. The methodology is explained more fully in Matheringham (2006) but has been necessary to modify some aspects to suit local conditions and to satisfy the AGS (2007a) guidelines for Landslide Risk Management. Source areas were determined by empirical slope gradient criteria of 42 degrees. The critical angle is based on the angle of repose for common soils derived in published literature (e.g. Caino 1983) and from unpublished field observations in Tasmania. It is recognised that landslides can occur on slopes lower than this, but this is considered to be generally of lower probability. A digital elevation model was constructed from which the source areas were derived. It is important to realise that the reliability of the source prediction is variable because the digital elevation model from which the source is derived is based on a combination of disparate datasets of varying resolution and quality.

Runout paths were modelled from each source cell, travelling in the direction of maximum downslope as defined by aspect data. This is a simplified technique that represents the most likely path of boulder(s) travelling downhill. In reality the actual path of material may deviate from this to some degree. These values are based on field studies of debris talus fan slope angles in Tasmania. For rockfalls occurring in walkway rock types, the travel angle was chosen to be, in many instances, too low and thus overestimates the hazard.

Relative or quantitative susceptibility descriptions of Very Low, Moderate and High are defined in the AGS (2007a) guidelines were not adopted because of insufficient field evidence in the study area. Instead the guidelines allow an alternative approach, although not necessarily satisfactory, of susceptible or not susceptible. The three zones on the map (susceptible area and the two hazard zones) can be considered as susceptible to rockfall as they are not susceptible to rockfall but they are not susceptible to rockfall because the modelling is not perfect there may be special cases where rockfall could occur.

This map identifies a number of locations (less than 0.05% of the study area) that could be affected by rockfall events. The main hazard areas are associated with steeply sloping and rocky terrain. Instead the guidelines allow an alternative approach, although not necessarily satisfactory, of susceptible or not susceptible. The three zones on the map (susceptible area and the two hazard zones) can be considered as susceptible to rockfall as they are not susceptible to rockfall but they are not susceptible to rockfall because the modelling is not perfect there may be special cases where rockfall could occur.

The velocity and size of boulders involved in rockfall is expected to vary from place to place and this is not considered in the specific susceptibility. This implies that the consequences of rockfall events can be considered as susceptible to rockfall as they are not susceptible to rockfall because the modelling is not perfect there may be special cases where rockfall could occur.

The frequency of rockfall events in the study area is difficult to quantify and needs further work for site specific instances.  
Maritime, ocean waves, foot washing and human activities are all potential triggers for these events. Seismic (Baking Earthquake) is another potential trigger, but is based on a purely unobserved in Tasmania.

**Conclusions**

The rockfall susceptibility map identifies small areas of land within the modelled boundaries that may experience this hazard. Most of these areas are in remote and sparsely populated regions where exposure of structures and persons is minimal. While a few recent (European era) rockfall records are known, there is insufficient information to calculate likelihood. Anecdotal evidence of incidents, obtained from an engineering firm that provides a rockfall risk assessment and properties of the displaced mass allow. For the purposes of the map they are modelled together and for convenience generally referred to as rockfall. It is important that third parties may be involved in some cases - rock or debris avalanches that describe the movement of a large number of boulders in a single event but this has not been witnessed in the region and is difficult to prove from available geological evidence.

**References**  
AGS 2007a. Guidelines for Landslide Susceptibility, Hazard and Risk Zoning for Land Use Planning. Australian Geomechanics, 42(1), 15-36.  
AGS 2007b. Commentary on Guidelines for Landslide Susceptibility, Hazard and Risk Zoning for Land Use Planning. Australian Geomechanics, 42(1), 37-58.  
AGS 2007c. Practice note guidelines for landslide risk management. Australian Geomechanics, 42(1), 63-114.  
AGS 2007d. Commentary on practice note guidelines for landslide risk management. Australian Geomechanics, 42(1), 115-158.

Caino, N., 1983. The mountains of northern Tasmania. A.A. Balkema, Rotterdam, 200p.  
Matheringham, C., 2006. The Tasmanian landslide hazard map series: Methodology. Tasmanian Geological Survey Record 2006/04, Mineral Resources Tasmania, Hobart, 43p.

**Further Information**  
**IMPORTANT:** This map should be used in conjunction with an understanding of the information contained within the document 'Tasmanian Landslide Map Series: User Guide and Technical Methodology'.

This document, and other information on this map series on Tasmanian landslides in general can be obtained from the MRT web site [www.mrt.gov.au](http://www.mrt.gov.au), or by contacting the agency directly. Copies of the map series (PDF format) are freely available from the MRT website. GIS layers developed by MRT and shown on the map are subject to each Council in the area and are available for purchase at a minimal cost of supply.

**Susceptibility Zones**



**Rockfall Features**



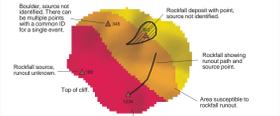
**Data Sources**

- 1 - Airborne Laser Scanning
- 2 - 1:5,000 topographic contours
- 3 - 1:25,000 topographic contours

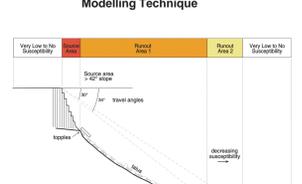
**Miscellaneous**

- Municipality boundary

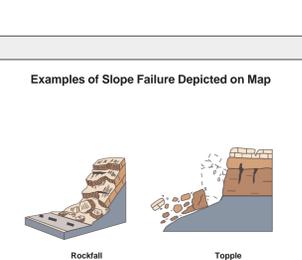
**Conceptual Relationships for the Depiction of Rockfalls and Susceptibility in Plan View**



**Conceptual Diagram Illustrating Rockfall Modelling Technique**



**Examples of Slope Failure Depicted on Map**



Scale: 1:25,000  
0 500 1000 1500 2000 2500m  
GDA1984 - MGA Zone 55, Contour Interval 20 metres



**Citation:**  
Matheringham, C., 2006. Map 4: Burnie - Rockfall Susceptibility. Tasmanian Landslide Map Series, Mineral Resources Tasmania, Department of Infrastructure Energy and Resources Hobart.

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**LOCATION DIAGRAM**



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