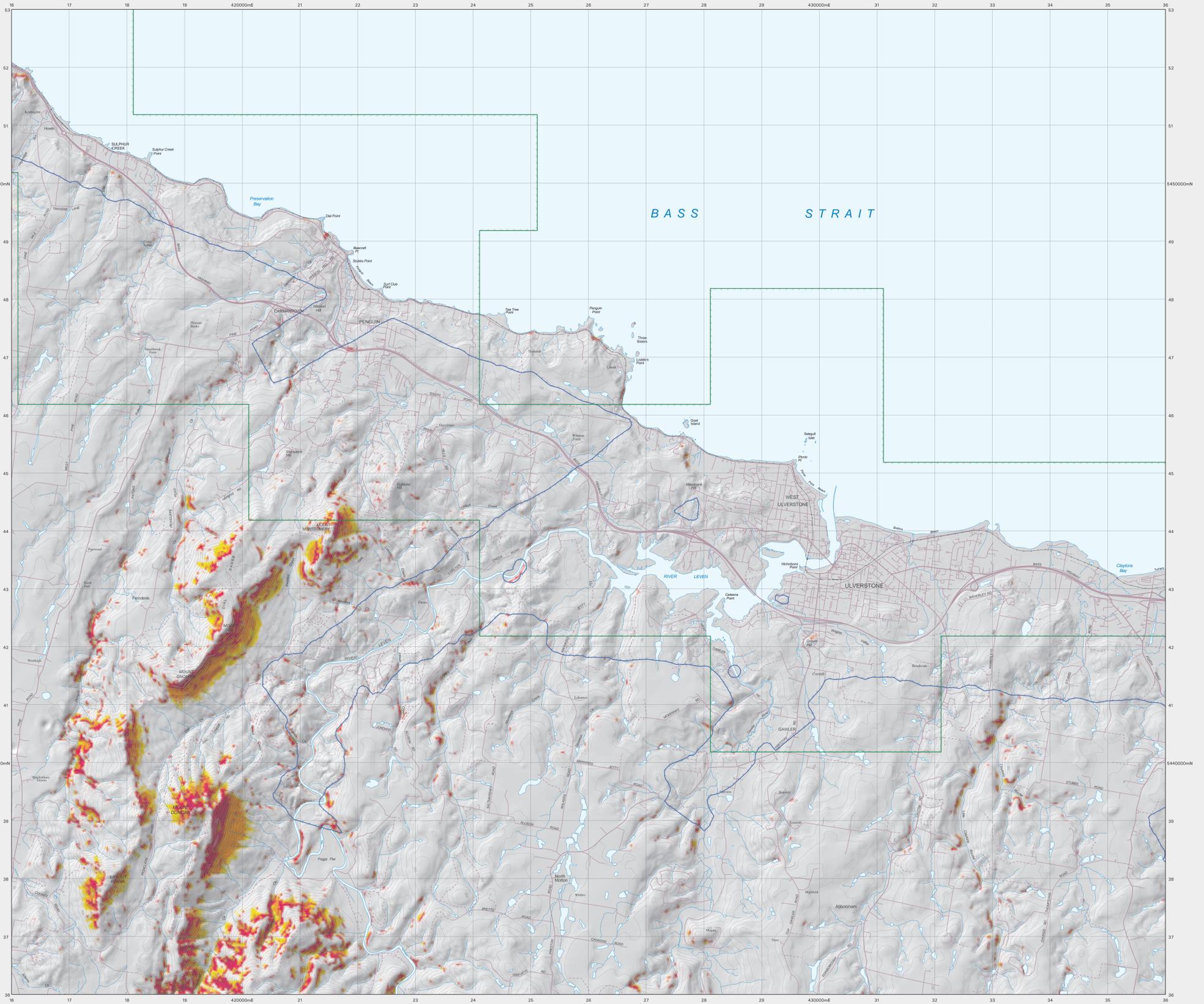


TASMANIAN LANDSLIDE MAP SERIES
ULVERSTONE – ROCKFALL SUSCEPTIBILITY
MAP 4



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 traumatic to those directly affected and the financial cost to individuals 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 good conditions are properly understood before construction proceeds and, in already developed areas, this understanding can be used to mitigate the damage 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 was compiled. 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).
- Analysis of the processes that control each landslide type.
- Correlation of landslide inventory with 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 refer and acknowledge 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 depiction on the map may also change.
- These maps can be used as a guide (flag) to the need for specific assessment in potential hazard areas.
- The maps should not be used as a basis for 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 on slopes cannot be predicted and the occurrence of slope failure resulting from the influence of human actions is specifically excluded from these maps.
- The identification and presence of cut and filled slopes have not been specifically considered in map production and their status is such that they often cannot be resolved on the maps.
- The performance 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 landslides process, rockfall (mass wasting) and toppling. A rockfall is the independent movement of rock or soil fragments through fracturing, bouncing, rolling and sliding. They are usually sourced from cliffs or steep slopes and are a distinct type of landslide. As long as the rockfall is confined to the cliff face and does not become a debris flow, it is not considered a landslide. For the purposes of the map, the rockfall is modelled as a single event, rather than a series of events. It is possible that a third process 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 Northwest Coast area and are mostly confined to modern coastal cliffs, some steep inland hills such as the Blue 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 preserved in the landscape, not generally visible on aerial photographs and often not reported.

The process of rockfall modelling consists of predicting source areas and runout paths. The methodology is explained more fully in Matheringham (2005) 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 assessing slopes greater than or equal to 42 degrees. The choice of angle is based on the angle of repose for common rock types identified in published literature (e.g. Caino 1983) and from unpublished field observations in Tasmania.

Runout paths were modelled from each source cell, travelling in the direction of maximum slope as defined by a vector grid. This is an empirical method that simulates the most likely path of boulders (or soil) travelling down the slope. The model uses a vector grid and small scale topography that are beyond the resolution of the 1:25,000 scale, such as tree, structures and protective fences. The extent of each runout has been defined using the level angle method with two values, 34 and 30 degrees, representing decreasing probability respectively (see conceptual diagram). These values are based on field studies of debris talus runout slope angles in Tasmania. For rockfalls occurring in weaker rock types, the travel angle values should be higher, in many instances, to be low and that overestimate the runout distance.

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 show an alternative approach, although not entirely satisfactory, of susceptible or not susceptible. The three zones on the map (source area and the two hazard zones) can be considered as susceptible to rockfall. Areas outside these zones are considered not susceptible with the proviso that 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 rockfall areas are associated with steep cliffs and rockfall failure of basal along the coastal cliffs. They may also occur on other natural slopes such as steep gullies and isolated rocky outcrops. Rockfalls can also occur on artificial slopes such as quarry faces and road cuttings that are spread throughout the study area.

The velocity and size of boulders involved in rockfall is expected to vary from place to place and should be considered in site specific investigations. This is because the composition, structure and orientation of rockfall can vary significantly. Structures that are not specifically designed for rockfall events are likely to suffer significant damage from typical sized boulders of basal or debris. The frequency of rockfall events in the study area is difficult to quantify and needs further work for site specific instances. Earthquakes, ocean waves, frost wedging and human activities are all potential triggers for these events. Steeply dipping (over)hangs is another potential trigger, but is based that is poorly understood 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 and) rockfall events are known, there is insufficient information to calculate likelihood. Despite the low spatial incidence of the rockfall hazard, caution is required in the susceptible zones identified. Rockfall may also occur in areas modelled as not susceptible given the limitations of the methodology used and consideration should be given to the hazard for developments on or adjacent to slopes. Where these areas a geological investigation should be undertaken - as outlined in the Practice Note Guidelines for Landslide Risk Management (AGS 2007b). The risk of destruction of property, injury or loss of life should be estimated on a site by site basis.

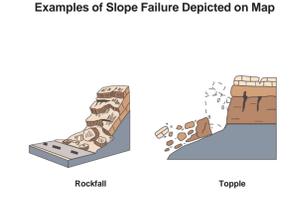
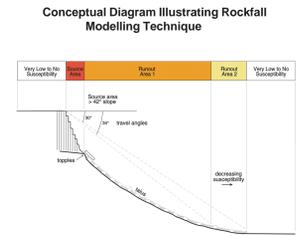
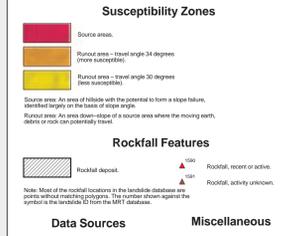
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AGS 2007a. Guidelines for Landslide Susceptibility, Hazard and Risk Zoning for Land Use Planning. Australian Geomechanics, 42(1), 13-36.
AGS 2007b. Commentary on Guidelines for Landslide Susceptibility, Hazard and Risk Zoning for Land Use Planning. 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., 2005. The Tasmanian landslide hazard map series: Methodology. Tasmanian Geological Survey Report 2005/4, 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 or Tasmanian landslides in general can be obtained from the MRT web site at 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 supplied to each Council in the area and are available for purchase at a minimal cost of supply.

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Citation:
Matheringham, C., 2005. Map 4. Ulverstone - Rockfall Susceptibility. Tasmanian Landslide Map Series, Mineral Resources Tasmania, Department of Infrastructure Energy and Resources, Hobart.

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