MINERAL RESOURCES TASMANIA

Tasmania

DEPARTMENT of INFRASTRUCTURE ENERGY and RESOURCES

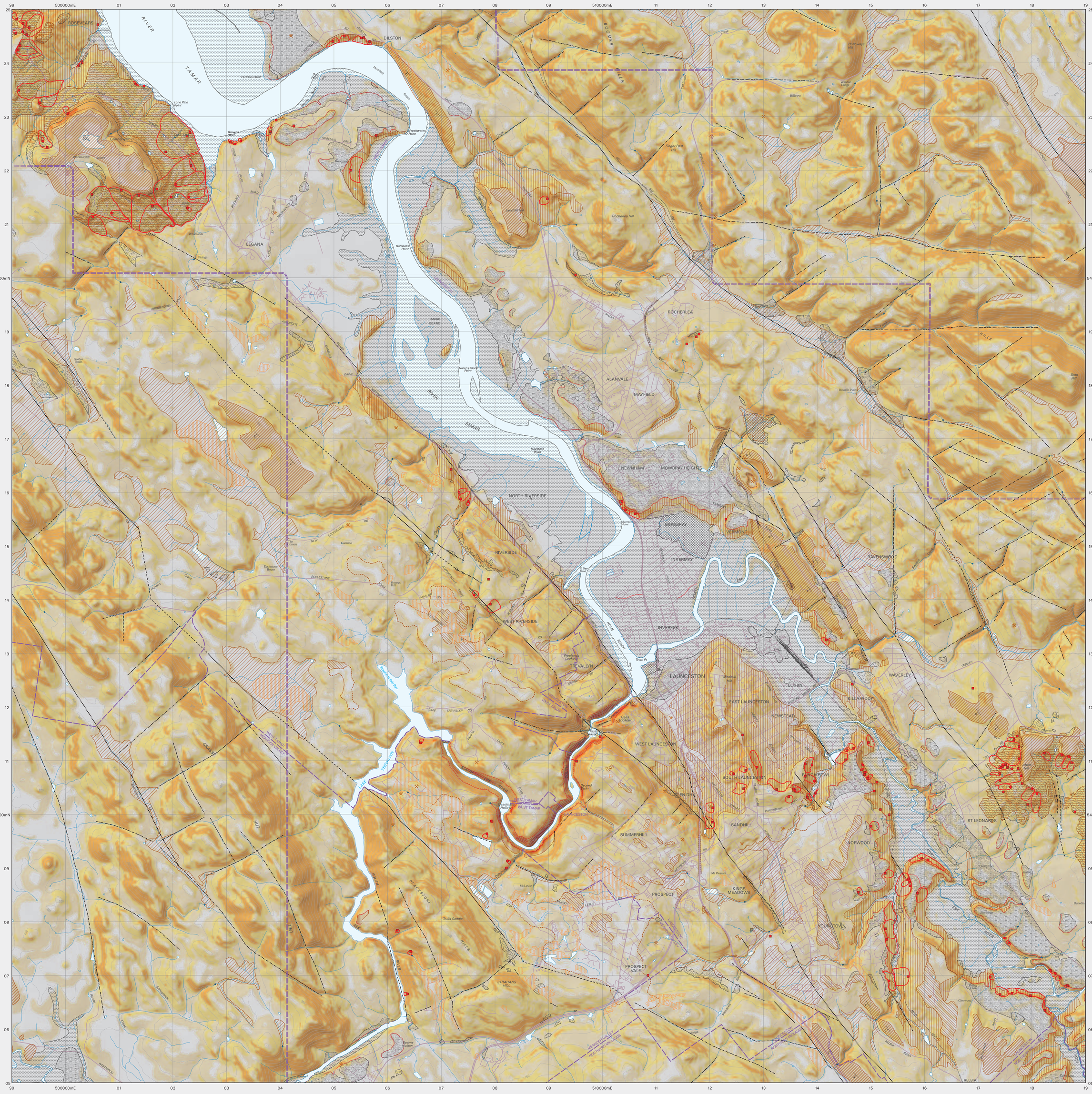
TASMANIAN LANDSLIDE HAZARD SERIES

LAUNCESTON – GEOMORPHOLOGY

MAP 2 OF 5

West Tamar COUNCIL

LAUNCESTON CITY COUNCIL



Geomorphology

Background, Aim and Purpose

Large tracts of land throughout Tasmania are subject to slope instability and about 60 houses have been destroyed by landslides since the 1950s. Fortunately only minimal loss of life has occurred in this time but such events are highly traumatic 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 society of the potential for loss of life even from relatively small landslides. Fortunately, landslide damage can be avoided when 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.

Regional landslide hazard maps provide an insight into the natural hazards that may potentially affect the area concerned. Mineral Resources Tasmania, in partnership with the Launceston City and West Tamar Councils, has produced a new landslide hazard map of the urban Launceston area and surrounds. The information provided is in the public domain and anyone is free to use it provided they read and understand the caveats for use.

Hazard and Risk

According to the joint Australian/New Zealand Standard (AS/NZS 4360:1999) risk is defined as the chance of something happening that will impact upon objectives. It is measured in terms of consequences and likelihood.

The definition of risk is often expressed by the following equation:

RISK = Hazard x Vulnerability x Elements at Risk

A hazard is defined as a source of potential harm or a situation with a potential to cause loss. A hazard, such as a landslide can be measured in terms of location, volume (or area), type, velocity and likelihood with time. Vulnerability refers to the susceptibility and resilience of structures, community and the environment to the hazard. The 'elements at risk' refers to the number of those structures, people, etc exposed to the hazard.

A hazard map attempts to portray the processes operating in an area, conveying all or some of the hazard parameters, generally in a qualitative to semi-quantitative manner. Because of the uncertainties involved, the translation of regional hazard maps into risk maps is challenging and seldom precise. An indication of the likely risk level is provided for each hazard at a regional scale but this will vary in detail. However, provided the limitations of the maps are understood, hazard maps can be used for many purposes in order to achieve the overall goal of safe and resilient communities.

Caveats for Use

The following caveats shall apply to the maps.

- 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 of the zones 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.
- Planning decisions should not be made solely on the basis of the hazard zones delineated on the map.
- The scale limitations of the data should be considered at all times as exceeding this limit could lead to inaccurate decisions about the hazard.
- 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 specific assessments should read the text and appendices attached to the maps and obtain a thorough understanding of the methodology and limitations of the maps.
- Areas where no hazard is shown 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 scale is such that they often cannot be resolved on the maps. The presence of such slopes should always be considered in specific assessments.

Method

A methodology has been specially developed for these maps and will be used for other urban areas of Tasmania. It can be downloaded from the MRT website.

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.
- Computer assisted modelling that simulates each of the landslide processes to predict areas that could be affected by future landslides.

Geomorphology

This map shows selected geomorphic features of the Launceston area. These features represent both individual geomorphic units and structural aspects of the landscape that assist in understanding its development.

Slope is classified into six categories based on the combination of an internationally recognised slope classification (Demek 1972) and geological stability thresholds. Alluvial fans, dunes, floodplains, terraces and slope deposits are all identifiable individual features within the landscape. Their delineation is partially based on simplification of the geological units from Map 3 – Launceston Geology. Areas of artificial deposits (e.g. areas of significant fill and the Trevallyn dam wall) and quarry centroids from the MRT construction material database (DEPOSITS), are shown to identify areas of significant artificial land disturbance. Landslides are shown as points, with polygons delineating their extent where available. Their categorisation in terms of type is shown on Map 1, Launceston – Landslide Inventory. Areas of deeply weathered dolerite are shown to highlight areas which may behave differently in terms of stability to other areas of dolerite. Other areas of geology significant to the geomorphology of the Launceston area (e.g. the Tertiary sediments, basalts and the other Jurassic dolerites types) are not shown on this map to maintain map clarity. These are shown on the Geology Map, as well as the areas of Tertiary sediments being shown on Map 5, Potential Landslide Hazard Map. Escarpments, both natural and artificial are depicted as scale permits.

Terrace edges show the abrupt change of slope associated with a terrace front but are not always coincident with the geology polygon boundary. These are also depicted as scale permits. The inner gorge of Cataract Gorge, upstream to the Lake Trevallyn dam wall is marked to represent the steep–sided portion of the gorge adjacent to the South Esk River.

The geomorphic features reflect structural aspects of the landscape. 'Structural surfaces' represent identifiable areas whose extent is controlled by the structure of the underlying geology. They are either horizontal Tertiary basalt, or dipping features associated with dolerite. 'Residual surfaces' show areas of relatively flat topography in areas defined by residual geology (ferricrete, bauxite, laterite, deeply weathered dolerite and cemented pisolitic ironstones). In some instances they can provide clues to the underlying strata of the bedrock. An additional surface type is depicted whose origin is uncertain. Examples of this occur at Prospect and on hilltops west of Riverside. 'Perched valley floors' are defined as valley floors (with slopes less than 3 degrees) in which the lower end of the valley is elevated above current base level, and may be connected to base level by a steeply sloping stream segment. This break in slope is marked by a 'knickpoint'. Only significant knickpoints are shown. A 'strath terrace' is a degradational landform cut into the underlying bedrock, with little or no modern riverine deposit. 'Talus/ colluvium deposits' that overlie Tertiary sediments are depicted. Slopes developed on Tertiary sediments and related to the last significant degradational cycle of the South Esk, North Esk and Tamar Rivers (slopes developed since the deposition of the lower terrace set for example at Newnham) are depicted as 'younger slopes on Tertiary sediments'. It is within these two latter categories that many of the documented landslides occur. Faults and lineaments are shown where they have landscape-forming aspects. They are generally sourced from Map 3, Launceston – Geology and aerial photography.

Geomorphic Setting

The Launceston study area sits within an asymmetric graben system resulting from a series of NW–SE trending faults. Gently SW–dipping tilted fault blocks have given rise to a sub–parallel system of ridges and valleys in Jurassic dolerite with Tertiary or Quaternary sediment infills. Tertiary fluvial and lacustrine sediments may once have covered the entire study area and were possibly deposited during, as well as after, faulting. A Late Tertiary peneplain is found SE of the study area. Within the study area, Tertiary strata are now primarily found in the central NW-SE trending valley, with some deposits in parallel valleys and from Prospect to Hagley. Erosional remnants of Tertiary basalt flows are found at about 200m above sea level in the northwest corner of the study area at Grindelwald and in the southeast corner of the area at Abels Hill, as well as in a few other locations. The flanks of both Grindelwald and Abels Hill are Tertiary strata with a thin veneer of basalt talus, and have the 'hummocky ground' commonly associated with landslides. The central valley contains the modern Tamar River estuary, North Esk and Rose Rivulet fluvial systems, and is joined from the southwest by the modern South Esk fluvial system. Quaternary alluvial sediments and alluvial terraces have been deposited associated with the longterm downcutting and episodic aggradational phases of the modern river systems. Between the dolerite ridges outside the central valley area, the Quaternary valley fills have formed in perched drainage basins.

Further Information

Further information on these maps or Tasmanian landslides in general can be obtained from the MRT web site at www.mrt.tas.gov.au or by contacting the agency directly.

References

Demek, J. 1972. International Geographical Union Commission on Geomorphological Survey and Mapping, Manual of Detailed Geomorphological Mapping.

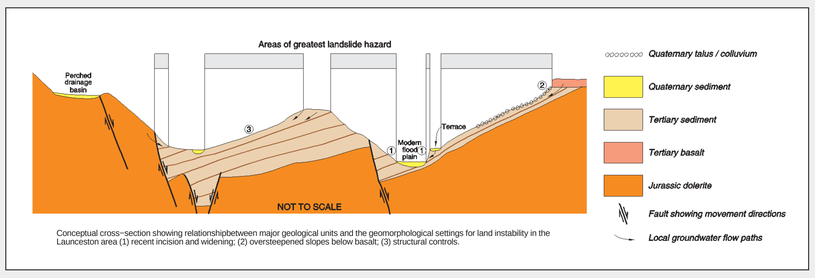
Selected Geomorphic Components

Alluvial fan
Artificial deposit
Dune
Floodplain
Slope deposit
Terrace
Structural surface, horizontal or dipping
Residual surface
Surface, type uncertain
Perched valley floor
Strath terrace
Talus / colluvium covered Tertiary sediments
Younger slopes on Tertiary sediments
Deeply weathered dolerite
Landslide

Slope Data

0 – 2 degrees
2 – 7 degrees
7 – 13 degrees
13 – 35 degrees
35 – 42 degrees
> 42 degrees
Escarpment
Inner gorge escarpment of the Cataract Gorge
Terrace edge
Lineament visible on aerial photographs.
Fault – position approximate
Fault – inferred and position approximate
Fault – concealed.
Municipality boundary
1:5000 / 1:25,000 boundary for DEM derivatives
Landslide point
Significant knickpoints
Dip direction and dip of structural slope
Quarry (derived from MRT DEPOSITS database) – Includes both active and historic features

Note: The techniques used to create the slope layer tends to underestimate values along cliffs.



Conceptual cross–section showing relationshipbetween major geological units and the geomorphological settings for land instability in the Launceston area (1) recent incision and widening; (2) oversteepened slopes below basalt; (3) structural controls.

Scale: 1:25 000

0 500 1000 1500 2000 2500m

AGD66 – AMG Zone 55. Contour interval 20m

Citation:

Selkirk–Bell, J.M. and Mazengarb, C. 2005: Map 2, Launceston – Geomorphology. Tasmanian Landslide Hazard Series. Mineral Resources Tasmania, Department of Infrastructure Energy and Resources, Hobart.

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Base data from the LIST, © State of Tasmania.

Map produced by the Data Management Branch, Mineral Resources Tasmania using G.I.S. software.

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LOCATION DIAGRAM

LANDSLIDE HAZARD SERIES

Data correct & plotfile generated: 17-MAY-2006

WARNING:INKS ARE LIGHT SENSITIVE