DOYLE SOIL CONSULTING

LANDSLIDE ASSESSMENT REPORT

Taroona High School

104 Channel Highway

Taroona

November 2023

Doyle Soil Consulting: 6/76 Auburn Rd Kingston Beach 7050 – 0488 080 455 – robyn@doylesoilconsulting.com.au

Founding Statement

Dr Richard Doyle is a highly qualified geologist, geomorphologist and soil scientist with over 38 years work experience in earth sciences. He has a B.Sc. (Hons) in geology with a double major in physical geography (Victoria University of Wellington, NZ), an M.Sc. in geology awarded with distinction specialising in geomorphology, erosion and soil development (Victoria University of Wellington, NZ) and a PhD in soil science (UTAS). Dr Doyle is a Certified Professional Soil Scientist (CPSS) of the Australian Society of Soil Science of which he is the former state and national president. Richard is a Program Leader with the Soil CRC an Australian Government supported national cooperative soil research centre. He has worked and taught around the world on a wide range of earth science projects (Greece, Namibia, USA, NZ and PNG). Dr Doyle has researched and taught soil and earth science at Tertiary level for over 28 years and co-supervised >30 honours/master students, and 22 research higher degree completions (PhDs and Masters). He has authored many landslides risk, coastal erosion, inundation and other earth-based risk assessments for Tasmanian councils and has over 100 refereed scientific publications in journals, books and conference proceedings with over 60,000 publication reads and 2000 citations leading to a H-Citation Index of 22.

Introduction

In response to Request for Information Kingborough Council (31st October) RE **ALTERATIONS TO SCHOOL BUILDINGS AND OUTBUILDING AT 'TAROONA SCHOOLS', 104 CHANNEL HIGHWAY, TAROONA (PID-1888267) –** below we address RFI point 3.

The proposed storage shed is located within a Medium Active Landslide Hazard Area overlay (figure 1). The mapped Landslide Hazard overlay has been generated by Mineral Resources Tasmania (MRT), but no known active landslides have occurred in the immediate area and are restricted to the coastline due to undercutting (see figures).

This report addresses the surrounding landform, soil materials and local geomorphology to assess the potential for landslip to occur before, during and after construction. The associated likelihood and risks with the potential landslide hazard are examined and best practice

mitigation measures are recommended to ensure a tolerable risk can be achieved and maintained.

Site Information

Client: Department of Education

Address: Taroona High School, 104 Channel Hwy, Taroona (PID 1888267)

Site Area: Approximately 8 ha

Date of inspection: 3/11/2023

Building type: New groundskeeper's shed

Mapped Geology - Mineral Resources Tasmania 1:250 000 Southeast Tasmania sheet: **Qhc** = Quaternary colluvium and **Tcbb** - Green to orange-brown (khaki) sandy-clay contains pebbles and boulders mainly of Jurassic dolerite and occasionally Permian sandstone origin.

Soil Depth: >2 m

Subsoil Drainage: Imperfectly drained

Drainage lines / water courses: Derwent Estuary River along the south eastern boundary

Vegetation: Pasture grasses with few trees along coastline

Rainfall in previous 7 days: Approximately 1 mm

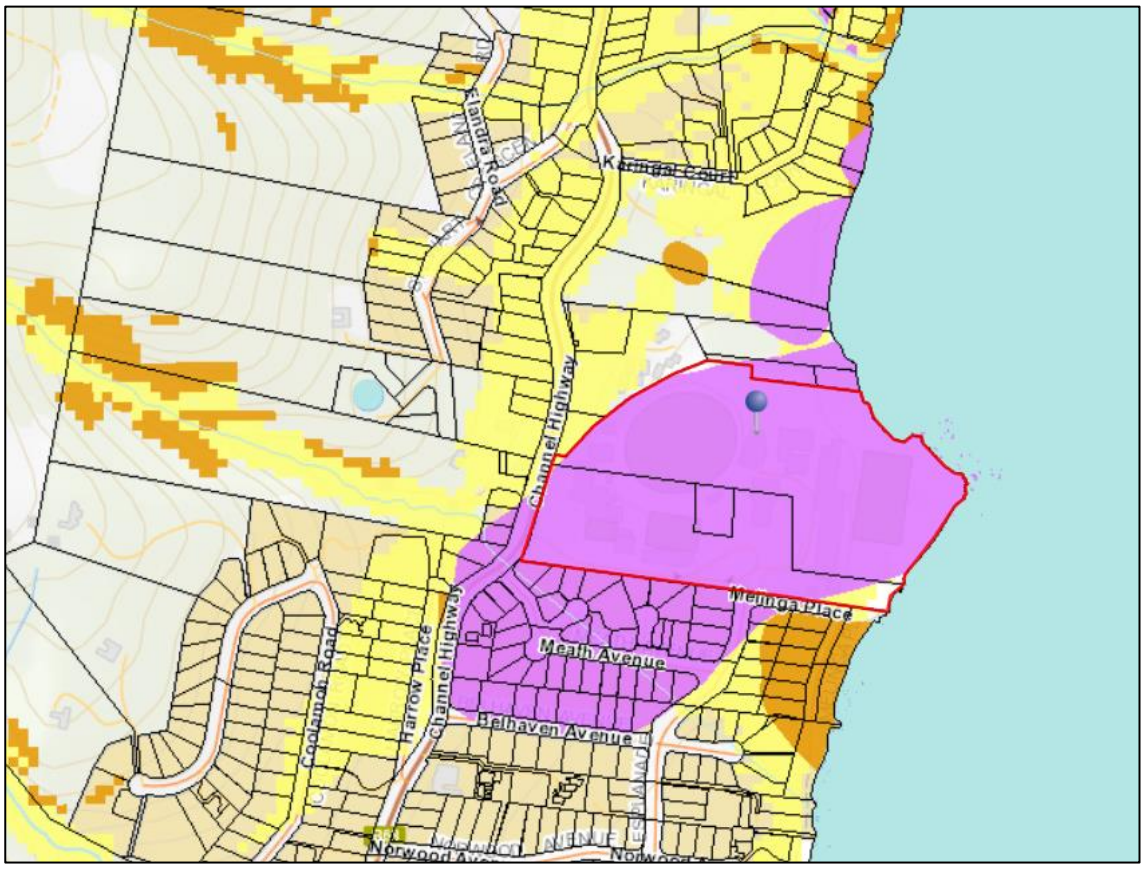


Figure 1: LIST Map topographic base map with the MRT Landslide Hazard Bands overlay: *Medium Active Landslide (purple)*. The blue pin marks the location of the proposed shed.

Geomorphology, Soils and Geology

The soil profiles are formed from clayey colluvium derived from Jurassic dolerite. The profiles are deep with no with refusal occurring at 2 m. The subsoil field textures of the soil profile are dominated by clay, which is highly reactive.

The proposed shed will be located on a north-easterly facing slope below the oval, on a moderate slope of ~6 – 8^0.

No sign of previous or active landslips were found at the time of visit other than along the coastline due to normal coastal undercutting in unconsolidated materials. Several large and significant buildings occur in the immediate area, and all were examined and no indication of any landslide or earth movement damage was noticed.

The landform of the hill is convex spreading with no notable hummocks, hollows or depressions. Any rainfall onto the site will evenly shed downslope and not cause areas of moisture accumulation.

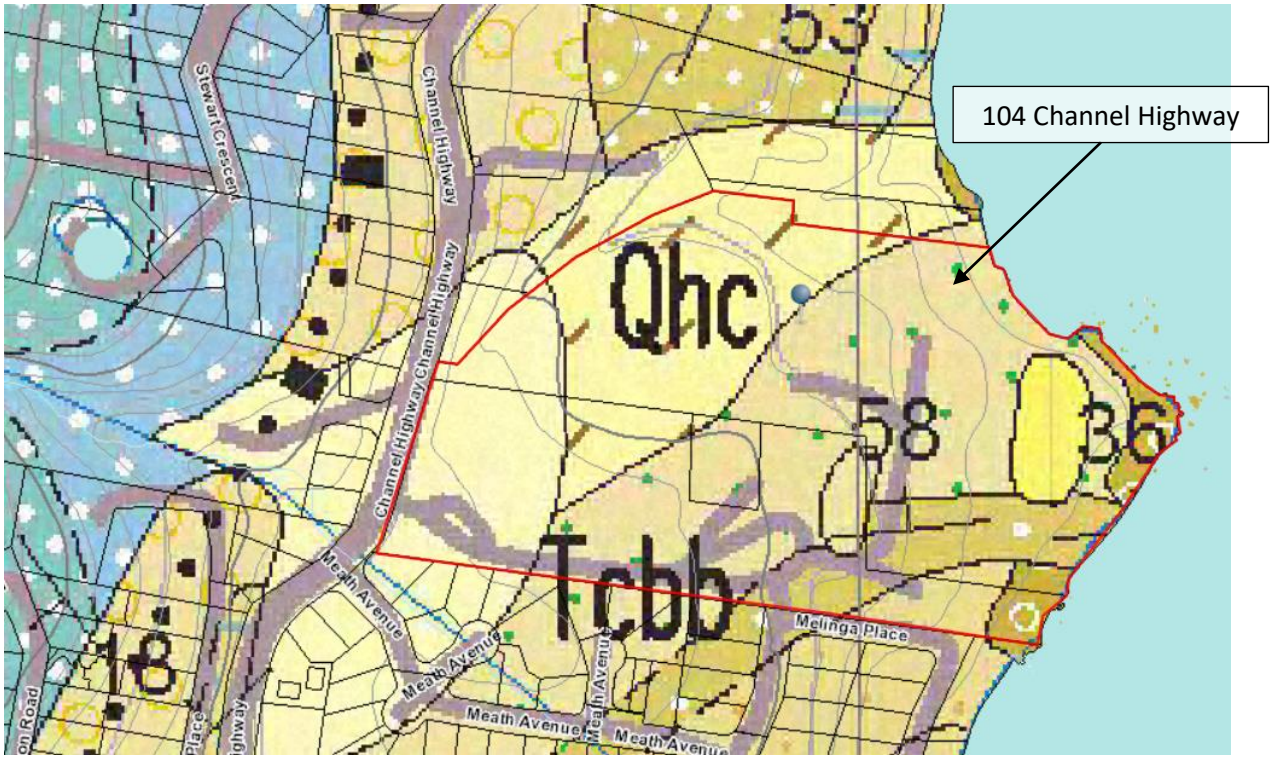


Figure 2: Mineral Resources Tasmania Geology 1:25 000 Taroona sheet geological polygons of the environs around 104 Channel Highway, Taroona. Pale yellow areas are mapped as Quaternary colluvium and pale brown areas are mapped as Tertiary boulder beds in clayey matrix.

Geotechnical Assessment of Landslip Hazard

The proposed construction site at 104 Channel Highway falls under the Interim Planning Scheme – Kingborough 2015 - Code E3.0 Landslide Code.

According to section E3.2.1, This Code applies to:

a) Development for buildings and works or subdivision on land within a Landslide Hazard Area.
b) Use of land for vulnerable use or hazardous use within a Landslide Hazard Area.

The site is assessed according to E3.7.1 P1 and E3.7.3 of the Scheme. This geotechnical advice on the site considers several important and specific parameters pertinent to the area.

Potential for Mass Movement of Soil and Geological Materials

The proposed development area is on moderate slopes of approximately 6 – 8° with well-established vegetative cover of grass. One auger hole and an assessment of an existing cut revealed *mostly* shallow clay and clay loam subsoils developing above variably weathered Tertiary boulder beds as mapped. Deeper pockets of more weathered and unconsolidated dolerite and earth material exist, to observed depths of approximately 1.9 m

In its current state, the site appears stable regarding landsliding, with no evidence of active instability in the immediate vicinity and in areas with similar slope angles and landform. However, the existing slope failure on the property confirms the MEDIUM ranking of the general area and the need for geotechnical advice and site treatments.

Measures to Mitigate Against Instability

The well-established grass should be retained and maintained where possible as vegetation helps stabilise soils and associated slopes and utilises soil moisture and wet soils are significantly more prone to land sliding than drier soils. We recommend revegetating any areas beyond the immediate development area that require clearing during construction.

We suggest that appropriate sediment and erosion control measures are in place during all phases of construction and thought be given to minimising soil disturbance throughout the construction phase along with appropriate and safe management of run-off and run-on waters.

For guidance of best practise in construction on potential landslide area please refer to the extract on good hillside construction practice from the Australian Geomechanics Society (Appendix 3) and CSIRO BTF-18.

The risk of land instability within the proposed building envelope can be reduced via use of current best practice for construction on sloping sites (appended to this report).

E3.7.1 Buildings and Works, other than Minor Extensions & E3.7.3 Major Works

Objective:

To ensure that landslide risk associated with buildings and works for buildings and works, other than minor extensions, in Landslide Hazard Areas, is:

a) acceptable risk; or
b) tolerable risk, having regard to the feasibility and effectiveness of measures required to manage the landslide hazard.

Acceptable Solution A1	**Comments**
No acceptable solution.	

Performance Solution P1	**Comments**
Buildings and works must satisfy all the following: a) no part of the buildings and works is in a High Landslide Hazard Area b) the landslide risk associated with the buildings and works is either: i. acceptable risk; or ii. capable of feasible and effective treatment through hazard management measures, so as to be tolerable risk.	 Complies It is recommended that: - the proposed shed have appropriate drainage around the footings and any stormwater runoff be directed into the stormwater infrastructure - minimal land disturbance occurs during the construction phase – further, grassy vegetation be re-established on the active parts of the site to stabilise the slopes against water erosion. - suitable retention, batter angles and landscaping techniques applied on any deeper cuts - appropriate drainage be installed (ASAP during construction phase) and maintained during occupation, to maximise slope stability.

Landslide Risk Analysis

Risk assessment of land sliding relates to a measure of the probability and severity of an adverse effect on health, property, or the environment:

The likelihood of occurrence of any form of mass movement e.g., soil creep, debris flow, slumping, landslide, rock fall etc, including its likely scale (size, area, volume) would not be affected by the proposed location and scale of construction.

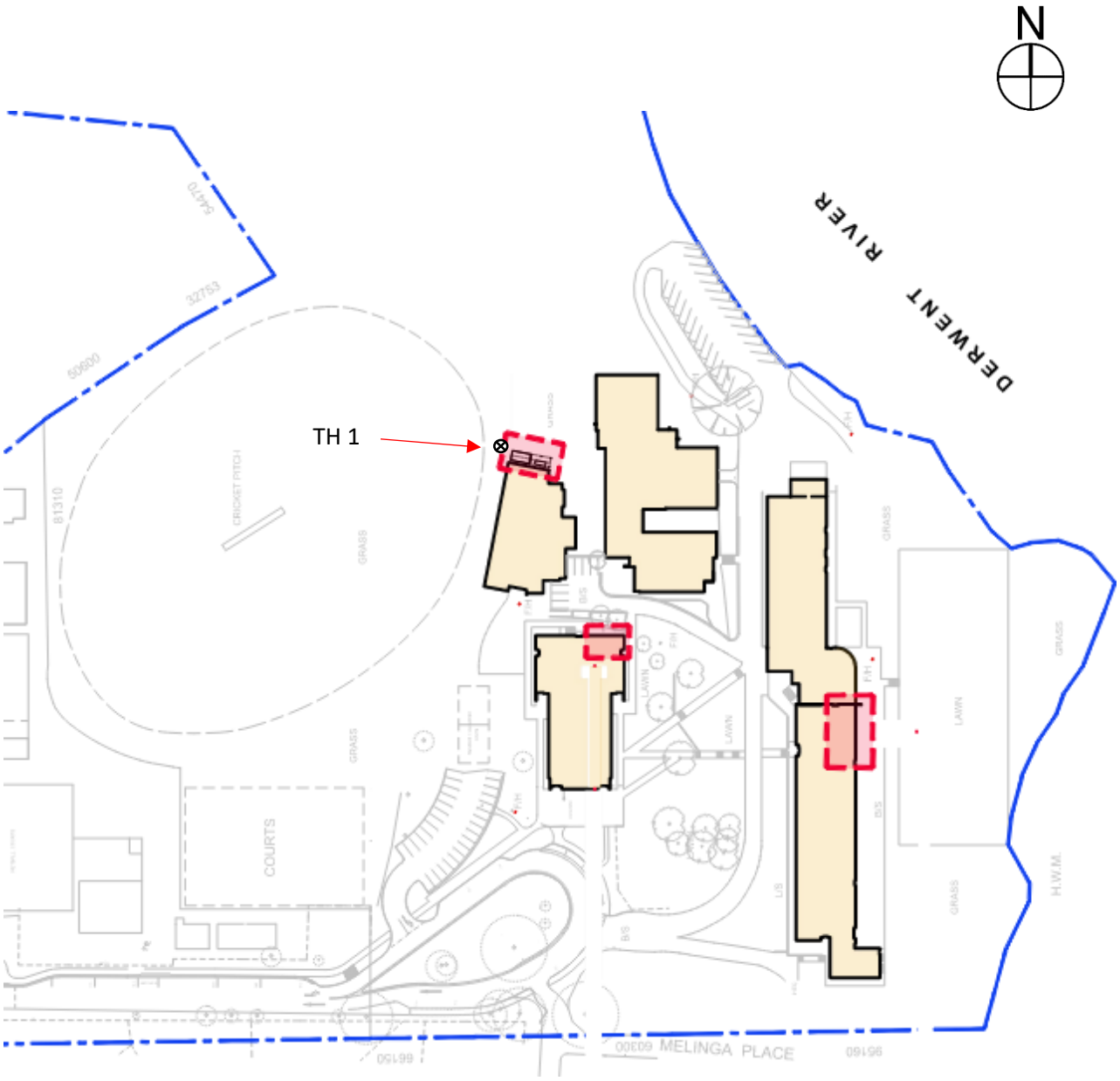
In this case, the likelihood of land sliding is mapped on the LIST Landslide Hazard Overlay as MODERATE; however, based on the data and information collected and assessed for this site, this ought to be reduced to a VERY LOW based on the site assessment and very small scale and land disturbance associated with the development. By following the recommendations in this report, the risk will be nil to implausible.

Consequences to life, property and services of such is reduced to VERY LOW if the site is appropriately developed as specifically outlined in this report. Thus the overall RISK of landsides will be reduced to VERY LOW and remain so if these guidelines and recommendations are followed in full.

Robyn Doyle
B.Agr.Sc.
Soil Scientist

Dr Richard Doyle
B.Sc.(Hons),
M.Sc.(Geol), Ph.D. (Soil Sci.), CPSS
(Certified Prof Soil Scientist)
Geologist and Soil Scientist

Appendix 1 – Approximate test hole location



Appendix 2 – Risk tables

Extracted from *Australian Geomechanics Journal Volume 42 No.1 March 2007 - Australian GeoGuide LR7 (Landslide Risk)*.

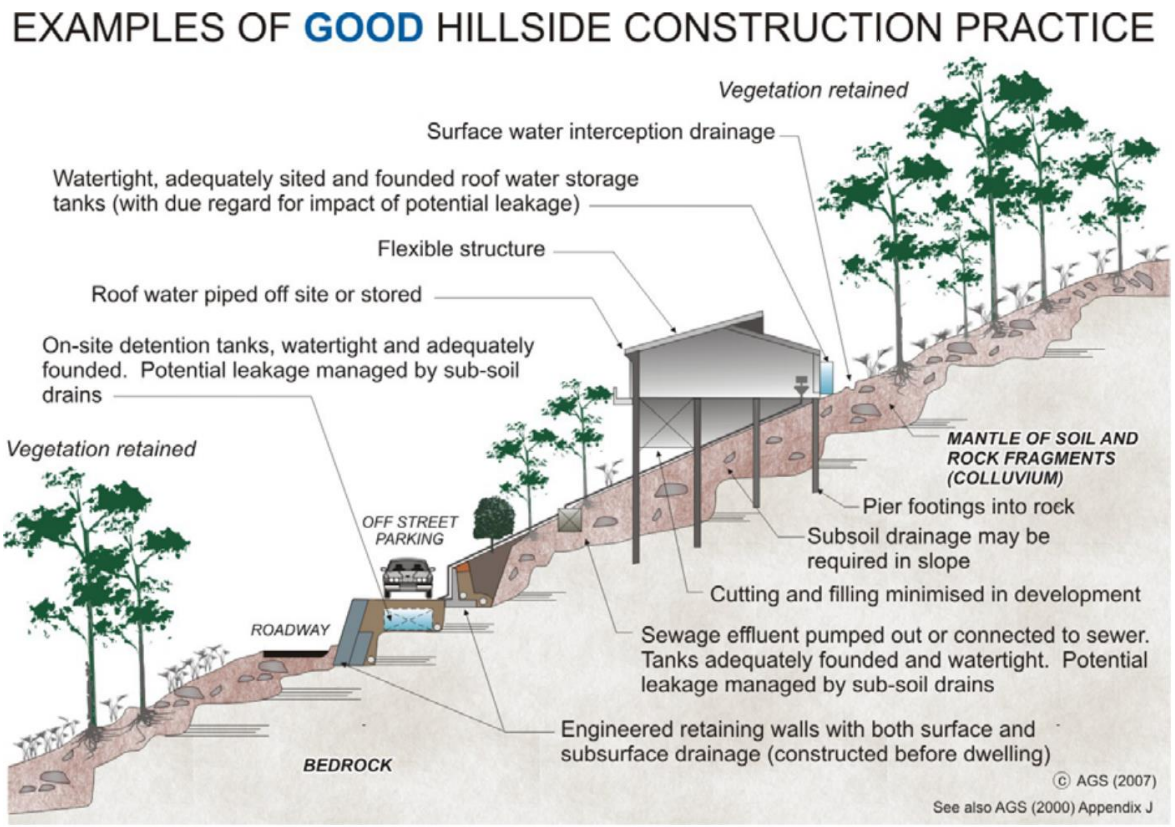
TABLE 1: RISK TO PROPERTY		
Qualitative Risk		**Significance - Geotechnical engineering requirements**
Very high	VH	**Unacceptable** without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low. May be too expensive and not practical. Work likely to cost more than the value of the property.
High	H	**Unacceptable** without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to acceptable level. Work would cost a substantial sum in relation to the value of the property.
Moderate	M	**May be tolerated** in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as possible.
Low	L	**Usually acceptable** to regulators. Where treatment has been needed to reduce the risk to this level, ongoing maintenance is required.
Very Low	VL	**Acceptable**. Manage by normal slope maintenance procedures.

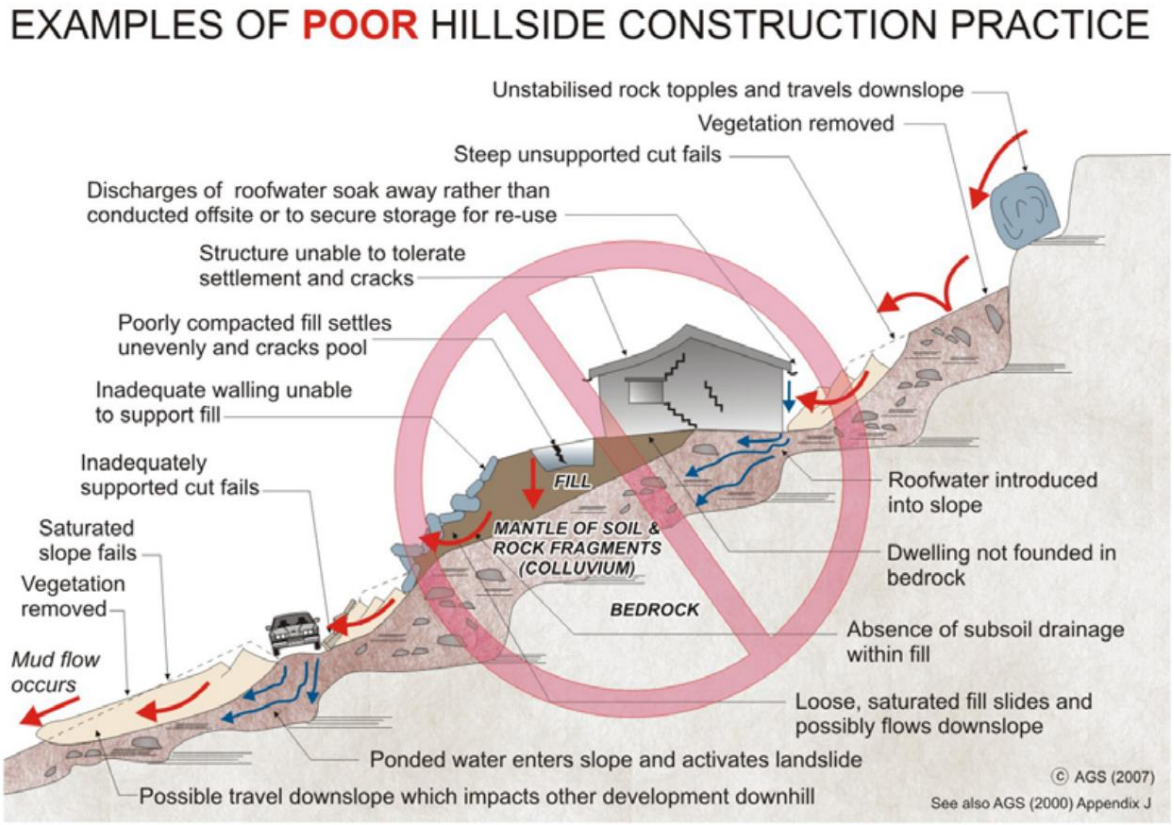
TABLE 2: LIKELIHOOD	
Likelihood	Annual Probability
Almost Certain	1:10
Likely	1:100
Possible	1:1,000
Unlikely	1:10,000
Rare	1:100,000
Barely Credible	1:1,000,000

TABLE 3: RISK TO LIFE	
Risk (deaths per participant per year)	**Activity/Event Leading to Death** (NSW data unless noted)
1:1,000	Deep sea fishing (UK)
1:1,000 to 1:10,000	Motor cycling, horse riding, ultra-light flying (Canada)
1:23,000	Motor vehicle use
1:30,000	Fall
1:70,000	Drowning
1:180,000	Fire/burn
1:660,000	Choking on food
1:1,000,000	Scheduled airlines (Canada)
1:2,300,000	Train travel
1:32,000,000	Lightning strike

Appendix 3 – Guidelines for hillside construction

Extracted from *Australian Geomechanics Journal Volume 42 No.1 March 2007 - Australian GeoGuide LR8 (Construction Practice)*.





Appendix 4 – Soil Profiles – Test Hole 1

Depth (m)	Horizon	Description and field texture grade	USCS Class
0.0 – 0.2	A1	Very dark brown (10YR 2/2) **Sandy Clay Loam**, strong fine angular blocky structure, slightly moist loose consistency, common roots.	**SC**
0.2 – 0.35	$B2_1$	Black (10YR 2/2), **Sandy Light Clay**, massive, slightly moist **soft** consistency, few roots.	**CH**
0.35 – 0.9	$B2_2$	Dark grey (2.5y 4/1) **Silty Light Clay**, massive, moist soft consistency to 0.8 m then slightly moist firm consistency, black soil down cracks to to ~0.6 m, trace of carbonate from 0.6 m.	**CH**
0.9 – 1.6	$B2_3$	Greyish brown (2.5Y 5/2), **Silty Light Clay,** massive, slightly moist firm consistency, few rocks, carbonate nodule at ~1.35 m.	**CH**
1.6 – 1.9+	BC	Light yellowish brown (2.5Y 6/4) Gritty Sandy Clay Loam, slightly moist dense consistency, common fine gravels, no refusal.	**SC**

CERTIFICATE OF QUALIFIED PERSON – ASSESSABLE ITEM

Section 321

Form **55**

To: Stuart Bowling Building Design *Owner name*

PO Box 321 *Address*

Sorell TAS 7172 *Suburb/postcode*

Qualified person details:

Qualified person: Richard Doyle

Address: 6/76 Auburn Rd

Kingston Beach 7050

Phone No: 0488 080 455

Fax No:

Licence No: N/A

Email address: robyn@doylesoilconsulting.com.au

Qualifications and Insurance details: Geologist and Soil Scientist PhD
Certified Professional Soil Scientist (CPSS)
Professional Indemnity cover –

About Underwriting -Lloyd's of London
ENG 21 000305

(description from Column 3 of the Director's Determination - Certificates by Qualified Persons for Assessable Items

Speciality area of expertise: Geotechnical Assessment

(description from Column 4 of the Director's Determination - Certificates by Qualified Persons for Assessable Items)

Details of work:

Address: 104 Channel Hwy

Taroona 7053

Lot No:

PID: 1888267

The assessable item related to this certificate: Classification of foundation conditions according to AS2870-2011

(description of the assessable item being certified)
Assessable item includes –
- *a material;*
- *a design*
- *a form of construction*
- *a document*
- *testing of a component, building system or plumbing system*
- *an inspection, or assessment, performed*

Certificate details:

Certificate type: Geotechnical Assessment

(description from Column 1 of Schedule 1 of the Director's Determination - Certificates by Qualified Persons for Assessable Items n)

This certificate is in relation to the above assessable item, at any stage, as part of - *(tick one)*

building work, plumbing work or plumbing installation or demolition work: X

or

a building, temporary structure or plumbing installation:

In issuing this certificate the following matters are relevant –

Documents:	The attached Geotechnical Assessment Report for the address detailed above in, 'Details of Work'.
Relevant calculations:	Refer to above report.
References:	AS1726-2017 Geotechnical site investigations CSIRO Building Technology File -18

Substance of Certificate: *(what it is that is being certified)*

Geotechnical Assessment -Slope stability

Scope and/or Limitations

The classification applies to the site as inspected and does not account for future alteration to foundation conditions as a result of earthworks, drainage condition changes or variations in site maintenance.

I certify the matters described in this certificate.

	Signed:	*Certificate No:*	*Date:*
Qualified person:		1457	7/11/2023