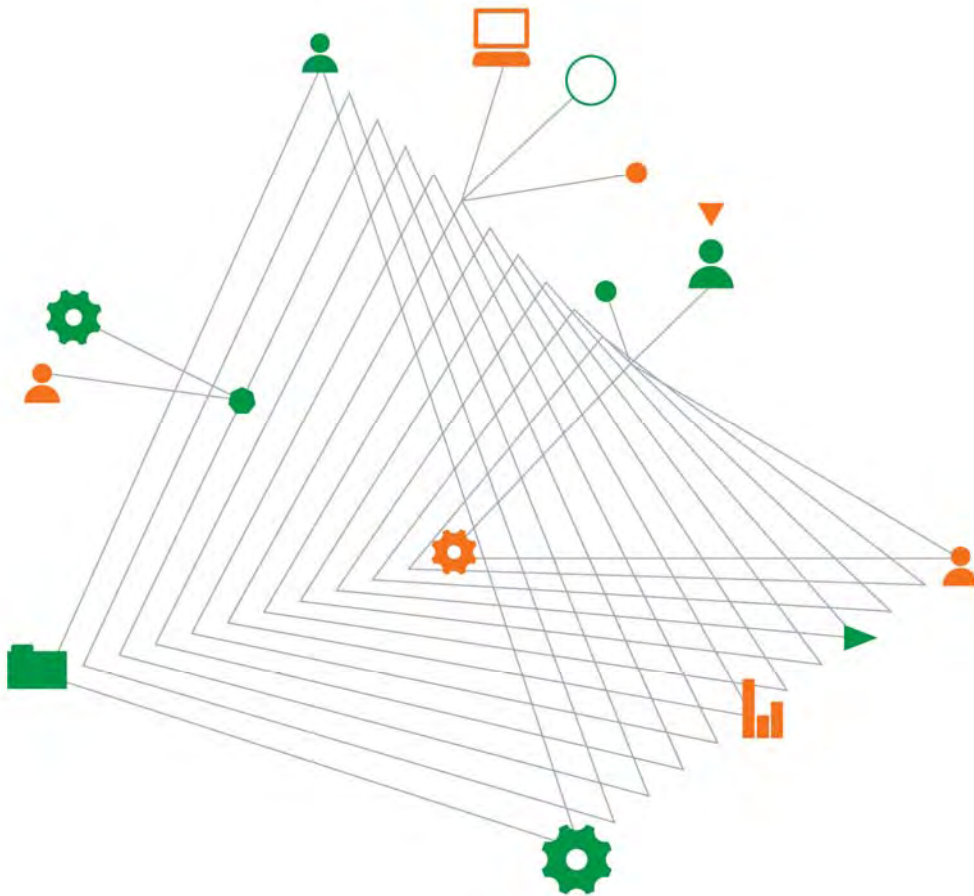


Department of Environment, Land, Water and Planning

**Wye River and Separation Creek -
Geotechnical, Land Capability and
Wastewater Solutions**

Geotechnical Assessment

31 March 2016



Experience
comes to life
when it is
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Wye River and Separation Creek - Geotechnical, Land Capability and Wastewater Solutions

Prepared for
Department of Environment, Land, Water and Planning

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For and on behalf of Coffey

Trevor Smith
Principal Engineering Geologist

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Table of contents

1.	Introduction.....	1
1.1.	Commission.....	1
1.2.	Colac Otway Shire EMO and its implications.....	1
1.3.	Background to AGS 2007	1
1.4.	Access constraints	3
2.	Scope	4
3.	Overview of geotechnical conditions.....	6
3.1.	Site conditions.....	6
3.2.	Geology	6
3.3.	Slope instability issues in the study area	6
4.	Site assessments	12
4.1.	Principles of risk assessment.....	12
4.2.	Methodology.....	12
4.3.	Risk to property	13
4.4.	Risk to loss of life	14
4.5.	Limitations	15
5.	Good hillside development practices.....	16
5.1.	Overview	16
5.2.	Road drainage.....	16
5.3.	Property drainage.....	16
5.4.	Do not develop in gullies and drainage lines	16
5.5.	Vegetation and erosion considerations.....	17
5.6.	Retaining walls	17
5.7.	Geotechnical parameters	17
5.8.	Onsite disposal of wastewater	18
5.9.	Building foundations.....	20
5.10.	Excavation conditions	20
5.11.	New cut and fill slopes	21
5.12.	Reuse of excavated in-situ soils	21
5.13.	Fill construction procedures	21
5.14.	Groundwater.....	22
5.15.	Site classification.....	22
6.	Key findings.....	23
7.	Glossary	24

8. References	26
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Important information about your Coffey Report

Tables

2.1 Summary of laboratory test results	5
3.1 Landslides in Wye River and Separation Creek area	10
3.2 Other vulnerable landforms in Wye River and Separation Creek area.....	10
4.1 Basis of fill and cut likelihood and consequence judgements.....	14
5.1 Typical geotechnical strength parameters for ground materials ^[1]	18
5.2 Recommended batters for new cut and fill slopes	21
7.1 Landslide size terms	25
7.2 Landslides according to age	25

Figures

1 Site plan	2
2 Slope analysis	7
3 Stylised cross section displaying many features seen on sites	8
4 Identified moderate, high and very high risks	9
5 Known landslides (after Coffey 2011)	19

Photographs

- 1: Tension crack in carport adjacent to burnt out retaining wall
- 2: Burnt out retaining wall
- 3: 'Upslope' property showing cut benches
- 4: 'Downslope' property showing both fill and cut

Appendices

- A - Copy of Schedule 1 to the Colac Otway Shire Erosion Management Overlay
- B - Site-specific geotechnical assessments
- C – Copy of Appendix C from AGS 2007
- D - Copy of Appendix G from AGS 2007 'Good Hillside Practice'
- E – Risk to life calculations

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1. Introduction

1.1. Commission

Coffey was engaged by the Department of Environment, Land, Water and Planning (DELWP) to conduct geotechnical assessments at each property destroyed by the 25 December 2015 bushfires at Wye River and Separation Creek.

The 109 sites that are the subject of this study are shown on Figure 1. They include 90 properties in Wye River and 19 properties in Separation Creek.

1.2. Colac Otway Shire EMO and its implications

The bushfire affected sites lie in steep terrain and they are covered by an Erosion Management Overlay (EMO) in the Colac Otway Shire (COS) Planning Scheme. Schedule 1 to the EMO (referred to on Colac Otway Planning Scheme as 'EMO1', copy in Appendix A) requires:

- Each development application that is subject to the EMO to be accompanied by a geotechnical assessment that identifies all slope instability hazards and provides recommendations that would allow development of the subject site;
- The assessment of the slope instability hazards to be in accordance with the AGS guidelines 2007 (AGS 2007, see discussion in Section 1.3);
- The assessment to be conducted with reference to the site development plans; and
- The assessment is accompanied by detailed plans and cross sections that include the underlying geology.

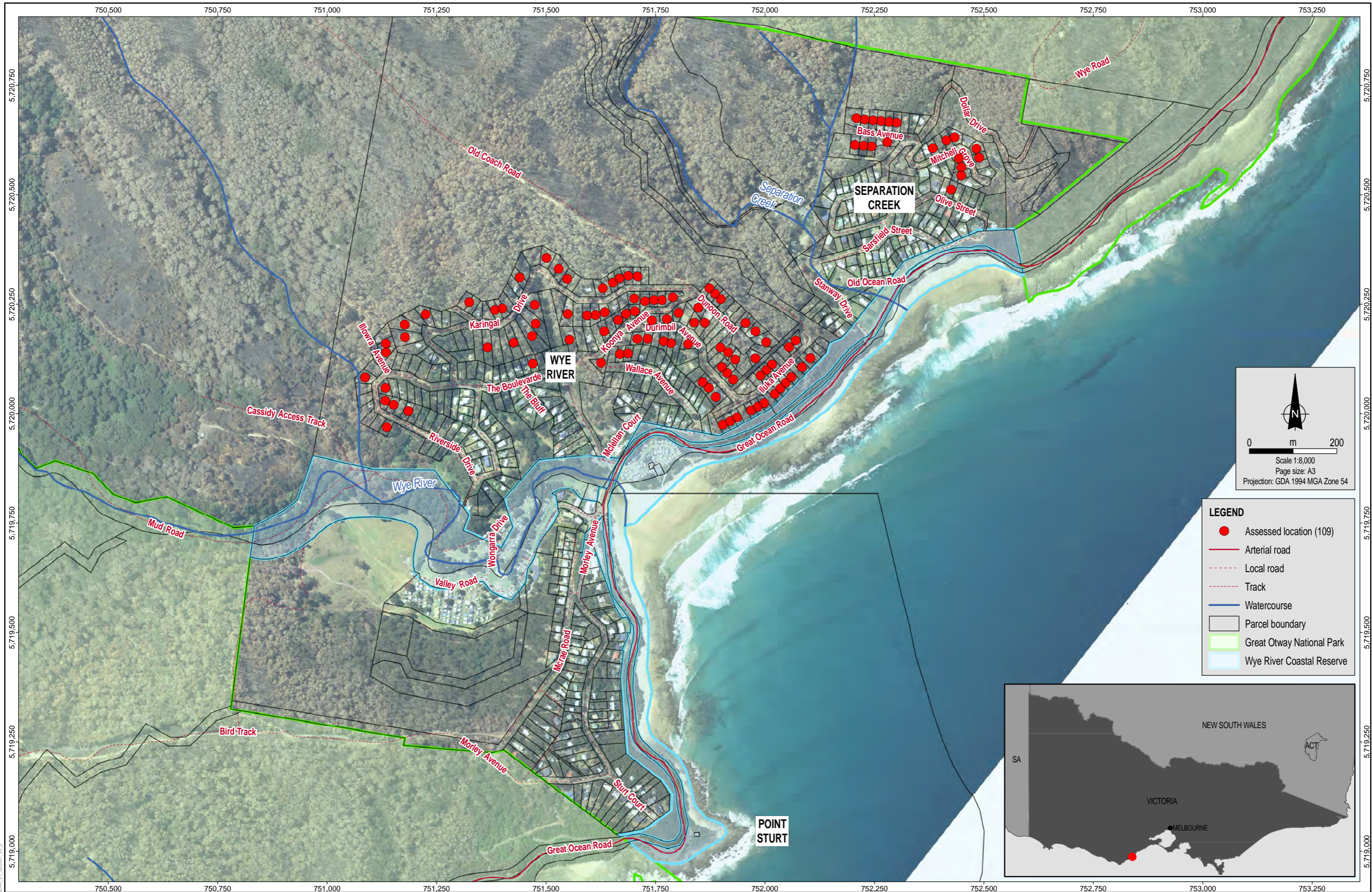
The timing of this study and the status of the sites means that site development plans are not available for any property. Furthermore, given the overview nature of this study, and in the interests of providing a timely response in accordance with our scope and DELWP's request, cross sections have not been prepared for each property.


Our geotechnical assessments consider each property as it existed at the time of our fieldwork with consideration of risks based on a similar structure(s) being reconstructed. If Colac Otway Shire (COS) require reports in accordance with EMO1 then additional individual reports for each property will be required, once the proposed redevelopment plans become available. The information included in this report provides a basis to expedite the preparation of such development-specific reports by providing:

- Identification of current geotechnical hazards on each site.
- Advice on redevelopment works to reduce the risk of instability.
- Advice that would assist other practitioners to write consistent reports for individual properties.

1.3. Background to AGS 2007

AGS 2007 is the standard reference technical document for slope instability assessments in Australia, and it has been widely referenced by regulators throughout Australia. AGS 2007 (References 1 to 4)




 Scale 1:8,000
 Page size: A3
 Projection: GDA 1994 MGA Zone 54

LEGEND

- Assessed location (109)
- Arterial road
- - - Local road
- - - Track
- Watercourse
- Parcel boundary
- Great Otway National Park
- Wye River Coastal Reserve



Source:
 Assessed locations derived from buildings attributed as destroyed from A.S. Miner 'Wye River Bushfires 2015 - Property owner geotechnical and tree status spreadsheet.xlsx'
 Roads, watercourses, parcel boundaries and parks/reserves from VICMAP.
 Imagery from DEWLP (captured 9 January 2016).



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Site plan

Figure No: 1

refers to a group of papers (182 pages) that were published by the Australian Geomechanics Society¹ (AGS) in 2007.

Until the mid-1990's slope stability issues in Australia were typically dealt with on an as-needs basis. The need for a more formalised approach to slope stability issues became apparent with several well-publicised cliff collapses and landslides in the 1980s and 1990s, including the fatal Gracetown cliff collapse in September 1996 and the fatal Thredbo landslide in July 1997. Following these events the AGS issued in 2000 a 44 page technical paper addressing landslide risk (AGS 2000, Reference 5). A copy of this paper was provided to the coroner for the Thredbo landslide who recommended it be taken into account in '... the Building Code of Australia and any local code dealing with planning, development and building approval procedures ...'. AGS 2000 was updated and expanded to produce AGS 2007.

1.4. Access constraints

The bushfire damage made the sites difficult to access. The bushfires had left a number of large burnt out trees, partially collapsed structures, fragmented fibre sheeting (possibly containing asbestos), loose corrugated metal, fallen trees, downed electricity lines and numerous trip hazards.

DELWP provided Coffey with safety assessments of the destroyed properties and these assessments deemed many sites 'unsafe to enter'. Most of those sites considered 'accessible' were still rated as a high risk to enter. Access was therefore restricted to many sites and where greater access was considered possible, the building debris often blocked off significant parts of the site. Assessments were therefore typically undertaken from vantage points on the road or in the driveway.

Six sites (namely 10 Olive St; 36, 40 and 42 Riverside; 23 Iluka and 25 Karingal) could only be viewed from street level.

¹ The AGS is the professional society for the geotechnical industry.

2. Scope

The scope of work conducted as part of this geotechnical study is outlined below:

- Desktop review of provided information including:
 - The published geology map (Reference 6), and available LIDAR generated topographic and slope plans;
 - Review of previous geotechnical reports for the broader area, including References 7 to 11. The key reports are the overview report prepared by Dahlhaus Environmental in 2003 dated and the Coffey report dated December 2011 (References 7 and 8); and
 - A review of relevant previous site-specific geotechnical site assessments provided by COS. These reports are referenced in Appendix B.
- Fieldwork including:
 - A review of post fire geotechnical assessments on site with COS geotechnical consultant Mr Tony Miner of AS Miner Geotechnical Pty Ltd and with Messrs Wilson and Smith, Senior Principal and Principal from Coffey;
 - Visits to every site by two geotechnical engineers from Coffey working together to assess site-specific conditions. Due to safety concerns not every site was accessible. Most could be viewed from a safe vantage point. Six sites could only be viewed from street level. The results of these assessments are presented in Appendix B. Height and slope measurements included as part of the assessments were made using a combination of conventional clinometers and tape measures, and a Leica D510 laser;
 - Review of the site-specific geotechnical assessments by Mr Smith, a Principal Engineering Geologist from Coffey, who visited approximately 30% of the sites; and
 - Collection and testing of six soil samples for subsequent Atterberg Limit analysis to assist in the classification of site soil and assessing potential characteristic surface movements due to shrinking and swelling (γ_s). All samples were collected in exposed cuts at about 0.5m depth from the cut crest. The results of the tests are summarised in Table 2.1 and discussed in Section 5 of this report.
- Reporting in accordance (this report) with AGS 2007 including:
 - Discussion of geotechnical conditions over the affected area with tabulated key information collected for each property;
 - Comments on risks to property and/or life as appropriate (part of the AGS 2007 process); and
 - General geotechnical advice to assist in rebuilding including allowable bearing capacities, site classification, earthworks, characteristic surface movements (γ_s) in accordance with AS2870 and Generic Guidelines for Good Hillside Practice.

Table 2.1 Summary of laboratory test results

Location	Liquid Limit(%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)
25 Iluka Avenue, Wye River	25	20	5	3.5
21 Iluka Avenue, Wye River	31	25	6	7.0
15 Mitchell Grove, Separation Creek	43	21	22	8.5
18 Bass Avenue, Separation Creek	Not Plastic			
9 Karingal Drive, Wye River	46	24	22	12.0
30 Karingal Drive, Wye River	25	22	3	1.5
Note: See Section 5 of this report for discussion of these results.				

3. Overview of geotechnical conditions

3.1. Site conditions

Figure 1 shows the study area and the properties that are the subject of this study. Figure 2 presents an analysis of the ground slopes in Wye River and Separation Creek derived from the LiDAR data provided by DELWP.

The Wye River and Separation Creek areas are located in steep topography, with dissected ridges and spurs that has been developed for residential living. Natural ground slopes on many properties exceed 20°. Particularly steep natural slopes occur in parts of the study area; including the north side of some properties on Dunoon Road (see Figure 2). Reduced levels on the high points of the towns lie at about RL 120 m and 70 m AHD for Wye River and Separation Creek, respectively. The geomorphology of the region is discussed in more detail in Dahlhaus Environmental 2003 (Reference 7).

Wye River and Separation Creek are serviced with power and telephone. There is no reticulated water, sewerage or gas supply. The roads comprise a mix of spray-sealed and gravel roads. Most stormwater drainage is via open earthen table drains. Stormwater discharges to the ocean and Wye River and Separation Creek watercourses.

The sites that are the subject of this study vary from about 570 to 2200 square metres, and average about 900 square metres. Most of these sites consist of a series of cuts and/or fills, particularly for driveways and car parks, and in some cases for the residence or ancillary structures such as water tanks. A stylised cross section showing the geotechnical features of a typical site is included as Figure 3.

3.2. Geology

The published 1:250,000 scale 'Colac' geological map (Reference 6) indicates that Wye River and Separation Creek are underlain by Early Cretaceous age (circa 100 million year old) sedimentary rocks of the Eumeralla Formation.

The Eumeralla Formation rocks comprise sandstone, mudstone, with minor conglomerate, pebble beds, black coal and carbonaceous shale, which are folded and faulted.

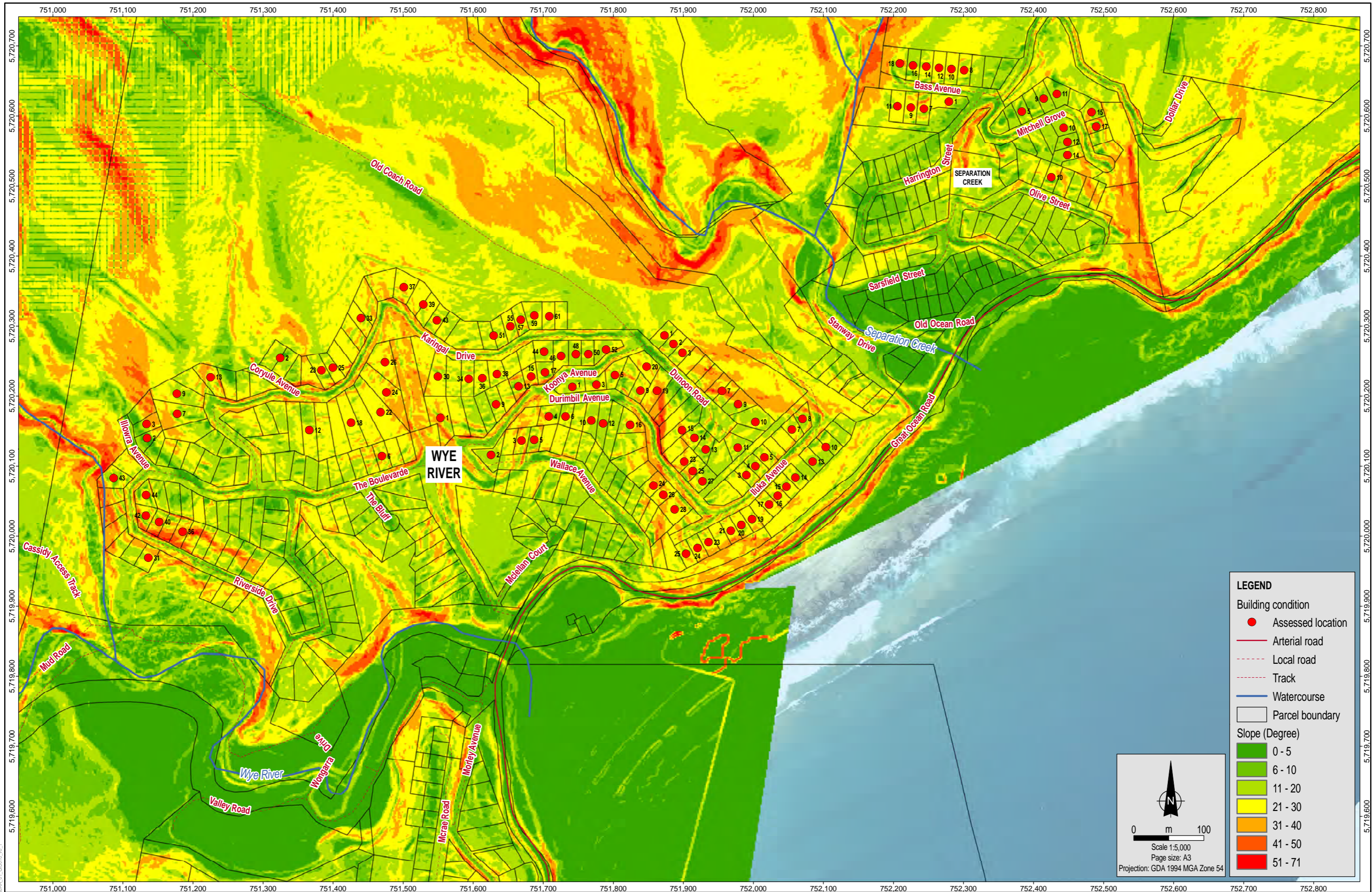
Based on our site observations, residual soil is commonly encountered overlying weathered bedrock. The residual soil is predominately clay, though areas of sand were observed and the bedrock often has a layer of extremely weathered material overlying highly weathered rock. The depth to weathered rock varies, however we observed it at less than 1.5m below the existing ground surface in a number of places.

Colluvium also exists in places, which is discussed in more detail in Section 3.3 of this report.

3.3. Slope instability issues in the study area

Slope instability issues in the greater Wye River -Separation Creek areas include ancient and active landslides in the Eumeralla Formation, both in the rock and the overlying soil materials, as well as steep slopes that are vulnerable to inappropriate hillside development.

Figure 4 and Table 3.1 present information about the known active landslides in the immediate Wye River - Separation Creek areas. There are three large active landslides and all these large active landslides lie beyond, and will not impact upon the properties that are the subject of this study.



Source:
 Assessed locations derived from buildings attributed as destroyed from A.S. Miner 'Wye River Bushfires 2015 - Property owner geotechnical and tree status spreadsheet.xlsx'
 Slope derived by Coffey from DELWP supplied 0.5m LIDAR contours.
 Roads, watercourses and parcel boundaries from VICMAP.
 Imagery and flood extent from DELWP (captured 9 January 2016).

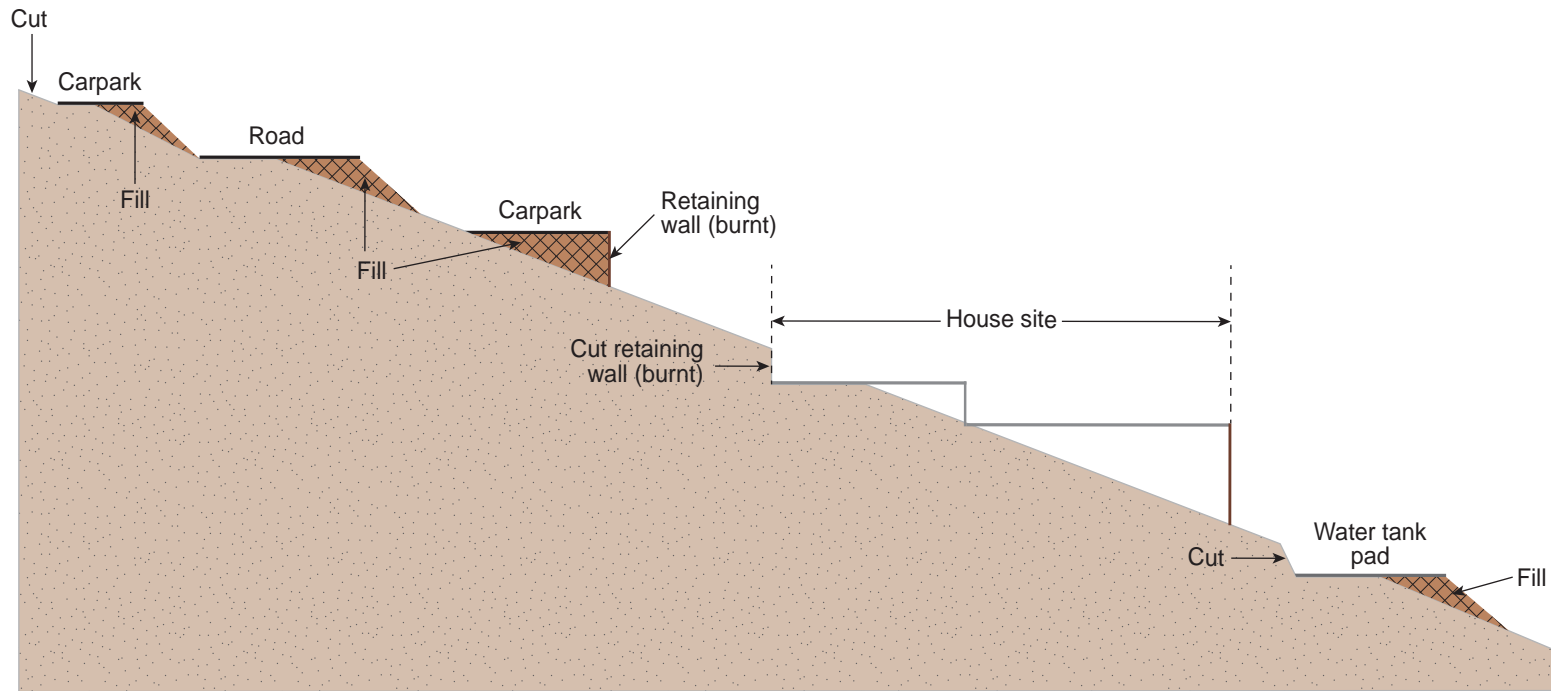


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Environment, Land, Water and Planning
 Slope analysis



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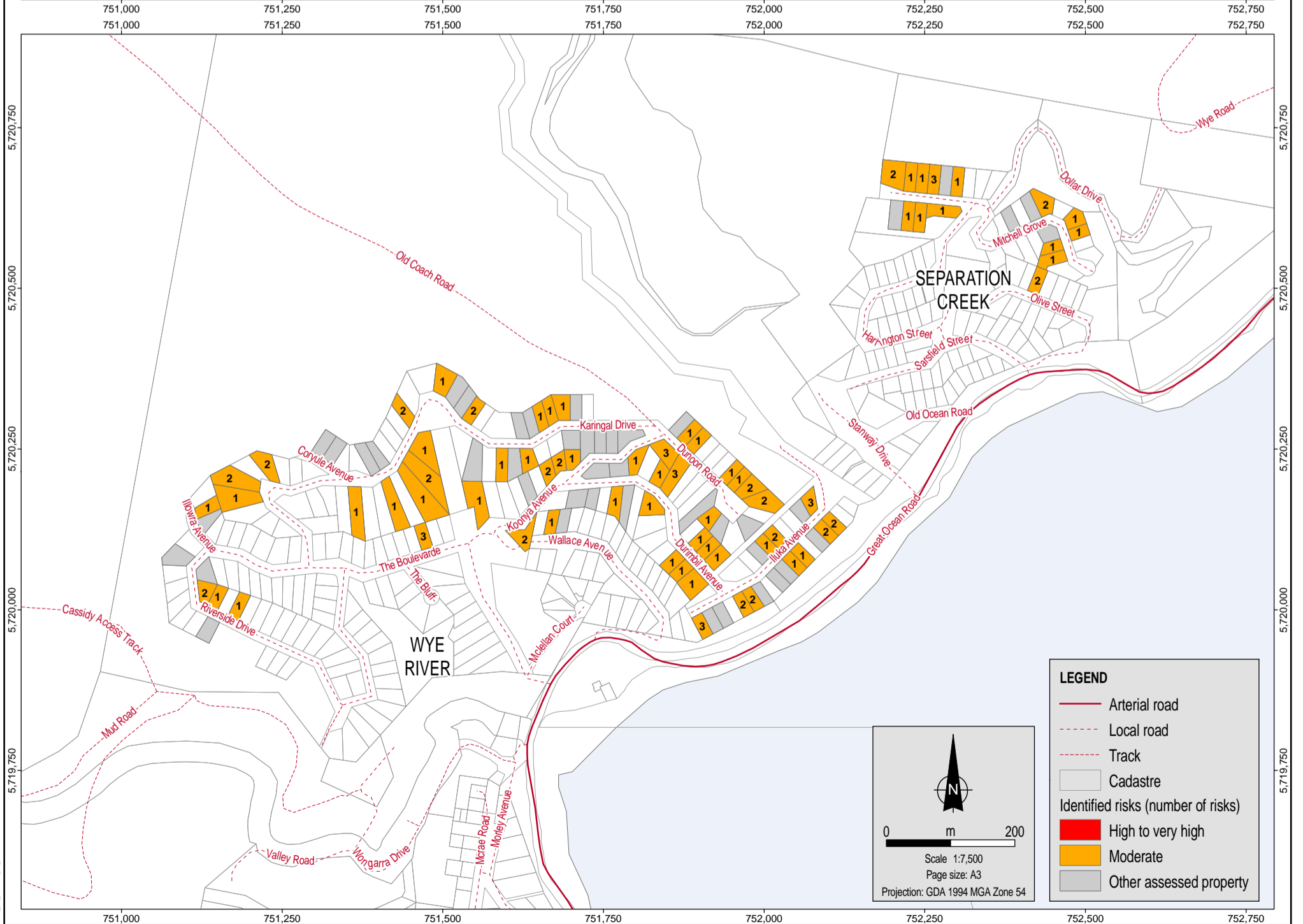
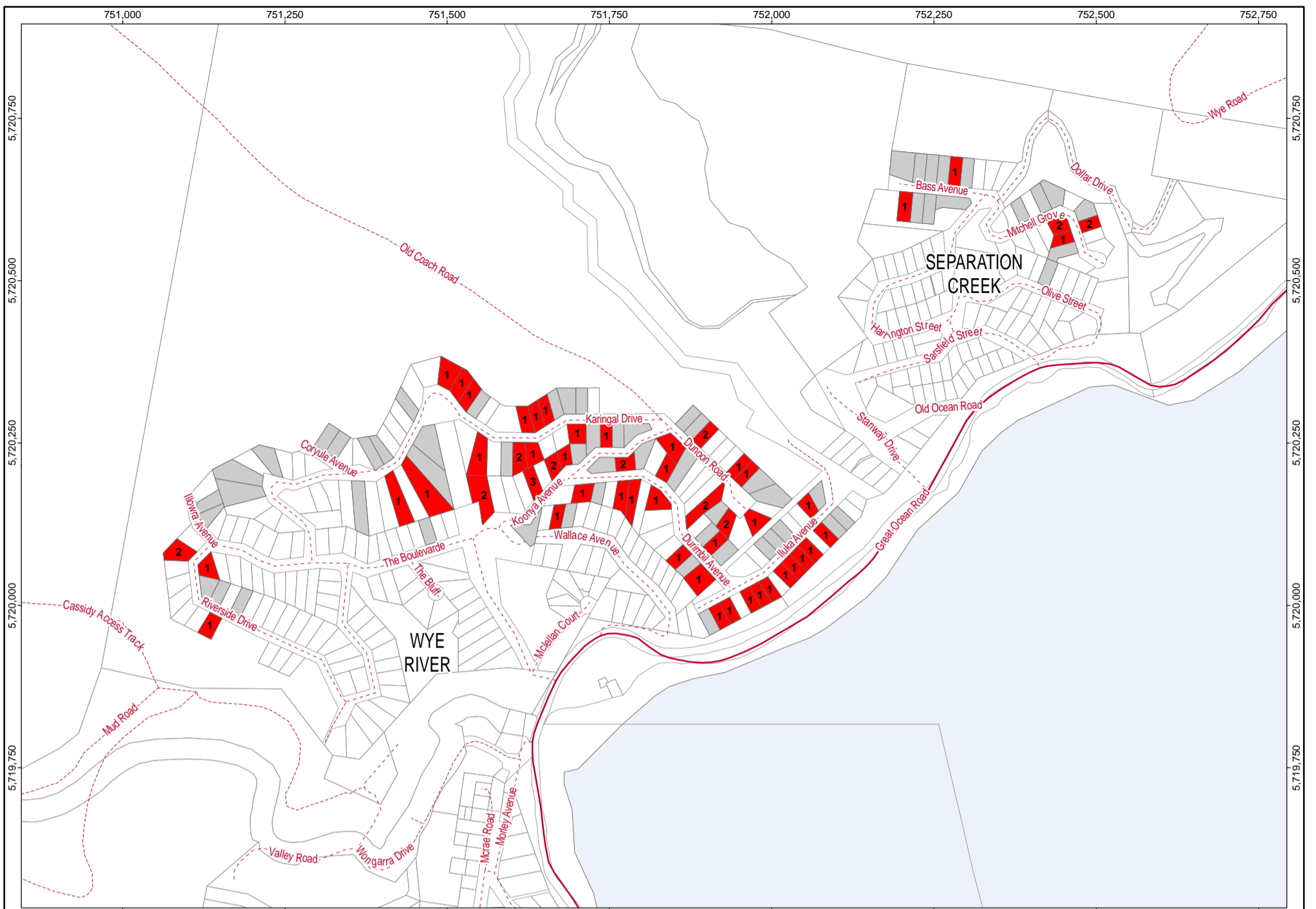
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Stylised cross section
displaying many features seen on sites

Figure No:

3



MJD Reference: 11630AA_01_GIS019_v0.2

Source:
Place names, roads, railways and cadastre from VICMAP.
Identified risks from Coffey.

coffey
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Date:
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Project:
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File Name:
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VICTORIA
State Government
Environment,
Land, Water
and Planning

**Identified moderate,
high and very high risks**

Figure No:
4

Figure 4 and Table 3.1 present information about five areas where there are landforms that are vulnerable to inappropriate development. These five areas include 'fossil' landslide debris (also known as 'colluvium') and surrounding steep slopes, as well as steep gullies. It is particularly important that development within or nearby these landforms adopt 'good hillside development practices', particularly with regarding to not developing in gullies; controlling surface water run-off; and limiting or otherwise retaining cuts and fills.

Elsewhere in the study area, inappropriate development practices on sloping sites could induce landsliding even where there is no evidence for such failures in the past. The steeper the slopes, the greater the potential for inducing slope instability by inappropriate development. Inappropriate development practices include excessive cutting and filling, uncontrolled water run-off, and uncontrolled removal of vegetation. Furthermore, without appropriate development controls it is possible for a development to inadvertently trigger old landslide which has been disguised by years of erosional processes. Section 5 of this report provides a detailed commentary of 'good hillside development' practices in the context of the study area and the post-bushfire conditions.

Table 3.1 Landslides in Wye River and Separation Creek area

Name	Figure 4 reference	Interpretation	Classification	Reference
Illowra Landslide	D	Ancient 40 hectare landslide that is very unlikely for this landslide to move en masse. Local failures may occur within the mass or along its sides.	Fossil landslide	Roberts, 2006 (Ref. 9).
Riverside Drive Landslide	E	Distinct landslide that is active with small landslides occurring within the vicinity in 1987. Probably part of toe of Illowra Landslide.	Active landslide	Cooney, 1987; Dahlhaus & Cooney, 1987
Morley Avenue Landslide		3 hectare rock slide that probably formed thousands of years ago. It did not move in the 1952 rainstorm, but part of its headscarp failed in 1964, and '...continued to fail ... until the 1990s'.	Active landslide	

Table 3.2 Other vulnerable landforms in Wye River and Separation Creek area

Name	Figure 4 reference	Interpretation	Classification	Reference
Wallace Street – Durimbil Avenue area	G	Comprise low-lying and irregular slopes, which are judged to comprise old colluvium ('fossil' landslide debris). The arc-shaped steep slopes represent the eroded remnants of the main and side scarps of the 'fossil' landslides.	'Fossil' landslide debris	Dahlhaus Environmental 2003 & Coffey, 2011
Mitchell Grove – Olive Street	H		'Fossil' landslide debris	Coffey, 2011
Steep slopes below parts of Durimbil Ave.		The steep slopes are probably the result of a combination of differential weathering along bedding and fossil landsliding as described above.	Steep slopes	Coffey, 2011

Table 3.3 Other vulnerable landforms in Wye River and Separation Creek area (cont'd)

Name	Figure 4 reference	Interpretation	Classification	Reference
Gully - Karingal Drive to The Boulevard	I	There is deep, probably uncontrolled, fill where roads cross these gullies. This fill is susceptible to erosion and local instability.	Steep gully	Coffey, 2011
Gully below Bass Avenue	J		Steep gully	Coffey, 2011

4. Site assessments

4.1. Principles of risk assessment

Risk assessment and management principles applied to slopes can be interpreted as answering the following questions:

- What are the issues? (scope definition).
- What might happen? (hazard identification).
- How likely is it? (likelihood).
- What damage or injury might result? (consequence).
- How important is it? (risk evaluation).
- What can be done? (risk treatment).

The risk is the combination of the likelihood, the consequences and the exposure to the identified hazard. All these factors are taken into account when evaluating a risk and deciding whether treatment is required. In the following sections of the report we have assessed the risks to property and life using a qualitative approach as per the recommendations of the AGS Guidelines (2007).

The qualitative likelihood, consequence and risk terms used in this report for risk to property are explained in Appendix C from AGS 2007 (copy included in Appendix C to this report). Also included in Appendix C to this report is a copy of Coffey's 'Important information about AGS 2007 Appendix C'. The Coffey document discusses the challenges about making landslide likelihood and consequence judgements, and the role of risk matrices in landslide risk management.

Appendix C from AGS 2007 presents a matrix that brings together different combinations of likelihood and consequence to define the risk terms. The matrix uses logarithmic scales of probability necessary for landslide studies, and its risk levels reflect the typical value judgements and risk adverse nature of home owners. Risk matrices help communicate the results of risk assessment, rank risks, set priorities and develop transparent approaches to decision making.

4.2. Methodology

The site assessments are included in Appendix B, in tabulated format, where we provide a summary of our site observations by street and our assessment of Risk to Property for hazards identified on the subject properties. The hazards are assessed based on current conditions for risk to the property in general.

Our process to assess each site included creating a sketch site plan and taking representative geo-located photographs. The sketch plan recorded the important geotechnical features of the site, noting such things as:

- Slope angles and heights (which were all measured);
- Presence of cut and/or fill;
- Site access;
- Presence and state of retaining walls;
- Drainage;
- Instability; and

- Ground conditions, as exposed in site cuts (where possible to do so).

Once the data was collected and field work complete, the information was entered into the tables presented in Appendix B. The field data was then assessed, after cross reference with the site photographs, in accordance with Appendix C of AGS 2007 to assess the risk to property.

The likelihood of failure was assessed considering the current state of the slope, the typical angle of repose of geotechnical materials of that type and engineering judgement. We then considered the manner of the modelled instability and the potential size of back scarp and debris and location of those features, to assess a level of consequence. Table 4.1 summarises how the judgements were typically made.

4.3. Risk to property

We considered the more plausible hazards at the 109 sites we visited in the field. Of the hazards identified and given a risk rating in accordance with AGS 2007, there were 10 considered to be 'Very High' and 48 considered to be 'High'. The property locations of the Very High, High and Moderate hazards are shown in Figure 4.

The Very High and High risk ratings were from the following type of hazards:

- Burnt out retaining walls (most);
- High fill slopes (some);
- Steep cut slopes (rare).

Our assessment found that most hazards were associated with access to and from the sites. Often steep fill or cut was associated with the road and in addition with driveways and carports.

Non-engineered fill (as occurs across the project area) is generally of lower strength than natural material and as such is more vulnerable to failure than natural materials. In addition the interface between fill and natural can be a zone of weakness and it is possible, in particular circumstances, for fill to fail en masse. As a consequence, fill slopes are both more vulnerable to failure than cut slopes and are also more likely to form larger failures.

The placing of fill on already steep cuts or natural slopes, for instance, which occurred in many sites, created slope geometries which we consider to be unsustainable in the post bushfire environment.

Hazards with Very High and High Risk ratings must be dealt with in the reconstruction works. We also note that we identified many 'Moderate' Risk hazards during our assessments. It is our understanding that COS require all Moderate risk ratings to also be dealt with during development works as a matter of policy.

We consider that rectifying these hazards should be done sooner, rather than later. If onsite prioritisation is required then it should be to the higher risk ratings first. In the case of repairing retaining walls, if this can be done soon (ie. prior to the soil backfill collapsing) then the amount of rectification work required at a later date will be reduced.

Table 4.1 Basis of fill and cut likelihood and consequence judgements

Slope type & angles	Slope heights [1, 2]	Judged likelihood of failure [3]	Judged consequence of failure [3]	Resultant risk [3]
Burnout Retaining Walls				
Retaining wall	< 1 m	Almost Certain	Insignificant	Moderate
Retaining wall	>1 m	Almost Certain	Minor to Moderate	High to Very High
Unsupported Fills				
Steep, i.e. >35 deg	<1 m	Possible	Insignificant	Very Low
	1 to 2 m	Likely to Possible	Insignificant to Minor	Low to Moderate
	2 to 4 m	Almost Certain to Likely	Medium	Moderate to Very High
Moderate, i.e. 25 to 35 deg [4]	<1 m	Unlikely	Insignificant	Very Low
	1 to 2 m	Possible to Unlikely	Minor	Low to Moderate
	2 to 4 m	Likely to Possible	Minor to Medium	Moderate to High
Unsupported Cuts				
Steep, i.e. >35 deg	<1 m	Unlikely	Insignificant	Low
	1 to 2 m	Unlikely to Possible	Insignificant to Minor	Very Low to Moderate
	2 to 4 m	Possible to Likely	Minor	Moderate
Moderate, i.e. 25 to 35 deg [4]	<1 m	Rare	Insignificant	Very Low
	1 to 2 m	Unlikely	Insignificant	Very Low
	2 to 4 m	Possible	Minor to Medium	Moderate

[1] Unsupported cuts and fills less than 1 m are not addressed in this table. The risk from these slopes will typically be Low or Very Low.

[2] Cuts and fills greater than 4 m high were assessed on an individual basis.

[3] Using terminology presented in Appendix C of AGS 2007.

[4] For gentler slopes, lowers likelihoods of failure and hence lower risks will apply.

4.4. Risk to loss of life

AGS 2007 recommends that the risk to life should be considered when assessing landslide risk. The landslide record from Australia and elsewhere indicates that most deaths and injuries are associated with fast moving landslides and associated high speed moving objects when there is insufficient warning for people present to take evasive action. People are most vulnerable if buried in open space, trapped in vehicles that are buried and crushed or in a building that collapses or is inundated with debris.

The scenarios identified in Appendix B represents instabilities that generally fit into two types, collapse of unsupported fill adjacent to burnt out retaining walls or collapse of steep fill or cut slopes. In the study area, fast moving landslides could include failure of un-retained soil behind burnt out retaining walls and failure of uncontrolled fill on steep slopes.

There is a risk to loss of life associated with unsupported soil adjacent to burnt-out retaining walls. These are structures are clearly dangerous in their present form and must be avoided until they are reconstructed using good engineering practice.

In Appendix E, we present an indicative quantitative assessment of risk to life for the larger fill slopes that exist adjacent to several properties. This assessment indicates annual probability of death of the most exposed individual to be of the order of 2×10^{-5} . There are no established individual or societal risk acceptance criteria for loss of life due to landslides in Australia, or for that matter worldwide (Reference 12). Risk criteria are available for some man-made structures (e.g., dams and the chemical industry) and Reference 12 uses these risk criteria to suggest that the annual probability of loss of an individual life must be less than 10^{-5} , before it could be considered to be tolerable/acceptable, but subject to application of the 'as low as reasonable achievable (ALARA)' principle. On this basis, the calculated probability of death for the fill slopes presented in Appendix D is marginal. Measures to reduce this risk must be considered.

4.5. Limitations

The site assessments are based on observations made during the period from 1 March 2016 to 11 March 2016. If site conditions are altered during clean up works due to demolition of existing structures or creation of new areas of cut and fill, then a new assessment will be required.

The assessments of cuts and fills adjacent to the road have been undertaken without knowledge of the location of the property boundary. Many of these cuts and fills may lie partly within the road reserve and partly on private property. The ground does not respect property boundaries - if a slope is steep and unstable, it will fail irrespective who owns the land, and that failure will have consequences.

More generally, it is important to note when considering the assessments that:

- The assessments are judgements based on our understanding of the existing landslides and knowledge and experience from elsewhere. The assessments apply to the described situations.
- The assessments apply to the current condition on the assumption similar structures to those that were destroyed are proposed. Should there be any changes the risk assessments presented in this report may change.
- The occurrence of further landslides or further development may change the risk (e.g. changing stormwater flows).
- The assessments should be considered as indicative and sufficient to illustrate the levels of risk associated with the assumed proposed works only. The assessments do not (and for that matter cannot) consider all eventualities.
- There are many uncertainties in making judgements about such situations, particular in relation to likelihood and the conditional probabilities relating to risk to life. Because of these uncertainties, different assessors may make different judgements when presented with the same information.

5. Good hillside development practices

5.1. Overview

Within the project area there are large areas of steep slopes covered with soil materials comprising extremely weathered bedrock and/or slopewash/colluvial material. These areas are vulnerable to inappropriate development practices including uncontrolled drainage and/or poor cut and fill practices and/or poor retaining wall design and construction practices. There is the potential for small and very small slides and debris flows in many places as a function of poor site development practices and heavy rainstorms. It will therefore be important that good hillside practices in accordance with sound engineering principles be adopted during redevelopment.

Examples of good hillside practices are included in Appendix G to AGS 2007 (copy included as Appendix D to this report). Discussion of these practices and generic geotechnical recommendations for the proposed re-development are provided in the following sections.

5.2. Road drainage

The management of water runoff is an important part of maintaining slope stability. If not properly controlled, water can infiltrate natural or constructed slopes and if these are marginally stable, the addition of water can be sufficient to cause instability.

Provision and maintenance of adequate roadside drainage with appropriate points of discharge are an important aspect in reducing the risk of slope instability. In selecting points of discharge, existing well defined water courses are more favourable than broad ill-defined depressions.

The road drainage systems in the study area require much more maintenance than drains in flatter and less vegetated areas. Blockage of the drains by debris falling from the trees, sloughing of material from over-steepened cuts into the drains, and erosion of soil from the base of the table drains are key causes of drainage malfunctions. Furthermore, because of the steep slopes in the study area, failure to maintain the road drainage may result in consequences far more serious than simple flooding of someone's backyard. We recommend a minimum of twice yearly inspections by Council and annual maintenance of the drains.

The residents also need to accept their responsibilities with respect to good hillside drainage practices including the need to maintain good drainage on their properties (see below), and to inform council if the road drainage system becomes damaged, blocked, or poorly maintained.

5.3. Property drainage

Restoration works on each and every property should include early and carefully planned management of site drainage.

Water should not be allowed to freely runoff fill platforms or other earthwork structures, but rather be diverted away from exposed slopes and into properly constructed drains and channels. The runoff from water tank overflow should also be considered and diverted into properly constructed drainage.

5.4. Do not develop in gullies and drainage lines

Gullies act as drainage lines and drainage courses. They may be dry for years on end, but in major storm events they can quickly become paths for water.

Some dry gullies and drainage lines may be the paths of channelised debris flows. These events occur infrequently, commonly in major storm events following a bushfire, and they comprise a fast flowing mass of water and entrained vegetation, soil and rocks.

5.5. Vegetation and erosion considerations

Apart from the destruction of property, the bushfires have destroyed a considerable amount of vegetation on the site in the form of grass, scrubs, small trees and a number of large trees.

The current absence of vegetation has altered the geotechnical environment across the project area. The vegetation is no longer acting as an umbrella protecting the ground; it is removing less water from the ground via transpiration; and with time the root reinforcement effect will also be lost. As a result of these changes, slopes that were previously of marginal stability may now experience instability. In addition the bushfires are likely to make the soil hydrophobic, reducing infiltration and coupled with the loss of vegetation, increasing the likelihood of erosion.

Vegetation regrowth should therefore be encouraged, and positively assisted in the short-term with new planting and via the wide-spread use of environmat-like products to protect the soil.

The topsoil and any remaining vegetation should be only stripped where necessary during site preparation for re-development. Where it is necessary to remove surviving or dead vegetation but not the existing soil, the vegetation should be cut or slashed to allow the root structure to remain to assist in limiting erosion.

Any exposed soil should be protected from erosion during and post construction. EPA Publication 275 (Ref. 12) provides sound advice on techniques to control sediment erosion, and its advice should be implemented as and where appropriate.

5.6. Retaining walls

Many timber retaining walls were destroyed by the bushfires and the previously retained soil was observed to be failing at a number of locations. The damaged retaining walls need to be reconstructed. Where the retaining walls were constructed with metal I-beams and timber lagging, and the metal I beams remain in place, we recommend that a suitable experienced structural engineer inspects and approves the I-beams before re-using them in the retaining wall re-construction. A suitably experienced structural engineer should also be consulted if any other structural elements that were damaged during the bushfires are proposed for re-use.

Existing cuts in soil greater than 1 m height should be supported by an engineered retaining wall. If an existing cut is both soil and rock and a retaining wall is not desired, then the soil should be battered back at the ratios provided in Section 5.11 of this report.

If new retaining walls are designed, the designer should consider where relevant the presence of sloping ground above the retaining wall in accordance with engineering principles.

5.7. Geotechnical parameters

Geotechnical strength parameters may be required by engineers for the design of new retaining walls and slope stability analysis. We note that for slope stability analyses it is important to adopt parameters for the drained case, which will reflect engineering conditions in the long term.

Table 5.1 provides typical geotechnical strength parameters for the ground materials commonly present within the study area. These parameters are provided to guide designers in their choice of

geotechnical parameters. The designer may adopt other parameters, but should provide a rational basis for their adopted alternative.

Table 5.1 Typical geotechnical strength parameters for ground materials^[1]

Material	Material unit weight	Drained		Undrained
		ϕ'	c'	C_u [2]
Engineered Fill	18 kN/m ³	25°	3kPa	50kPa
Natural Clay	20 kN/m ³	27°	5kPa	100kPa
Natural Sand	20 kN/m ³	30°	N/A	N/A
HW Rock ^[3]	25 kN/m ³	35°	25kPa	300kPa
Landslide Debris ^[4]	18kN/ m ³	16°	2kPa	25kPa

[1] The recommended strength parameters are judged to be typical values for the types of ground materials present on site. It is recommended that slope stability sensitivity analyses be conducted using a range of strength parameters that are appropriate to site-specific circumstances.

[2] Do not use for long term slope stability assessment

[3] These strength parameters apply to failures through the rock mass. They do not account for failures that are controlled by geological structures (e.g. soil strength materials on bedding). Where such geological structures are present, kinematic (wedge and/or planar) analyses using appropriate soil strength parameters should be conducted.

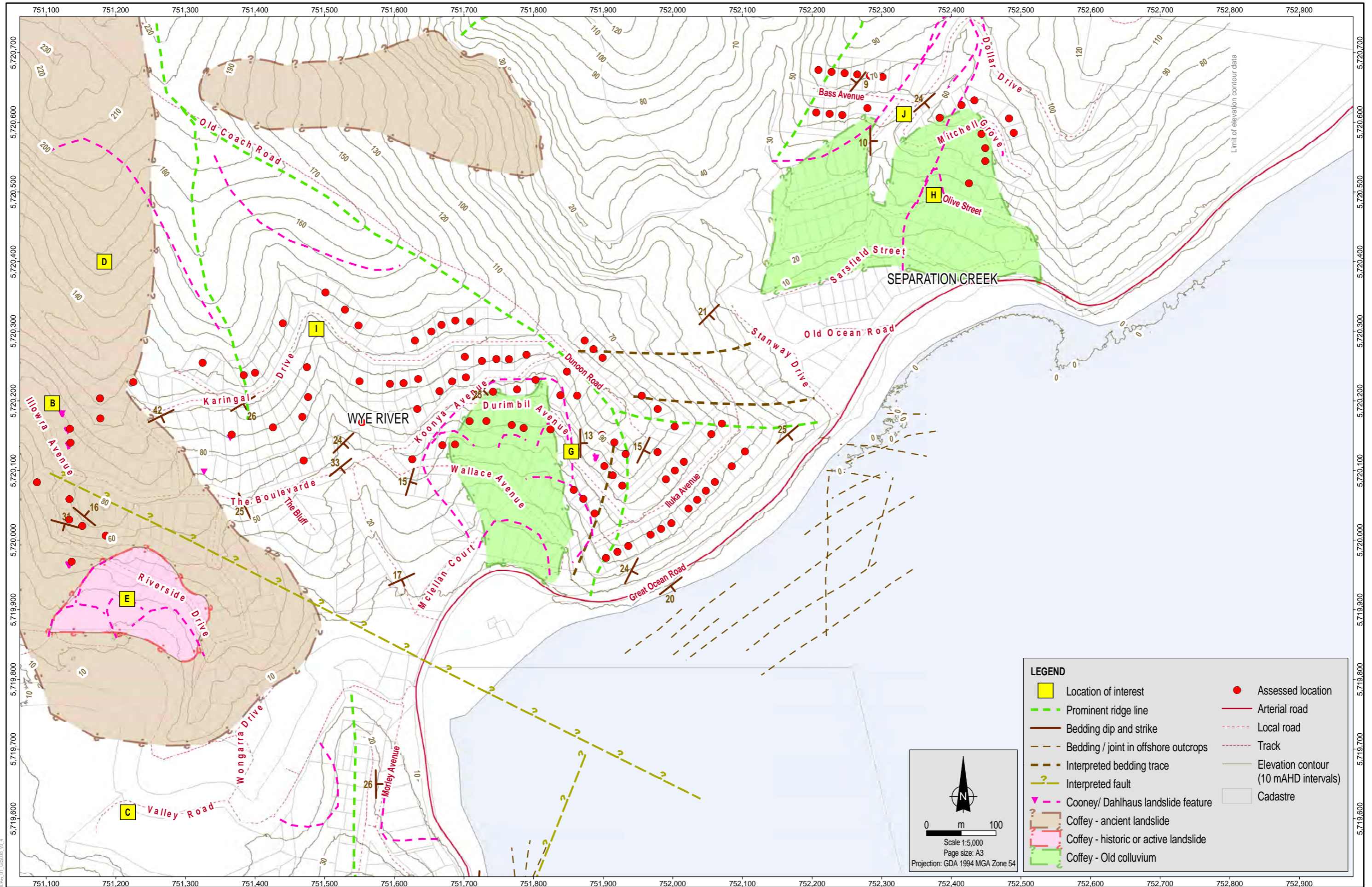
[4] In areas of landslide debris, the designer should conduct careful analysis before selecting geotechnical strength parameters, including laboratory testing and back analysis as appropriate. These proposed values are provided for preliminary purposes. For preliminary purposes areas of landslide debris can be identified as the features noted as landslides or colluvium on Figure 5.

5.8. Onsite disposal of wastewater

The geotechnical implications of onsite disposal of wastewater should be considered when selecting an appropriate treatment method for each site. The issues for each site will depend on the nature of the site and what is proposed. Given the generally steep nature of the topography of the site, it will be important to reduce the amount of water infiltration into the soil and thus treatment systems that have less water infiltration are recommended. In addition any earthworks for the wastewater disposal system should avoid the creation of large filled benches.

Onsite disposal of wastewater represents a significant change in the natural water balance and can have a similar contribution to an increase in rainfall of about 70% (Coffey, 2011), thus it should only be considered where slope instability risks are likely to remain within acceptable levels. The challenge is to identify situations where onsite disposal will not unduly impact on the slope instability risks. Factors that need to be taken into consideration when identifying such situations include:

- Size and location of the development area;
- Nature of the surface topography;
- Variability of subsurface conditions;
- Variability of surface and subsurface water and the response of each to rainfall;



LEGEND

	Location of interest		Assessed location
	Prominent ridge line		Arterial road
	Bedding dip and strike		Local road
	Bedding / joint in offshore outcrops		Track
	Interpreted bedding trace		Elevation contour (10 mAHD intervals)
	Interpreted fault		Cadastre
	Cooney/ Dahlhaus landslide feature		
	Coffey - ancient landslide		
	Coffey - historic or active landslide		
	Coffey - Old colluvium		

0 m 100

Scale 1:5,000
Page size: A3
Projection: GDA 1994 MGA Zone 54

Source:
Assessed locations derived from buildings attributed as destroyed from A.S. Miner 'Wye River Bushfires 2015 - Property owner geotechnical and tree status spreadsheet.xlsx'
Place names, roads, railways and cadastre from VICMAP.
Geological layers derived from Barwon Water - Geotechnical Assessment Report, (Coffey, November 2011).
Imagery and elevation contours from DELWP (captured 9 January 2016).



Date: 23.03.2016
Project: ENAUA8TFODELWPAA
File Name: 11630AA_01_F008_GIS

Department of Environment, Land, Water & Planning
Wye River and Separation Creek
Geotechnical, Land Capability and Wastewater Solutions Project



Environment, Land, Water and Planning
Known landslides (after Coffey 2011).

Figure No: 5

- Cumulative effect of multiple developments within an area.

Wastewater disposal by ground absorption trenches should not be adopted because ground absorption trenches:

- Provide an efficient way for water to enter the ground and to build up groundwater pressures;
- Are hidden from view so that if the groundwater is causing a problem it cannot be noticed;
- Act like cracks extending across a property which can be the first point of slope failure.

The preferred wastewater management options should address the following:

- The disposal procedure can be (and is) visually monitored, and at the same time limiting access to the wastewater for health and safety reasons;
- Minimal earthworks are required by the disposal procedures, and in particular the construction of trenches extending across the slope and / or the creation of large filled benches should be avoided;
- Wastewater dosing rates should be conservative with respect to net infiltration from rainfall; and
- No post disposal concentration of water can occur in the ground. By adopting onsite disposal only where the natural slopes are planar to convex is probably the only practical way to meet this requirement. A corollary is that there should be no disposal in poorly drained areas.

5.9. Building foundations

We consider that all buildings should be founded into the Highly Weathered (or less weathered) sandstone or siltstone of the Eumeralla Formation and be keyed into rock to a depth of at least 300 mm. Ancillary structures (such as water tanks) may be founded in natural soil or engineered fill, provided the ancillary structure is set back from the crest of the fill platform at least twice the fill platform height (or if a cut platform a minimum of 1 m).

Spread footings may be designed based on the allowable bearing pressures provided below within the various materials:

- | | |
|---|---------|
| • Engineered fill | 50kPa. |
| • Natural soils/extremely weathered materials | 50kPa. |
| • Highly weathered rock | 400kPa. |

Spread footings proportioned in accordance with the above recommendations are assessed to have load induced settlements of no greater than 0.5% of the width of the footing.

The excavated foundation pads and strips should be assessed by a suitably experienced individual prior to the concreting to confirm the founding conditions are as designed.

5.10. Excavation conditions

Based on the subsurface conditions observed in the existing site cuts, the materials to be excavated would comprise layers of fill, topsoil, residual soils and then weathered rock.

We consider that excavation of the fill and natural soils should be able to be carried out using backhoes or tracked excavators.

Excavation of the predominately low to medium strength weathered interbedded sandstone and siltstone should be able to be carried out using excavators, with some higher strength zones or locations requiring the use of rock breaker.

5.11. New cut and fill slopes

The recommended temporary and permanent batter slopes for unsupported cuts of greater than 1 m but less than 2 m depth in the various materials are provided in Table 5.2. It is recommended that no surcharge loadings be placed or located from the crest of a batter cut within a distance of 1 m and that surface water should be diverted away from the crests of batter slopes.

Table 5.2 Recommended batters for new cut and fill slopes

Description of Material	Temporary batters	Permanent batters
Topsoil / new/existing fill / natural soils	1(V):1(H)	1(V):2(H)
Highly or less weathered or better rock	2(V):1(H)	1(V):1(H)

Steeper slopes than recommended in Table 5.2 may be possible for the less weathered rock, but would require a site specific assessment by an experienced geotechnical professional during excavation.

5.12. Reuse of excavated in-situ soils

We understand that filling may be required for platforms at some sites. The following comments are provided for the reuse of excavated materials for engineered or landscape fill, if required:

- The topsoil and organic rich soil are assessed not suitable for reuse as engineered fill and may be reserved for future landscaping;
- The natural soils are assessed as suitable for reuse in engineered fill, provided carefully moisture conditioning is maintained;
- The highly weathered sandstone and siltstone is considered likely to be suitable for reuse as engineered fill provided particles larger than 75 mm in size are broken down or excluded.

5.13. Fill construction procedures

New fill should be placed and compacted to an engineering specification in general accordance with the recommendations outlined in AS3798-2007, 'Guidelines on Earthworks for Commercial and Residential Developments'. The following procedure is recommended as a guide for site preparation and the placement of controlled fill.

- Remove existing fill, vegetation, root affected or other potentially deleterious material from the proposed fill area;
- The exposed natural soils should then be scarified to a depth of about 150 mm, moisture conditioned to within +/-3% of Standard Optimum Moisture Content (SOMC) and then recompacted to a minimum dry density ratio of 95% Standard in accordance with AS1289 5.1.1, 5.4.1 or 5.7.1;
- Soft or weak areas identified during the compaction process that do not respond to further compaction should be removed and replaced with suitable site materials in layers not exceeding 250 mm thickness and should be compacted to the above criteria;

- Subsequent layers of fill should be placed in uniform 250 mm thick layers, moisture conditioned and compacted to the above criteria.

Where fill is being added to a slope, it should be 'keyed in' in benches no greater than 500mm in height.

Earthworks should be carried out during dry weather conditions. Provision should be made for effective diversion of surface water from outside the property. The runoff from the property should be treated to remove excess sediments before discharge.

5.14. Groundwater

We consider that the groundwater table is likely to be deeper than most proposed excavation levels (provided proposed structures are similar to those existing pre-bushfire) and no significant dewatering would be required during the excavation for foundations.

We recommend that normal provision should be made for sumps and pumps to control surface and groundwater seepage that may occur from wet weather. Such water should be collected and diverted away from the site.

5.15. Site classification

In accordance with Australian Standard 2870-2011 'Residential slabs and footings', a site classification of Class P is applicable to each property considered as part of this study, due to their locations on steep terrain and because each property is subject to an EMO.

The natural soils across the study area are predominately clay, ranging from low to high plasticity, with limited areas of sand. Given the presence of clay, characteristic surface movements similar to those of a Class M site should be expected on most sites. If the existing fill were to be removed and replaced with engineered clay fill, the characteristic surface movements should be re-assessed.

We have recommended that buildings be founded in rock. If structures include elements that are founded directly on the ground (for instance floor slabs) then structural designers should allow for potential for differential movements as a result of shrink swell of the soil.

It should be noted that the site classification in accordance with AS2870-2011 is applicable for residential buildings or buildings that have a similar construction method and loading. The above classification is presented as a guide only and the designer should assess the applicability of the above site classification to each proposed building.

6. Key findings

The bushfires did not impact on areas where there are known large active landslides in Wye River and Separation Creek. The bushfires did impact on areas where there is extensive residential development on steep slopes, including mapped fossil landslide debris, that are vulnerable to inappropriate hillside development practices.

A consistent set of issues were observed at most sites. The roads are typically constructed as 'cut to fill', with upslope being cut and fill being placed on the downslope. On downslope sites there was typically steep fill slopes above the site, with earthworks and/or retaining walls to allow for car parking immediately downslope of the road. Some of these slopes would have been of marginal stability prior to the bushfires and stability issues have worsened with the loss of vegetation from the fire. Sites upslope of the road often had car parks created as cut and fill with the additional fill placed on an already relatively steep cut slope.

Most retaining walls in the site were constructed as metal I beam posts with timber lagging. The timber lagging has been burnt in many of the retaining walls, particularly on 'downslope' sites.

Assessments were conducted in accordance with AGS 2007. We identified geotechnical hazards on the sites and classified them from 'Very High' Risk to 'Very Low' Risk. Ten hazards were classified as Very High Risk and 46 as High Risk, which were from burnt out retaining walls (most), high fill slopes (some) and high cut slopes (rare).

We recommend that all Very High Risk and High Risk hazards be dealt with in the redevelopment work. In addition we note that we understand that it is COS policy to also deal with Moderate Risk hazards.

We have provided comments and recommendations for redevelopment works in our report. These should be applied on a case by case basis to reduce the risk rating of identified hazards. Redevelopment works should follow good hillside practice guidelines which are outlined more fully in our report.

It should be noted that the bushfire damage made the sites were difficult to access. Most of those sites considered 'accessible' were still rated as a high risk to enter. Access was therefore restricted to many sites and where greater access was considered possible, the building debris often blocked off significant parts of the site. Assessments were therefore typically conducted from vantage points on the road or in the driveway. Six sites could only be viewed from street level.

Our geotechnical assessments consider each site as it existed at the time of our fieldwork with consideration of risks based on a similar structure(s) being reconstructed. If COS require reports in accordance with EMO1 then additional individual reports for each property will be required, once the proposed redevelopment plans become available. The information included in this report provides a basis to expedite the preparation of such development-specific reports.

7. Glossary

Consequence the outcome, or potential outcome, arising from the occurrence of a landslide expressed quantitatively, or qualitatively, in terms of loss, disadvantage, damage, injury, or loss of life.

Discontinuity in relation to the ground is a crack, a bedding plane (a boundary between strata) or fault (a plane along which the ground has sheared) which forms a plane of weakness and reduces the overall strength of the ground.

Equilibrium the condition when the forces on a mass of soil or rock in the ground, or on a retaining structure, are equal and opposite.

Failure when part of the ground experiences movement as a result of the out of balance forces on it. Failure of a retaining structure means it is no longer able to fulfil its intended function.

Geotechnical practitioner when referred to in the Australian GeoGuides (LR series), is a professional geotechnical engineer, or engineering geologist, with chartered status in a recognised national professional institution and relevant training, experience and core competencies in landslide risk assessment and management.

Hazard a condition with the potential for causing an undesirable consequence. In relation to landslides this includes the location, size, speed, distance of travel and the likelihood of its occurrence within a given period of time.

Landslide the movement, or the potential movement, of a mass of rock, debris, or earth down a slope.

Likelihood a qualitative description of probability, or frequency, of occurrence.

Perched water table a water table above the true water table supported by a low permeability stratum.

Risk a measure of the probability and severity of an adverse effect to life, health, property or the environment.

Retaining structure anything built by humans which is intended to support the ground and inhibit failure.

Structure in relation to rock, or soil, means the spacing, extent, orientation and type of discontinuities found in the ground at a particular location.

Tension crack a distinct open crack that normally develops in the ground around a landslide and indicates actual, or imminent, failure.

Water table the level in the ground below which it is saturated and the voids are filled with water.

Landslides terminology

The landslide terminology used in this study follows that of Australian Geomechanics Society (AGS, 2007, Ref. 18). Landslide size and landslide age terms used are defined in the tables below.

Table 7.1 Landslide size terms

Relative size term	Volume range (m ³)	Typical dimensions (length x width x depth, m)	Example (see Section 5.4)
Very Large	>30,000	150 x 140 x 12	Morley Avenue Landslide
Large	3,000 to 30,000	80 x 40 x 8	Parts of the Riverside Landslide Complex
Medium	300 to 3,000	30 x 20 x 4	-
Small	30 to 300	10 x 10 x 2	Potential fill slides from Durimbil Ave.
Very Small	3 to 30	6 x 5 x 1	-
Extremely Small	<3	3 x 1 x 0.3	A boulder falling from a cutting

Table 7.2 Landslides according to age

Terminology		Typical description
After Zaruba and Mencl, 1969 (Ref. 12)	After McCalpin, 1984 (Ref. 13)	
Active	Active or Historic	Easily recognized by the sharp topographic expression of the landslide features.
Dormant	Inactive – young and Inactive - mature	The topographic expression is obscure and recognition may be difficult; though the cause of the movement may be renewed.
Fossil	Inactive – old age	Generally developed in the Pleistocene or earlier periods, under different morphological and climatic conditions. Movement cannot be repeated under present conditions.

8. References

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Important information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.



Important information about your **Coffey Report**

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical information in Construction Contracts" published by the Institution of Engineers Australia, National headquarters, Canberra, 1987.

Photographs



Photograph 1
Tension crack in carport adjacent to burnt out retaining wall



Photograph 2
Burnt out retaining wall



Photograph 3
"Upslope" property showing cut benches



Photograph 4
"Downslope" property showing both cut and fill

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**Appendix A - Copy of Schedule 1 to the Colac Otway
Shire Erosion Management Overlay**

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31/01/2013
C68**SCHEDULE 1 TO THE EROSION MANAGEMENT OVERLAY**

Shown on the planning scheme map as **EMO1**.

1.0 Land susceptible to landslip and erosion31/01/2013
C68

The Shire contains areas which are susceptible to landslip, including land throughout the Otway Ranges.

A number of geotechnical studies have been undertaken, in various forms and scope, within Colac Otway by various public agencies.

Colac Otway Shire Council has adopted updated landslip and erosion data for the whole Shire and subsequent reviews of selected areas displaying a greater complexity of landslip and erosion issues.

All land included in the Erosion Management Overlay has been identified as having a sufficiently high risk of potential instability to warrant specific review of these risks prior to the construction of buildings, commencement of works and the removal of vegetation as outlined below.

2.0 Definitions31/01/2013
C68

AGS Guidelines 2007 means including all Practice Notes Guidelines (Part C) and Commentary (Part D).

Geotechnical Practitioner means a specialist Geotechnical Engineer or Engineering Geologist who is degree qualified, is a member of a professional institute, with experience in the management of slope stability problems and landslip risk management as a core competence.

Landslide, as defined by the AGS Guidelines 2007, or “**landslip**”, as defined by the VPPs, means the movement of a mass of rock, debris or earth down a slope. This includes debris flow, which is the rapid flow of water saturated soil or rock debris.

Acceptable Risk – A risk for which, for the purposes of life or work, we are prepared to accept as it is with no regard to its management. Society does not generally consider expenditure in further reducing such risks justifiable. An acceptable risk level for new development or changes to existing development a risk to life and/or risk to property is in accordance with the AGS Guidelines 2007. It reflects a combination of the slope and type of development proposed.

Tolerable Risk – A risk within a range that society can live with so as to secure certain net benefits. It is a range of risk regarded as non-negligible and needing to be kept under review and reduced further if possible. Tolerable Risk for new development or changes to existing development a risk to life and/or risk to property is in accordance with the AGS Guidelines 2007.

3.0 Guidance for users31/01/2013
C68

This schedule;

- Requires at a minimum a Geotechnical Assessment to be prepared by a suitably qualified professional; and
- Potentially requires a Landslip Risk Assessment to be prepared where required by a Geotechnical Assessment or where the site is located within the slope thresholds contained in Clause 6.0 of this schedule by a suitably qualified professional.

4.0 Objectives31/01/2013
C68

- To manage the risk of landslip.

- To ensure that development can be carried out in a manner which will not adversely increase the landslip risk to life or property affecting the subject land or adjoining or nearby land.
- To ensure that development is not carried out unless the risk associated with the development is a Tolerable Risk or lower.
- To ensure that applications for development are supported by adequate investigation and documentation of geotechnical and related structural matters.
- To ensure that development is only carried out if identified geotechnical and related structural engineering risks to life and property are effectively addressed.

5.0

31/01/2013
C68

Exemptions from permit requirements

A permit is not required to construct or carry out the following:

- Earthworks that do not exceed 1m in depth or fill exceeding 1m in height; or
- A retaining wall that does not exceed 1m in height that is replacing an existing retaining wall with the same form of construction and dimensions and/or materials of improved durability and is not associated with other building construction work and does not provide landslip protection for any adjoining land; or
- Extension to the floor area of an existing building, including decks and verandahs provided that there is no increase in the ground surface area covered by roofed buildings and the floor area of the extension does not exceed 20m²; or
- Road works undertaken by a public authority; or
- Minor structures ancillary to an existing dwelling where the floor area of the structure does not exceed 20m²; or
- The removal, destruction or lopping of any vegetation providing the roots below ground level are retained; or
- Timber production where all timber production activities comply with the Code of Forest Practices for Timber Production (Revision No.2 November 1996) or as amended from time to time in accordance with section 55 of the Conservation, Forests and Lands Act 1987, and/or the Timber harvesting Prescriptions for Environmental Protection – Otway Region Private Land Native Forests and Plantations, where details of management of landslip risk have been provided to the satisfaction of the Responsible Authority; or
- In the Farming Zone, the construction of an outbuilding with a floor area less than 150m² for non habitable agricultural purposes.

6.0

31/01/2013
C68

Application requirements

An application for a planning permit must be accompanied by a Geotechnical Declaration and Verification Form (Form A) and include the information set out below, to the satisfaction of the Responsible Authority.

Development Plans

Development plans drawn to scale and dimensioned, showing as appropriate:

- The proposed development, including a site plan and building elevations, access, any proposed cut and fill, retaining wall or effluent disposal system.
- Any existing development, including buildings, water tanks and dams on both the subject lot and adjacent land (as appropriate).
- Any existing development on the subject lot, including cut and fill, stormwater drainage, subsurface drainage, water supply pipelines, sewerage pipelines or effluent disposal installations and pipelines and any otherwise identified geotechnical hazard.
- Details and location of existing vegetation, including any vegetation to be removed.

Geotechnical Assessment

A written Geotechnical Assessment must be prepared by a suitably qualified and experienced Geotechnical Practitioner in accordance with the methodology described below and with reference to the AGS Guidelines 2007. The Geotechnical Assessment must be for the development proposed in the application and include, to the satisfaction of the Responsible Authority:

- Details of the Geotechnical Practitioner and their qualifications and experience including but not limited to experience in the management of slope instability problems and landslip risk management.
- A statement that the assessment is based on field survey measurements which have been undertaken not more than 12 months prior to the relevant application for development.
- A detailed site description.
- Site assessment plans and cross-sections of the subject lot within the landslip impact zone and related land form survey and field measurements with contours and ground slopes as measured shown and drawn to scale and dimensioned.
- A detailed assessment of subsurface conditions, including the underlying geology.
- A statement indicating whether there are natural slopes on or immediately adjacent to the subject lot which exhibit evidence of possible or past landslip.
- Details of all site investigations and any other information used in preparation of the geotechnical report.
- A statement indicating whether site investigation requires subsurface investigation or may involve boreholes and/or test pit excavations or other methods necessary to adequately assess the geotechnical/geological model for the subject lot and details of all such investigations, boreholes, test pits or other methods.
- Include a statement indicating that the risks for all slope instability hazards identified, are of an acceptable risk level (as defined above) and will remain at an acceptable risk level over the design life of the development such that a Landslip Risk Assessment (as described in the following section) is not required.
- Where it is considered that a Landslip Risk Assessment is not required, state that, in the opinion of the Geotechnical Practitioner, the development can be carried out in a manner which will not adversely increase the landslip risk to life or property affecting the subject lot or adjoining or nearby land
- A statement as to whether the subject lot/s are suitable for the proposed development, or can be made suitable for the proposed development, and that the subject lot/s and the proposed development can meet the tolerable risk criteria, as defined in this schedule.
- A statement indicating whether or not development should only be approved subject to conditions, and if so state recommendations of what conditions should be required including but without limitation conditions relating to:
 - The determination of appropriate footing levels and foundation materials in any structural works, including all footings and retaining walls.
 - The location/s of and depth/s of earth and rock cut and fill.
 - The construction of any excavations and fill and the method of retention of such works.
 - Any details of surface and sub-surface drainage.
 - The selection and design of a building structure system to minimise the effects of all identified geotechnical hazards.
 - Retention, replanting and new planting of vegetation.
 - Any drainage and effluent discharge.
 - Any necessary ongoing mitigation and maintenance measures and any recommended periodic inspections, including performance measures.
 - The time within which works must be completed after commencement and the location/s and period in which materials associated with the development can be stockpiled.

- Any requirements for geotechnical inspections and approvals that may need to be incorporated into a construction work plan for building approval.
- A statement on whether or not a Landslip Risk Assessment is required.

Landslide/Landslip Risk Assessment

A written Landslip Risk Assessment of the proposed development must be included in the application for a planning permit if the Geotechnical Assessment or other landform data (a detailed site survey) indicates natural slopes on or immediately adjacent to the subject lot which:

- are steeper than 9 degrees (15.8%) in Gellibrand Marl Narrawaturk Marl & the Yaugher Volcanic Group the unnamed coastal lagoon deposits and lake and swamp deposits; or
- are steeper than 14 degrees (25%) in all other geologies including the spatially extensive Eumeralla Formation (Otway Group); or
- exhibit evidence of possible or past landsliding on or immediately adjacent to the site; or
- where, in the opinion of the Responsible Authority, the Geotechnical Assessment is not sufficient to determine that the development can be carried out in a manner which will not adversely increase the landslip risk to life or property affecting the subject lot or adjoining or nearby land.

A written Landslip Risk Assessment must be prepared by a suitably qualified and experienced Geotechnical Practitioner in accordance with the methodology detailed in the AGS Guidelines 2007. The Landslip Risk Assessment must be for the development proposed in the application and include, to the satisfaction of the Responsible Authority:

- A copy of the Geotechnical Assessment prepared for the subject land and proposal and, if not prepared by the Geotechnical Practitioner preparing the Landslip Risk Assessment, contain a response by the Geotechnical Practitioner preparing the Landslip Risk Assessment that the findings and conclusions of the Geotechnical Assessment are agreed with.
- Contain all the requirements of a Geotechnical Assessment if the need for an LRA is triggered by the LRA slope thresholds above.
- If the Geotechnical Practitioner preparing the Landslip Risk Assessment does not agree with the findings and conclusions of the Geotechnical Assessment for the subject land and proposal, another Geotechnical Assessment must be prepared by that Geotechnical Practitioner.
- An assessment underpinned by field survey and measurements which have been undertaken not more than 12 months prior to the lodgement of the application for a planning permit.
- A full assessment of the risk posed by all reasonably identified geotechnical hazards which have the potential to either individually or cumulatively impact upon people or property on the subject lot or related land, in accordance with the AGS Guidelines 2007.
- A full assessment of the risk posed by future vegetation removal for bushfire protection if undertaken to the maximum extent permissible under the conditions of any planning permit and under permit exemptions in the Planning Scheme, in accordance with the AGS Guidelines 2007.
- A conclusion as to whether the subject lot/s are suitable for the proposed development. This must be in the form of a specific statement that the subject lot/s are suitable, or can be made suitable, for the proposed development and that the subject lot and/or the proposed development can meet the tolerable risk criteria, as defined in this schedule. The report must specify all conditions required to achieve this objective.

7.0

Independent review

31/01/2013
C68

The Responsible Authority may require a Geotechnical Assessment and any Landslip Risk Assessment that has been submitted with an application to be reviewed by an independent Geotechnical Practitioner.

8.0 Transitional requirements

31/01/2013
C68

Any planning permit application that was lodged with Council prior to the approval date does not need to meet the requirements of the new schedule.

9.0 Decision Guidelines

31/01/2013
C68

Before deciding on a planning permit application the Responsible Authority must consider, as appropriate:

- Whether the risk to property and the risk to life measured against the tolerable risk as defined in the AGS Guidelines 2007 is acceptable.
- Geotechnical reports greater than one year old from the time of application will not be accepted unless accompanied by a letter from the Geotechnical Practitioner confirming report conclusions are still applicable.
- Whether the proposed subdivision, building or works or the removal of vegetation can be carried out in a manner which will not increase to an unacceptable level the possibility of landslip affecting the site or adjoining or nearby land.
- The recommendations of the Geotechnical Assessment and any Landslip Risk Assessment and any other information accompanying the application.
- The recommendations of any Independent Review of the Geotechnical Assessment and any Landslip Risk Assessment.
- Whether the proposed removal of vegetation is required to facilitate a permitted use or development of the land, and if there is any practical alternative form of development which would result in less disturbance to the existing vegetation.
- The impact of future vegetation removal for bushfire protection and whether any such vegetation removal would result in an increase to the risk to property and/or the risk to life as measured against the tolerable risk criteria defined in the AGS Guidelines 2007.
- The risks associated with the development requiring ongoing monitoring and maintenance of all mitigation measures.
- The risks associated with non-compliance with any conditions of any permit which may be subsequently issued.
- Effluent disposal considerations including any Environment Protection Authority requirements for on-site disposal in unsewered areas.

10.0 Permit conditions

31/01/2013
C68

Any permit issued must also contain the following condition:

- The approved development must be carried out on the site in accordance with the recommendations of the Geotechnical Assessment (title/date/author) or, where applicable, the Landslip Risk Assessment (title/date/author) or any Geotechnical Practitioner engaged to review those assessments submitted with the application.

11.0 Reference Documents

31/01/2013
C68

- Practice Note Guidelines for Landslide Risk Management 2007, Journal of Australian Geomechanics Society, Vol. 42: No 1, March 2007.
- Commentary on Practice Note Guidelines for Landslide Risk Management 2007, Journal of Australian Geomechanics Society, Vol. 42: No 1, March 2007.
- Guideline for Development of Sites Prone to Landslide Hazard, Final draft submitted to Australian Building Codes Board, prepared by Australian Geomechanics Society, 2004.
- Miner A S & Dalhaus P 2011, Revision of Colac Otway Shire's Erosion Management Overlay, A.S. Miner Geotechnical, Manifold Heights, Victoria, Australia.

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**Appendix B - Site-specific geotechnical
assessments**

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Site summary	
BASIC DATA	
Address:	1 Bass Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	03-Mar-16
Access onto site:	No
Overall groundslope:	28 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.5m @ 50 deg.
Access - fills:	N/A
House - cuts:	N/A
House - fills:	N/A
Water Tank - cuts:	about 1m @ 70 deg unsupported
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Access Fill
Max height:	to 1.5m
Typical max batters:	45 deg
Potential Hazard:	Failure of fill between road and driveway, undermining road, covering driveway
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes, Road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	7 Bass Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	03-Mar-16
Access onto site:	Yes
Overall groundslope:	25 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	orange clay with some rock cobbles. Colluvium or XW?, rock at 3m depth
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	N/A
Access - fills:	1.5m @ 90 deg (retaining wall)
House - cuts:	4.2m @ 45 deg.
House - fills:	
Water Tank - cuts:	
Water Tank - fills:	5m @ 35 deg.
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Building Cut
Max height:	4.2m
Typical max batters:	45 deg
Potential Hazard:	Failure of clay upslope of building cut against house
Likelihood:	Possible
Consequence:	Medium
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	Building Fill
Max height:	5m
Typical max batters:	35 deg
Potential Hazard:	collapse of fill platform that septic tanks may have been founded on
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	8 Bass Avenue
Location:	North side of road, upslope
Previous SSA:	November 1999 - Australian Geotechnical Services Pty Ltd, September 2001 - AGS Schult Pty Ltd, July 2002 (review) - A.S.Miner Geotechnical Pty Ltd, June 2013 - Bruce Holoake and Partners
Field work:	03-Mar-16
Access onto site:	Yes
Overall groundslope:	25 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	orange brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.5m @ 90 deg. (retained)
Access - fills:	2.3m @ 35 deg. (fill and cut)
House - cuts:	up to 1.0m @ 90 deg. (retained - damaged)
House - fills:	N/A
Water Tank - cuts:	within house cut
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	Site appears to have been under construction prior to fires
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	House Cut
Max height:	To 1.0m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall, forming small slump over building pad.
Likelihood:	Almost Certain
Consequence:	Insignificant
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	Access Fill & Cut
Max height:	2.3m
Typical max batters:	35 deg
Potential Hazard:	collapse of fill on top of cut
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	9 Bass Avenue
Location:	South side of road, downslope
Previous SSA:	Saunders Consulting, January 2000
Field work:	03-Mar-16
Access onto site:	No
Overall groundslope:	25 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	orange clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	N/A
Access - fills:	1.5m @ 90 deg. (burnt out retaining wall, slumped)
House - cuts:	<1m
House - fills:	
Water Tank - cuts:	
Water Tank - fills:	
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Access Fill
Max height:	1.5m
Typical max batters:	90 deg
Potential Hazard:	Failure of soil if retaining wall not reinstated
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes, Road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	10 Bass Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	03-Mar-16
Access onto site:	No - assessed as unsafe on site
Overall groundslope:	25-30 deg (approx)
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Orange brown residual soil.
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.5m @ 30 deg.
Access - fills:	N/A
House - cuts:	not accessible - up to 2.0m near vertical.
House - fills:	not accessible
Water Tank - cuts:	not accessible
Water Tank - fills:	not accessible
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	House Cut
Max height:	To 2.0m approx
Typical max batters:	70-80 deg. (estimated)
Potential Hazard:	Failure of unsupported cut slopes over building pad, resulting loss of support from building pad or forming small slump against building.
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	11 Bass Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	03-Mar-16
Access onto site:	Yes
Overall groundslope:	20 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	orange clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	N/A
Access - fills:	1.5m @ 30 deg.
House - cuts:	1.5m @ 90 deg (burnt out retaining wall)
House - fills:	
Water Tank - cuts:	
Water Tank - fills:	
Other - cuts:	
Other - fills:	1m @45 deg
additional comments:	two fill benches at southern extent of property
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Building Cut
Max height:	1.5m
Typical max batters:	90 deg
Potential Hazard:	Failure of soil if retaining wall not reinstated
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	2
Situation:	Access Fill
Max height:	Failure of fill slope
Typical max batters:	30 deg
Potential Hazard:	collapse of fill slope up to and including road edge
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	Yes, Road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	12 Bass Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	03-Mar-16
Access onto site:	Yes
Overall groundslope:	25 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Colluvial gravelly clay, hard.
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	3.0m @ 50 deg.
Access - fills:	1.5m @ 90 deg. (retained) + 1.5m @ 30 deg
House - cuts:	1.5m @ 80 deg. and 1.0m @ 80 deg. over building pad
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	Burnt retaining wall over part of access cut (approx 1m high)
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Burnt retaining wall
Max height:	To 1.0m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall above driveway, forming a small slump in driveway.
Likelihood:	Almost Certain
Consequence:	Insignificant
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	Building Cut
Max height:	To 1.5m
Typical max batters:	80 deg.
Potential Hazard:	Failure of unsupported cut behind building pad, forming a small slump into building.
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	3
Situation:	cut slope for driveway access
Max height:	3m
Typical max batters:	50 deg
Potential Hazard:	failure of cut slope blocking part of driveway
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	14 Bass Avenue
Location:	North side of road, upslope
Previous SSA:	January 2001 and February 2001 - AGS Schult Pty Ltd, May 2011 - Provincial Geotechnical Pty Ltd
Field work:	03-Mar-16
Access onto site:	Yes
Overall groundslope:	20 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Grey residual clay, highly weathered rock from 1.0m, low strength
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.5m @ 90 deg (unsupported)
Access - fills:	1.9m @ 40 deg. (fill and cut)
House - cuts:	N/A
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Cut
Max height:	To 1.5m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported cut slope above driveway, forming a small slump in driveway.
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	Access Fill
Max height:	1.9m
Typical max batters:	45 deg (in cut)
Potential Hazard:	Failure of fill on cut for driveway access
Likelihood:	Possible
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	Yes, Road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	16 Bass Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	03-Mar-16
Access onto site:	Yes
Overall groundslope:	15 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Clay, stiff or better. Highly weathered rock from 1.5m
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.3m @ 80 deg. (unsupported - slumping)
Access - fills:	N/A
House - cuts:	N/A
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Access Cut
Max height:	1.3m
Typical max batters:	80 deg.
Potential Hazard:	Failure of unsupported cut slope above driveway, forming a small slump in driveway.
Likelihood:	Almost Certain
Consequence:	Insignificant
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	18 Bass Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	03-Mar-16
Access onto site:	Yes
Overall groundslope:	15 deg (north east of property) to 30 deg. (west of site)
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Orange brown residual clay, very stiff. Highly weathered rock in house cut from about 0.5m.
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	3.5m @ 38 deg.
Access - fills:	2.1m @ 45 deg.
House - cuts:	3.5m @ 70 deg.
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	Slope steepens to west of property into gully
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Building Cut
Max height:	To 3.5m
Typical max batters:	70 deg.
Potential Hazard:	Failure of slope behind building, forming a small slump behind building.
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	Access Fill
Max height:	To 2.1m
Typical max batters:	45 deg.
Potential Hazard:	Failure of slope beneath driveway, resulting in loss of support of part of driveway.
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	3
Situation:	Access Cut
Max height:	To 3.5m
Typical max batters:	38 deg.
Potential Hazard:	Failure of cut slope between building and driveway, forming a small slump on the driveway and potentially loss of support beneath building.
Likelihood:	Unlikely
Consequence:	Medium
Risk:	Low
Affects neighbour:	No
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	2 Coryule Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	15 to 20 deg
On known landslide:	No
Drainage:	small gully to east of property
Exposed subsurface conditions:	residual soil, orange brown, overlying XW- HW rock
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts	max 1.3m @ 70 deg
Access - fills	N/A
House - cuts	N/A
House - fills	1.3m @ 33 deg
Water Tank - cuts	N/A
Water Tank - fills	N/A
Other - cuts	1.5m @ 65 deg
Other - fills	N/A
additional comments	small failure in cut onto Coryule Avenue
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Cut
Max height:	1.3
Typical max batters:	70
Possible event	failure of cut onto driveway
Likelihood:	Possible
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	No
Scenario No	2
Situation:	Other cut
Max height:	1.5m
Typical max batters:	65 deg
Potential Hazard	Failure of slope onto Coryule Avenue
Likelihood:	Likely
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	Yes - road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	1 Dunoon Road
Location:	North east side of road, downslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	18-21 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.0m @ 33 deg. (fill)
Access - fills:	1.3m @ 27 deg. (fill)
House - cuts:	Not accessible - minor cuts through building pad (<0.5m)
House - fills:	Not accessible
Water Tank - cuts:	Not observed
Water Tank - fills:	Not accessible - possible minor fill beneath water tanks (approx 0.5m)
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Access Cut
Max height:	To 1.0m
Typical max batters:	33 deg.
Potential Hazard:	Failure of slope between road and driveway, forming a small slump on the driveway.
Likelihood:	Rare
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	2 Dunoon Road
Location:	North east side of road, downslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	Approx. 18-21 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.4m @ 40 deg. (fill - approx), 0.8m @ 90 deg (retained)
Access - fills:	1.0m @ 28 deg.
House - cuts:	1.5m @40-50 deg.
House - fills:	Not accessible - fill at base of building pad approx 30-35 deg.
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	3
Scenario No 1	
Situation:	Building Cut
Max height:	To 1.5m
Typical max batters:	40-50 deg.
Potential Hazard:	Failure of unsupported soil behind building, forming a small slump behind the building.
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No 2	
Situation:	Building Fill
Max height:	Not accessible
Typical max batters:	30-35 deg. (approx)
Potential Hazard:	Failure of fill slope beneath building, causing the building to lose support.
Likelihood:	Unlikely
Consequence:	Medium
Risk:	Low
Affects neighbour:	No
Scenario No 3	
Situation:	Access Cut
Max height:	1.4m
Typical max batters:	40 deg
Potential Hazard:	Failur through slope onto driveway
Likelihood:	Possible
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	see text

Site summary	
BASIC DATA	
Address:	3 Dunoon Road
Location:	North east side of road, downslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	18-23 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.8m @ 35 deg (fill), 0.8m @ 90 deg. (retained - damaged)
Access - fills:	1.3m @40 deg, 0.5-1.0m @ 90 deg. (retained - damaged)
House - cuts:	Approx 0.5-1.0m retaining wall noted in Access - Fill
House - fills:	Not accessible - 1.0-1.5m @ 90 deg. (retained - damaged)
Water Tank - cuts:	0.5m @ 30 deg. (fill)
Water Tank - fills:	1.7m @ 45 deg.
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	House Cut/Access fill
Max height:	1.8m
Typical max batters:	40 deg (fill) and 90 deg (retained)
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	2
Situation:	Building Fill
Max height:	1.0-1.5m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall
Likelihood:	Almost Certain
Consequence:	Medium
Risk:	Very High
Affects neighbour:	No
Scenario No	3
Situation:	Water Tank Fill
Max height:	To 1.7m
Typical max batters:	45 deg.
Potential Hazard:	Faiure of fill slope beneath water tank, causing loss of support beneath water tank.
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	7 Dunoon Road
Location:	North east side of road, downslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	14-52 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Brown clay, extremely weathered material. Sandstone boulders in 40 deg slope (outcrop?)
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.0m @ 27 deg. (fill), 1.0m @ 55 deg. (cut)
Access - fills:	2.3m @ 28 deg.
House - cuts:	Not accessible - approx 1.0m @ 70-80 deg.
House - fills:	not accessible - approx 2.5-3.0m @ 40 deg.
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	Terrain steepens over centre of site (>40 deg.) near northwest building boundary
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	House Fill
Max height:	approx 2.5-3.0m
Typical max batters:	approx 40 deg.
Potential Hazard:	Failure of fill slope beneath building, causing loss of support beneath building
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	No
Scenario No	2
Situation:	House Cut/ Access Fill
Max height:	To 3.3m
Typical max batters:	28-80 deg.
Potential Hazard:	Failure of slope between driveway and building, forming a slump behind the building
Likelihood:	Almost Certain
Consequence:	Insignificant
Risk:	Moderate
Affects neighbour:	No
Scenario No	3
Situation:	Access Cut
Max height:	1.0m
Typical max batters:	55 deg
Potential Hazard:	Failure of cut slope onto driveway
Likelihood:	Possible
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	9 Dunoon Road
Location:	North east side of road, downslope
Previous SSA:	September 1999 - Provincial Soil Services Pty Ltd
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	20-50 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Red brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	0.9m @ 90 deg. (retained)
Access - fills:	2 access points - 0.9m @ 90 deg. (retained - damaged) - 1.0m @ 30 deg.
House - cuts:	1.2m @ 40 deg.
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	2.5m @ 37 deg.
Other - cuts:	
Other - fills:	
additional comments:	Natural slope increases over northern half of site. Two access driveways
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Access Cut/Fill
Max height:	To 0.9m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall, forming a small slump on driveway/undermining driveway.
Likelihood:	Almost Certain
Consequence:	Insignificant
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	Water Tank Fill
Max height:	To 2.5m
Typical max batters:	37 deg.
Potential Hazard:	Failure of fill slope beneath tanks, causing loss of support.
Likelihood:	Likely
Consequence:	Minor
Risk:	Medium
Affects neighbour:	No
Scenario No	3
Situation:	House Cuts
Max height:	1.2m
Typical max batters:	40 deg
Potential Hazard:	
Likelihood:	Possible
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	10 Dunoon Road
Location:	North east side of road, downslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	Yes
Overall groundslope:	13-24 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Orange brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	0.9m @90 deg (retained)
Access - fills:	2.3m @ 34 deg. Or 1.0m @ 90 deg. (retained - damaged)
House - cuts:	0.6m @ 65 deg.
House - fills:	N/A
Water Tank - cuts:	<0.5m
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	Gentle ridge runs west to east through property
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Access Cuts/Fill
Max height:	To 1.0m
Typical max batters:	90 Deg
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall, undermining driveway
Likelihood:	Almost Certain
Consequence:	Insignificant
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	House Cut
Max height:	0.6m
Typical max batters:	65 deg
Potential Hazard:	Failure of slope onto house
Likelihood:	Unlikely
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	No
Scenario No	3
Situation:	Access Fill
Max height:	2.3m
Typical max batters:	34 deg
Potential Hazard:	
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	11 Dunoon Road
Location:	South east side of road, downslope
Previous SSA:	July 2001 - Provincial Soil Services Pty Ltd
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	22 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.9m @ 30 deg. (fill), 0.5m @ 30 deg. (cut)
Access - fills:	1.3m @ 90 deg (retained - damaged)
House - cuts:	N/A
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	Not accessible - approx 1.0m @ 35 deg.
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Fill
Max height:	To 1.3m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall, undermining driveway
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	2
Situation:	Water Tank Fill
Max height:	Approx 1.0m
Typical max batters:	Approx 35 deg.
Potential Hazard:	Failure of fill slope beneath water tanks, causing loss of support beneath water tanks.
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	13 Dunoon Road
Location:	South west side of road, downslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	0.8m stone retaining wall
Access - fills:	1.7m @ 50 deg (fill) + 1.2m @60 deg (cut)
House - cuts:	0.8m damaged retaining walls
House - fills:	Not accessible - unknown
Water Tank - cuts:	
Water Tank - fills:	
Other - cuts:	1.6m @ 70 deg
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	3
Scenario No 1	
Situation:	Access Fill
Max height:	2.9m
Typical max batters:	50 deg (fill) and 60 deg cut
Potential Hazard:	Failure of slope onto Dunoon Road
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes, road
Scenario No 2	
Situation:	Other Cuts
Max height:	1.6m
Typical max batters:	70 deg
Potential Hazard:	Failure of slope causing small slump
Likelihood:	Likely
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	No
Scenario No 3	
Situation:	House Cuts
Max height:	0.8m
Typical max batters:	90 deg
Potential Hazard:	Failure of fille behind damaged retaining wall, potential to cause damage to carport
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	see text

Site summary	
BASIC DATA	
Address:	14 Dunoon Road
Location:	South west side of road, downslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	20 deg
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	XW material overlying HW Siltstone
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	2.5m @ 50 deg
Access - fills:	0.8m stone retaining wall
House - cuts:	1.1m @ 60 deg
House - fills:	Not accessible - unknown
Water Tank - cuts:	see house cut
Water Tank - fills:	
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Cut
Max height:	2.5m
Typical max batters:	50 deg
Potential Hazard:	Failure of cut slope onto driveway
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	House Cuts
Max height:	1.1m
Typical max batters:	60 deg
Potential Hazard:	
Likelihood:	Unlikely
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	15 Dunoon Road
Location:	South west side of road, downslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	11-31 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Orange brown residual soil
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.2m @ 70 deg. (retained)
Access - fills:	1.3m @ 90 deg. (retained - damaged)
House - cuts:	Approx 1.8m @ 70 deg.
House - fills:	Not accessible - significant fill at building pad - approx 5.0m @40-50 deg. (estimated)
Water Tank - cuts:	N/A
Water Tank - fills:	<0.5m @ 90 deg. (retained - damaged)
Other - cuts:	
Other - fills:	
additional comments:	Site steepens at south west half of property. Building posts near edge of building fill.
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Fill/Cut
Max height:	To 1.3m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall, undermining driveway and forming a slump behind water tanks
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	2
Situation:	Building Fill
Max height:	Approx 5.0m
Typical max batters:	Approx 40-50 deg.
Potential Hazard:	Failure of fill slope beneath building pad, resulting in loss of support of part of structure
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	19 Dunoon Road
Location:	South west side of road, downslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	25-46 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Brown clay, extremely weathered material
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.3m @ 90 deg. (retained - damaged)
Access - fills:	N/A
House - cuts:	N/A
House - fills:	N/A
Water Tank - cuts:	not accessible - approx 1.0-1.5m
Water Tank - fills:	not accessible - approx 1.9m @ 40 deg.
Other - cuts:	garage cut - 1.9m @ 70 deg.
Other - fills:	
additional comments:	Site steepens at south west half of property.
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Access Cut
Max height:	To 1.3m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining walls, forming a slump on property.
Likelihood:	Almost Certain
Consequence:	Insignificant
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	Carport cut
Max height:	To 1.9m
Typical max batters:	70 deg.
Potential Hazard:	Failure of unsupported cut slope, causing small slump into garage.
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	3
Situation:	Water tank fill
Max height:	Approx 1.9m
Typical max batters:	Approx 40 deg.
Potential Hazard:	Failure of fill slope beneath water tank, resulting in loss of support of water tank.
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	20 Dunoon Road
Location:	South west side of road, downslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	27 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	3.4m @ 35 deg (in fill) + 1.1m damaged retaining wall
Access - fills:	1.2m @ 30 deg (fill) stone retaining wall
House - cuts:	Not accessible - approx 2.8m @ 55-60 deg.
House - fills:	Not accessible - approx 4.0m @ 40 deg.
Water Tank - cuts:	1.0m @ 35 deg.
Water Tank - fills:	Not accessible - 1.2m @ 50 deg.
Other - cuts:	
Other - fills:	1.3m @ 40 deg
additional comments:	gully located to the west of property, 29 deg slope
RISK TO PROPERTY	
No of scenarios:	4
Scenario No	1
Situation:	House Cut
Max height:	2.8m
Typical max batters:	55 to 60 deg
Potential Hazard:	Failure of slope causing slump into house
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	House Fill
Max height:	approx 4m
Typical max batters:	40 deg
Potential Hazard:	Failure of fill slope causing slump, potential damage to house
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	No
Scenario No	3
Situation:	Water Tank Fill
Max height:	1.2m
Typical max batters:	50 deg
Potential Hazard:	Failure of fill slope beneath water tank, resulting in loss of support of water tank.
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	4
Situation:	access cut
Max height:	3.4m
Typical max batters:	35 deg
Potential Hazard:	failure in material above retaining wall
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes, road
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	1 Durimbil Avenue
Location:	North side of road (driveway access from Koonya Avenue), upslope
Previous SSA:	N/A
Field work:	07-Mar-16
Access onto site:	Yes
Overall groundslope:	15-18 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Orange brown residual clay. Very stiff
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.0m @ 75 deg.
Access - fills:	2.8m @ 30 deg.
House - cuts:	N/A
House - fills:	N/A
Water Tank - cuts:	1.0m @ 80 deg. (unsupported - failed)
Water Tank - fills:	N/A
Other - cuts:	Durimbil Avenue - 1.5m @ 50 deg.
Other - fills:	Koonya Avenue Fill - 2.3m @ 35 deg.
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No 1	
Situation:	Koonya Avenue Fill
Max height:	To 2.3m
Typical max batters:	35-40 deg.
Potential Hazard:	Failure of fill slope above driveway, causing small slump on to property driveway
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	No
Scenario No 2	
Situation:	Water tank cut
Max height:	To 1.0m
Typical max batters:	80 deg.
Potential Hazard:	Failure of unsupported cut behind water tank
Likelihood:	Likely
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	see text

Site summary	
BASIC DATA	
Address:	3 Durimbil Avenue
Location:	North side of road (driveway access from Kooya Ave), upslope
Previous SSA:	N/A
Field work:	07-Mar-16
Access onto site:	No
Overall groundslope:	25 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Brown residual clay. Very stiff
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	0.5m cut into fill
Access - fills:	3.1m @ 39 deg. (fill) + 0.5m @ 90 deg (retained)
House - cuts:	Not accessible - approx 2.0m @ 90 deg. (retained - damaged)
House - fills:	approx 3.0m @ 35 deg.
Water Tank - cuts:	Approx 1.5m @ 60-80 deg.
Water Tank - fills:	N/A
Other - cuts:	Durumbil Avenue - 1.7m @ 50 deg.
Other - fills:	2.0m @ 40 deg (downslope of driveway)
additional comments:	Open crack (<5mm) in Koonya Avenue upslope from property (probable tension crack), further assessment recommended. Failure in Durimbil Avenue cut slope.
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Koonya Avenue Fill
Max height:	3.1m
Typical max batters:	39 deg.
Potential Hazard:	Failure along probable tension crack in Koonya Avenue, loss of road verge, loss of driveway functionality
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes, Road
Scenario No	2
Situation:	Building Cut
Max height:	Approx 2.0m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall behind building, causing the driveway to slump into the building.
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	No
Scenario No	3
Situation:	Durimbil Avenue cut
Max height:	To 1.7m
Typical max batters:	50 deg.
Potential Hazard:	Failure of cut on Durimbil Avenue boundary, causing slump onto Durimbil Avenue (existing failure in
Likelihood:	Likely
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	Yes - Durimbil Avenue
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	4 Durimbil Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	Yes
Overall groundslope:	22-25 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Orange brown residual clay. Very Stiff/friable.
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	N/A
Access - fills:	1.8m @ 38 deg.
House - cuts:	1.0m @ 70 deg.
House - fills:	2.0m @30 deg, or 1.4m (retained)
Water Tank - cuts:	not accessible - approx 1.5m @ 40 deg.
Water Tank - fills:	not accessible - approx 3.0m @ 30 deg.
Other - cuts:	
Other - fills:	
additional comments:	Damaged retaining wall beneath building 1.4m height, damaged retaining wall above building 0.5m height
RISK TO PROPERTY	
No of scenarios:	3
Scenario No 1	
Situation:	Access fill
Max height:	To 1.8m
Typical max batters:	38 deg.
Potential Hazard:	Failure of fill slope beneath driveway, causing the driveway to be undermined.
Likelihood:	Possible
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	No
Scenario No 2	
Situation:	Building Fill
Max height:	1.4m (retained)
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind old retaining wall , beneath building pad.
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No 3	
Situation:	Building Fill
Max height:	To 2.0m
Typical max batters:	30 deg.
Potential Hazard:	Failure of fill slope beneath building pad
Likelihood:	Rare
Consequence:	Medium
Risk:	Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	5 Durimbil Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	07-Mar-16
Access onto site:	Yes
Overall groundslope:	Approx 20-25 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Red brown residual clay, very stiff
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.8m @ 55 deg.
Access - fills:	3.0m @ 33 deg.
House - cuts:	1.0m @ 50 deg.
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	Koonya Avenue - Northern Boundary - To 3.7m @ 35 deg.
additional comments:	Open crack (<5mm) in Koonya Avenue upslope from property (probable tension crack), further assessment recommended
RISK TO PROPERTY	
No of scenarios:	3
Scenario No 1	
Situation:	Building Cut
Max height:	To 1.0m
Typical max batters:	50 deg.
Potential Hazard:	Failure of unsupported cut slope behind building, causing slump onto building
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	
Scenario No 2	
Situation:	Access Cut
Max height:	To 1.8m
Typical max batters:	55 deg.
Potential Hazard:	Failure of cut slope at road causing a small slump on Durimbil Ave
Likelihood:	Likely
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	Yes, Durambil Avenue
Scenario No 3	
Situation:	Koonya Avenue Fill
Max height:	3m
Typical max batters:	31 deg.
Potential Hazard:	Failure along probable tension crack in Koonya Avenue, loss of road verge, loss of driveway
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes, Road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	6 Durimbil Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	Yes
Overall groundslope:	18-22 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Orange brown residual clay. Very Stiff/friable.
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	N/A
Access - fills:	not visible, approx 1.8m @ 35 deg.
House - cuts:	negligible - pole home
House - fills:	negligible - pole home
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	1
Scenario No 1	
Situation:	Access Fill
Max height:	To 1.8m
Typical max batters:	approx 35 deg.
Potential Hazard:	Failure of slope between propoerty and road
Likelihood:	Unlikely ⁽²⁾
Consequence:	Minor
Risk:	Low
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	9 Durimbil Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	07-Mar-16
Access onto site:	Yes
Overall groundslope:	27 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Colluvial gravelly clay, Brown residual clay, Very stiff
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	2.9m @ 39 deg, 1.4m @ 70 deg., 2.5m @ 55 deg
Access - fills:	1.8m @ 90 deg (fill retained - damaged)
House - cuts:	1.5m @ 80 deg.
House - fills:	1.6m @ 38 deg, 1.6m @ 90 deg (retained)
Water Tank - cuts:	0.6m @ 20 deg. (unsupported)
Water Tank - fills:	0.8m @ 70 deg.
Other - cuts:	
Other - fills:	
additional comments:	Damaged retaining wall - driveway fill unsupported. Small failure in road cutting (<1m³). Driveway cutting fretting where unsupported.
RISK TO PROPERTY	
No of scenarios:	4
Scenario No	1
Situation:	Burnt out retaining walls (access fill)
Max height:	To 1.8m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall beneath driveway, causing the driveway slab to be undermined and the soil to slump onto Durimbil Avenue
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	Yes - Durimbil Avenue
Scenario No	2
Situation:	Access Cut
Max height:	2.5m
Typical max batters:	55 deg
Potential Hazard:	Failure of slope beneath driveway, causing slump onto Durimbil Avenue
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes - Durimbil Avenue
Scenario No	3
Situation:	Burnt out retaining walls (house)
Max height:	To 1.6m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall adjacent to house
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	4
Situation:	Access Cut
Max height:	2.9m
Typical max batters:	39 deg
Potential Hazard:	Failure of slope above driveway, causing slump onto driveway
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	10 Durimbil Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	07-Mar-16
Access onto site:	No
Overall groundslope:	15 deg. (27 deg. from road)
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.2m @ 40 deg. (fill) +1.5m @ 65 deg. (cut)
Access - fills:	0.9m @ 90 deg. (retained - damaged)
House - cuts:	not accessible - approx 2.0-2.5m @ 45 deg.
House - fills:	not accessible - approx 2.0m @ 90 deg. (retained - damaged - rotated)
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	Fill terraces below driveway - total height approx 3.0m @ 30 deg. avg slope.
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Building Fill
Max height:	Approx 2.0m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall beneath building pad
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	No
Scenario No	2
Situation:	Access Fill & Cut
Max height:	2.6m
Typical max batters:	up to 65 deg.
Potential Hazard:	Failure on to bench, undermining road verge
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	12 Durimbil Avenue
Location:	South side of road, downslope
Previous SSA:	September 2000 - Bruce Hollioake and Partners Pty Ltd
Field work:	07-Mar-16
Access onto site:	Yes
Overall groundslope:	15 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Red brown residual clay, very stiff
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.4m @ 34 deg. (fill) + 0.5m @ 90 deg. (retained)
Access - fills:	2.4m @ 37 deg.
House - cuts:	1.0m @ 90 deg (retained - damaged)
House - fills:	1.0m @ 23 deg.
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Access Fill/Building Cut
Max height:	Approx 1.0m
Typical max batters:	90 deg.
Potential Hazard:	Failure of soil behind damaged retaining wall causing soil to slump into building and undermine driveway.
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	No
Scenario No	2
Situation:	Access Fill & Cut
Max height:	To 1.9m
Typical max batters:	34-90 deg.
Potential Hazard:	Failure of slope beneath road causing slump onto driveway.
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	Yes - road
Scenario No	3
Situation:	Access Fill
Max height:	2.4m
Typical max batters:	37 deg
Potential Hazard:	Failure of slope beneath driveway, small amount of debris might reach neighbours
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	16 Durimbil Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	07-Mar-16
Access onto site:	No
Overall groundslope:	Not measured
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	
Cuts and fills:	
Access - cuts:	negligible
Access - fills:	1.8m @ 36 deg.
House - cuts:	not accessible - up to 1.5m @ 90 deg. (retained - brick wall)
House - fills:	not accessible
Water Tank - cuts:	not accessible - up to 0.5m @ 50 deg. (approx)
Water Tank - fills:	not accessible - up to 0.5m @ 90 deg. (retained)
Other - cuts:	
Other - fills:	2.2m @ 47 deg. From road to site
additional comments:	Property located in gully
RISK TO PROPERTY	
No of scenarios:	2
Scenario No 1	
Situation:	Durimbil Avenue Fill
Max height:	To 2.2m
Typical max batters:	47 deg.
Potential Hazard:	Failure of fill slope between property and road, undermining road and forming a slump onto the property.
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes, Road
Scenario No 2	
Situation:	Access Fill
Max height:	To 1.8m
Typical max batters:	36 deg.
Potential Hazard:	Failure of fill slope between road and driveway, undermining road and forming a slump onto the driveway.
Likelihood:	Possible
Consequence:	Minor
Risk:	Medium
Affects neighbour:	Yes - road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	23 Durimbil Avenue
Location:	North east side of road, upslope
Previous SSA:	February 1997, January 2001 - Provincial Geotechnical Pty Ltd
Field work:	07-Mar-16
Access onto site:	No
Overall groundslope:	Approx 22 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Pale brown clay, extremely weathered material
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	0.5m @ 70 deg (cut) + 0.5m @ 15 deg (retaining wall backfill) + 1.75m @ 90 deg (retained)
Access - fills:	1.75m @ 37 deg.
House - cuts:	Not accessible
House - fills:	3.0m @ 32 deg.
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No 1	
Situation:	Access Fill
Max height:	To 1.75m
Typical max batters:	37 deg.
Potential Hazard:	Failure of fill slope beneath driveway, causing driveway to be undermined.
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	
Scenario No 2	
Situation:	Building Fill
Max height:	To 3.0m
Typical max batters:	32 deg.
Potential Hazard:	Failure of fill slope beneath building
Likelihood:	Rare
Consequence:	Major
Risk:	Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	24 Durimbil Avenue
Location:	South west side of road, downslope
Previous SSA:	N/A
Field work:	07-Mar-16
Access onto site:	No
Overall groundslope:	Approx 30 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.3m @ 65 deg (fill)
Access - fills:	1.2m @ 45 deg + 0.5m retaining wall (rotating) + 2.8m @45 deg
House - cuts:	approx 1-2m @ 70 deg.
House - fills:	Not observed
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	Small retaining wall in fill beneath driveway rotating, access staircase damaged
RISK TO PROPERTY	
No of scenarios:	3
Scenario No 1	
Situation:	Access Fill
Max height:	To 4.0m
Typical max batters:	45 deg.
Potential Hazard:	Failure of fill slope beneath driveway, causing driveway to be undermined.
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes (22, vacant)
Scenario No 2	
Situation:	House Cut
Max height:	approx 1 to 2m
Typical max batters:	approx 70 deg.
Potential Hazard:	Failure of unsupported slope behind building pad, causing a small soil slump behind property.
Likelihood:	Possible
Consequence:	Medium
Risk:	Moderate
Affects neighbour:	No
Scenario No 3	
Situation:	Access Fill
Max height:	To 1.3m
Typical max batters:	65 deg.
Potential Hazard:	Failure of fill slope between road and driveway, causing loos of road verge and slumping on driveway.
Likelihood:	Likely
Consequence:	Minor
Risk:	Medium
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	25 Durimbil Avenue
Location:	North east side of road, upslope
Previous SSA:	October 2005 - Saunders Consulting Group Pty Ltd
Field work:	07-Mar-16
Access onto site:	No
Overall groundslope:	Approx 23 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Pale brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	2.4m @ 53 deg (fill) + 1.0m @ 90 deg (retained - damaged)
Access - fills:	1.2m @ 90 deg (retained - damaged) + 3.0m @ 50 deg.
House - cuts:	2 x retaining walls - damaged (1.75m @ 90 deg, 2.0m @ 90 deg)
House - fills:	Not observed
Water Tank - cuts:	Not observed
Water Tank - fills:	Not observed
Other - cuts:	
Other - fills:	
additional comments:	Several damaged retaining walls
RISK TO PROPERTY	
No of scenarios:	3
Scenario No 1	
Situation:	Building Cut
Max height:	To 3.75m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported slope behind damaged retaining wall beneath building
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	No
Scenario No 2	
Situation:	Access Fill
Max height:	To 4.2m
Typical max batters:	50-90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall beneath driveway, causing driveway to be undermined.
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No 3	
Situation:	Access Cut
Max height:	To 3.4m
Typical max batters:	53-90 deg.
Potential Hazard:	Failure of slope behind damaged retaining wall above driveway access
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	26 Durimbil Avenue
Location:	South west side of road, downslope
Previous SSA:	N/A
Field work:	07-Mar-16
Access onto site:	No
Overall groundslope:	Approx 30 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	N/A
Access - fills:	3.0m @ 37 deg + 1.2m @ 90 deg (retained).
House - cuts:	Not accessible
House - fills:	Not accessible
Water Tank - cuts:	Not accessible - approx 1m (retained)
Water Tank - fills:	Not accessible - fill present
Other - cuts:	
Other - fills:	
additional comments:	Small brick retaining wall (0.3m high) rotating in driveway cut.
RISK TO PROPERTY	
No of scenarios:	3
Scenario No 1	
Situation:	Access Fill
Max height:	To 4.2m
Typical max batters:	37-90 deg (retained)
Potential Hazard:	Failure of slope between driveway and road
Likelihood:	Possible
Consequence:	Medium
Risk:	Moderate
Affects neighbour:	Yes - road
Scenario No 2	
Situation:	Access Fill
Max height:	To 1.0m
Typical max batters:	40 deg.
Potential Hazard:	Failure of fill slope beneath driveway, undermining driveway
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	No
Scenario No 3	
Situation:	Water tank fill
Max height:	Not accessible
Typical max batters:	Not accessible
Potential Hazard:	Failure of fill slope beneath water tank, causing water tank to lose support
Likelihood:	Possible to Unlikely
Consequence:	Minor
Risk:	Moderate to Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	27 Durimbil Avenue
Location:	North east side of road, upslope
Previous SSA:	N/A
Field work:	07-Mar-16
Access onto site:	No
Overall groundslope:	18-23 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Brown residual clay, stiff. Extremely weathered from approx 1m depth, occasional boulders.
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.2m @ 65 deg.
Access - fills:	3.6m @ 45 deg.
House - cuts:	Not accessible
House - fills:	Approx 1.0m @70 deg. (retained)
Water Tank - cuts:	Not observed
Water Tank - fills:	Not observed
Other - cuts:	
Other - fills:	
additional comments:	Driveway fill being undermined
RISK TO PROPERTY	
No of scenarios:	2
Scenario No 1	
Situation:	Access Fill
Max height:	To 3.6m
Typical max batters:	45 deg.
Potential Hazard:	Failure of slope between driveway and road (fill currently failing)
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes - road
Scenario No 2	
Situation:	Access Cut
Max height:	To 1.2m
Typical max batters:	65 deg.
Potential Hazard:	Failure of cut slope above driveway
Likelihood:	Likely
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	see text

Site summary	
BASIC DATA	
Address:	28 Durimbil Avenue
Location:	South west side of road, downslope
Previous SSA:	March 1988 - G.C.Black Pty Ltd; February 2001 - P.J.Yttrup & Associates Pty Ltd
Field work:	07-Mar-16
Access onto site:	No
Overall groundslope:	25 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Brown residual clay. Very Stiff. XW/HW material @ 0.5m.
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	3.2m @ 41 deg (fill) + 1.7m @ 70 deg (cut).
Access - fills:	2.6m @ 40 deg.
House - cuts:	Not accessible
House - fills:	not accessible - however fill at base of building pad
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	small failures (<1m ³) in access cut above driveway
RISK TO PROPERTY	
No of scenarios:	
Scenario No 1	
Situation:	access fill & cut
Max height:	To 4.9m
Typical max batters:	41-70 deg.
Potential Hazard:	Failure of slope between driveway and road (at least some of fill is in road reserve)
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes - road
Scenario No 2	
Situation:	Access Fill
Max height:	To 2.6m
Typical max batters:	40 deg.
Potential Hazard:	Failure of fill slope, undermining driveway and forming a slump behind the building.
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	see text

Site summary	
BASIC DATA	
Address:	2 Illowra Avenue
Location:	East side of road, upslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	Yes
Overall groundslope:	Not Measured
On known landslide:	No
Drainage:	
Exposed subsurface conditions:	residual clay over XW material at 0.6m
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	max 0.6m @ 30 deg (fill) and 0.8m @ 50 deg (cut)
Access - fills:	N/A
House - cuts:	N/A
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	0.85m @26 deg
Other - fills:	N/A
additional comments:	previous failure noted along road cut
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	
	1
Situation:	Access Cut
Max height:	1.0m
Typical max batters:	65 deg
Potential Hazard:	Failure through cut
Likelihood:	Possible
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	Yes, Road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	Not credible

Site summary	
BASIC DATA	
Address:	3 Illowra Avenue
Location:	East side of road, upslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	No
Overall groundslope:	Not Measured
On known landslide:	35 deg
Drainage:	
Exposed subsurface conditions:	residual clay over XW material at 1.0m
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	1m @27 deg (fill) + 0.2m (50 deg) cut
Access - fills:	N/A
House - cuts:	N/A
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	max 2.0m @ 48 deg (on 4 Illowra?)
Other - fills:	0.2 to 0.3m @ 5-18 deg
additional comments:	
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	
1	
Situation:	Other Cut
Max height:	2.0m
Typical max batters:	48 deg
Potential Hazard:	failure through cut
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	

Site summary	
BASIC DATA	
Address:	3 Iluka Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	Not measured
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	2.0 to 3.0m @ 75 deg. (retained)
Access - fills:	2.6m @ 70 deg. (retained)
House - cuts:	not accessible
House - fills:	not accessible
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	retaining walls undamaged
RISK TO PROPERTY	
No of scenarios:	0
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	see text

Site summary	
BASIC DATA	
Address:	4 Iluka Avenue
Location:	North side of road, upslope
Previous SSA:	November 1999 - Saunders Consulting Group Pty Ltd
Field work:	04-Mar-16
Access onto site:	Yes
Overall groundslope:	22 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	>1 m Red-brown residual clay. Very Stiff.
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	To 1.0m (retained)
Access - fills:	4 m at 45 deg.
House - cuts:	Negl.
House - fills:	Negl.
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access cut
Max height:	To 1.0m (retained)
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind old retaining wall , forming a small (<1m3) slump in the parking bay.
Likelihood:	Almost Certain
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	No
Scenario No	2
Situation:	access fill & cut
Max height:	To 4.0m
Typical max batters:	45 deg.
Potential Hazard:	Failure of slope between driveway and road (at least some of cut is in road reserve)
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	5 Iluka Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	Yes
Overall groundslope:	22 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Brown residual clay. Very Stiff. XW clay @ 1m.
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.3m @ 60 deg
Access - fills:	2.2m @ 40 deg
House - cuts:	not accessible
House - fills:	1.5m @ 40 deg
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Access cut
Max height:	To 1.3m
Typical max batters:	60 deg.
Potential Hazard:	Failure of cut slope , forming a small (<1m3) slump in the parking bay.
Likelihood:	Likely
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	No
Scenario No	2
Situation:	access fill & cut
Max height:	To 2.2m
Typical max batters:	40 deg.
Potential Hazard:	Failure of slope between driveway and road (at least some of cut is in road reserve)
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	yes, road
Scenario No	3
Situation:	house fill
Max height:	To 1.5m
Typical max batters:	40 deg.
Potential Hazard:	Failure of slope beneath house, undermining edge of house pad
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	7 Iluka Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	22 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Brown XW clay with cobbles and boulders. Very Stiff.
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.7m @ 50 deg
Access - fills:	2.0m @ 55 deg (cut) + 1.5m @ 30 deg (fill)
House - cuts:	not accessible
House - fills:	not accessible
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access cut
Max height:	To 1.7m
Typical max batters:	50 deg.
Potential Hazard:	Failure of cut slope , forming a slump in the parking bay.
Likelihood:	Likely
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	No
Scenario No	2
Situation:	access fill & cut
Max height:	To 3.5m
Typical max batters:	55 deg.
Potential Hazard:	Failure of slope between driveway and road (at least some of cut is in road reserve)
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	8 Iluka Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	up to 35 deg
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.7m @ 30 deg (cut) + 2.0m @ 40 deg (fill)
Access - fills:	2.7m @ 42 deg
House - cuts:	not accessible
House - fills:	2.5m @ 45 deg
Water Tank - cuts:	1.5m @ 45 deg
Water Tank - fills:	not measured
Other - cuts:	
Other - fills:	
additional comments:	Cracked driveway - repaired. Stability issues in past
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Access fill
Max height:	2.7m
Typical max batters:	42 deg.
Potential Hazard:	Failure of fill, possible reaching road
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes, road
Scenario No	2
Situation:	access fill & cut
Max height:	To 3.5m
Typical max batters:	55 deg.
Potential Hazard:	Failure of slope between driveway and road (at least some of cut is in road reserve)
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	yes, road
Scenario No	3
Situation:	house fill
Max height:	2.5m
Typical max batters:	45 deg
Potential Hazard:	failure of fill pad
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	10 Iluka Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	20 deg. approx
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Brown residual clay, very stiff. Highly weathered sandstone from 1.0m, low strength. Medium strength from 1.5m.
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	2.0m @ 70 deg. (unsupported)
Access - fills:	2.9m @ 35 deg. (fill) + 1.2m @ 65 deg (cut)
House - cuts:	not accessible
House - fills:	not accessible
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access cut
Max height:	To 2.0m
Typical max batters:	70 deg.
Potential Hazard:	Failure of cut slope , forming a slump in the driveway.
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	no
Scenario No	2
Situation:	Access Fill
Max height:	4.1m
Typical max batters:	35 deg (fill) and 65 deg (cut)
Potential Hazard:	Failure of slope between driveway and road
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	13 Iluka Avenue
Location:	South side of road, downslope
Previous SSA:	August 2001 - Provincial Geotechnical Pty Ltd
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	15 deg. approx
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	2.6m @ 30 deg.
Access - fills:	6.2m @ 40 deg. (retained with several timber retaining walls 0.5m-1.0m high - damaged)
House - cuts:	not accessible
House - fills:	not accessible
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Access fill
Max height:	To 6.2m
Typical max batters:	40 deg.
Potential Hazard:	Failure of fill slope, partially undermining the driveway.
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	14 Iluka Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	Yes
Overall groundslope:	20 deg. approx
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Yellow brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	0.6m @ 60 deg. + 1.3m @ 80 deg. (recent cuts - unsupported - 1.1m bench between cuts)
Access - fills:	2.8m @ 37 deg. (recent fill)
House - cuts:	not accessible
House - fills:	not accessible
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	Recent excavation post fires in driveway, near vertical cuts
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Cut
Max height:	To 1.9m
Typical max batters:	60-80 deg.
Potential Hazard:	Failure of recent cut slopes, forming a slump on the driveway (cut may be in road reserve)
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	yes, road
Scenario No	2
Situation:	Access Fill
Max height:	2.8m
Typical max batters:	37 deg
Potential Hazard:	Failure of slope undermining driveway
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	no
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	15 Iluka Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	23 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Yellow brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	0.6m @ 60 deg. + 1.3m @ 80 deg. (recent cuts - unsupported - 1.1m bench between cuts)
Access - fills:	1.5m @ 40 deg.
House - cuts:	not accessible - minor cuts
House - fills:	not accessible
Water Tank - cuts:	not accessible
Water Tank - fills:	Fill observed beneath water tank - slope and height not accessible
Other - cuts:	
Other - fills:	
additional comments:	Recent excavation post fires in driveway, near vertical cuts
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Cut
Max height:	1.3m
Typical max batters:	80 deg
Potential Hazard:	Failure of recent cut slopes, forming a small slump on the driveway (cut may be in road reserve)
Likelihood:	Almost Certain
Consequence:	Insignificant
Risk:	Moderate
Affects neighbour:	yes, road
Scenario No	2
Situation:	Access Fill
Max height:	2.4m
Typical max batters:	40 deg
Potential Hazard:	Failure of slope undermining driveway
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	no
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	16 Iluka Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	30 deg. approx
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Orange brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	not measured - >1.0m height
Access - fills:	1.1m @ 35 deg. (fill) + 2.0m @ 90 deg. (retained - damaged)
House - cuts:	not accessible - cut >1.0m beneath building
House - fills:	not accessible
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Access fill
Max height:	To 3.1m
Typical max batters:	35-90 deg.
Potential Hazard:	Failure of soil behind damaged retaining walls
Likelihood:	Almost Certain
Consequence:	Medium
Risk:	Very High
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	17 Iluka Avenue
Location:	South side of road, downslope
Previous SSA:	August 2002 - Saunders Consulting Group Pty Ltd
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	30 deg. approx
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Orange brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.0m @ 40 deg. (fill) + 1.1m @ 80 deg. (retained)
Access - fills:	1.5m @90 deg. (retained - damaged)
House - cuts:	Negl
House - fills:	Negl
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Fill
Max height:	2m
Typical max batters:	90 deg
Potential Hazard:	Failure of soil behind damaged retaining walls
Likelihood:	Almost Certain
Consequence:	Medium
Risk:	Very High
Affects neighbour:	No
Scenario No	2
Situation:	Access Cut
Max height:	1m
Typical max batters:	40 deg
Potential Hazard:	Failur through cut slope onto driveway
Likelihood:	Possible
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	19 Iluka Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	Yes
Overall groundslope:	25 deg. Approx
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	approx 0.5m @ 10 deg (fill) and 0.8m @ 70 deg
Access - fills:	2m @ 90 deg (retained)
House - cuts:	approx. 1.5m
House - fills:	Not Accessible
Water Tank - cuts:	Not Accessible
Water Tank - fills:	Not Accessible
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No 1	
Situation:	Access Fill
Max height:	2m
Typical max batters:	90 deg
Potential Hazard:	Failure of soil behind damaged retaining walls
Likelihood:	Almost Certain
Consequence:	Medium
Risk:	Very High
Affects neighbour:	No
Scenario No 2	
Situation:	Access Cut
Max height:	0.8m
Typical max batters:	70 deg
Potential Hazard:	Failur of slope onto driveway
Likelihood:	Likely
Consequence:	Insignifcant
Risk:	Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	see text

Site summary	
BASIC DATA	
Address:	20 Iluka Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	26 deg. Approx
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.7m @ 65 deg
Access - fills:	1.9m @ 43 deg
House - cuts:	Negl
House - fills:	Negl
Water Tank - cuts:	On Driveway
Water Tank - fills:	On Driveway
Other - cuts:	1.5m @ 70 deg
Other - fills:	
additional comments:	1.5m @ 90 deg (retained)
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Access Fill
Max height:	1.5m
Typical max batters:	90 deg
Potential Hazard:	Failure of soil behind damaged retaining walls
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	no
Scenario No	2
Situation:	Access Cut
Max height:	1.7m
Typical max batters:	65 deg
Potential Hazard:	Failure through slope causing slump onto driveway
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	no
Scenario No	3
Situation:	Access Fill
Max height:	1.9m
Typical max batters:	43 deg
Potential Hazard:	failure of fill below driveway
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	no
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	21 Iluka Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	25 deg approx
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	red brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.6m @ 75 deg (cut) and 2.1m @ 35 deg (fill)
Access - fills:	1.6m @ 40 deg (fill)
House - cuts:	Not accessible
House - fills:	Not accessible
Water Tank - cuts:	up to 2.1m @ 90 deg (retained)
Water Tank - fills:	unknown height, approx 40 deg
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Access Cut
Max height:	3.7m
Typical max batters:	75 deg (cut) and 35 deg (fill)
Potential Hazard:	Failure through slope beneath road
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	yes, road
Scenario No	2
Situation:	Water Tank Cut
Max height:	2.1m
Typical max batters:	90 deg (retained)
Potential Hazard:	Failure of soil behind slightly damaged retaining wall
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	3
Situation:	Access Fill
Max height:	1.6
Typical max batters:	40 deg
Potential Hazard:	failure of fill below driveway
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	no
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	23 Iluka Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No access & viewing very restricted
Overall groundslope:	22 deg
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	N/A
Access - fills:	N/A
House - cuts:	not accessible - multiple benches up to 1.5m (approx) visible with damaged retaining walls
House - fills:	not accessible
Water Tank - cuts:	not accessible
Water Tank - fills:	not accessible
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	Majority of structure remains(pole home) obscuring site.
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Building cut
Max height:	not accessible - approx 1.5m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining walls
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	24 Iluka Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	22 deg
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	<0.5m @ 90 deg. (retained - damaged)
Access - fills:	two car parks with retaining walls - 1.0m @ 90 deg (retained-damaged)
House - cuts:	not accessible
House - fills:	not accessible
Water Tank - cuts:	not accessible
Water Tank - fills:	not accessible
Other - cuts:	minor cuts over site (H<0.5m)
Other - fills:	
additional comments:	Pole home, natural slope steepens to the south beyond the house debris
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Access Fill
Max height:	1.0m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining walls, resulting in loss of support at car park
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	25 Iluka Avenue
Location:	South side of road, downslope
Previous SSA:	August 2006 - Bruce Holoake and Partners
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	N/A
Access - fills:	0.6m @ 90 deg. (retained - damaged)
House - cuts:	not accessible - 2.0m (approx) @ 40 deg.
House - fills:	not accessible - fill observed at house
Water Tank - cuts:	not accessible - minor cut observed behind water tanks
Water Tank - fills:	not accessible - fill observed at water tanks
Other - cuts:	
Other - fills:	Path fill - 4.4m @ 35 deg.
additional comments:	minor cuts (<0.5m) over
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Path fill
Max height:	4.4m
Typical max batters:	35 deg.
Potential Hazard:	Failure of fill slope, resulting in slump undermining access path
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes - block to the west
Scenario No	2
Situation:	House Cut
Max height:	approx 2.0m
Typical max batters:	40 deg.
Potential Hazard:	Failure of unsupported soil in house cut
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	3
Situation:	Access Fill
Max height:	0.6m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind damaged retaining wall
Likelihood:	Almost Certain
Consequence:	Insignificant
Risk:	Moderate
Affects neighbour:	No
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	7 Karingal Drive
Location:	West side of road
Previous SSA:	N/A
Field work:	09-Mar-16
Access onto site:	No
Overall groundslope:	13 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	at road 1m XW clay overlying HW-XW highly fractured rock
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	max 3.0m @54 deg
Access - fills:	N/A
House - cuts:	about 1m @ 50 deg
House - fills:	about 1.5m @ (not measurable)
Water Tank - cuts:	N/A
Water Tank - fills:	about 2m @ (not measurable)
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Access Cut
Max height:	3m
Typical max batters:	54 deg
Potential Hazard:	failure of cut on to Karingal Drive
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes, Road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	9 Karingal Drive
Location:	West side of road, upslope
Previous SSA:	March 2013 - 2020 Engineering Solutions
Field work:	09-Mar-16
Access onto site:	No
Overall groundslope:	18 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	max 3.0m @54 deg
Access - fills:	max 1.3m @32 deg
House - cuts:	about 1m @ 50 deg
House - fills:	max 1.7m @ 37 deg
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Cut
Max height:	3.0m
Typical max batters:	54 deg
Potential Hazard:	failure of cut, leading to loss of some driveway area
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	
Scenario No	2
Situation:	Building Fill
Max height:	1.7m
Typical max batters:	37 deg
Potential Hazard:	Failure of building pad fill
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes, Might travel to 7 Karingal
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	12 Karingal Drive
Location:	South side of road, downslope
Previous SSA:	May 2013 - 2020 Engineering Solutions
Field work:	08-Mar-16
Access onto site:	Yes
Overall groundslope:	10 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	cuts in fill 1m @ 70 deg
Access - fills:	5m @ 40 deg
House - cuts:	
House - fills:	unknown fill dimensions due to access restrictions
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Access Fill
Max height:	5m
Typical max batters:	40 deg
Potential Hazard:	failure through slope and on to carport
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	13 Karingal Drive
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	09-Mar-16
Access onto site:	Yes
Overall groundslope:	25 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	residual clay overlying HW sandstone at 1.9m depth
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	max 3.0m @55 deg
Access - fills:	max 1.4m @40 deg
House - cuts:	max 3.1m @ 55 deg
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	unsupported gully on west of site (banks 1.4m @ 40 deg)
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Gully
Max height:	1.4
Typical max batters:	40 deg
Potential Hazard:	erosion and failure of gully banks
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	House Cut
Max height:	3.1m
Typical max batters:	55 deg
Potential Hazard:	failure of soil on top of cut, loose rocks falling
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	3
Situation:	Access Cut
Max height:	3m
Typical max batters:	60 deg
Potential Hazard:	failure of soil & rock cut on to car park & Karingal Drive
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	Yes, Road
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	18 Karingal Drive
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	09-Mar-16
Access onto site:	Yes
Overall groundslope:	25 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	1.6m @53 deg (in fill)
Access - fills:	3.1m @ 41 deg
House - cuts:	N/A
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	unable to locate house
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Cut
Max height:	1.6
Typical max batters:	53
Potential Hazard:	Failure through slope, including road verge
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	Yes, road
Scenario No	2
Situation:	Access Fill
Max height:	3.1m
Typical max batters:	43 deg
Potential Hazard:	Failure Through Fill
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	22 Karingal Drive
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	09-Mar-16
Access onto site:	No
Overall groundslope:	20 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	max 3.6m @ 40 deg (in fill) and 1.6m @ 90 deg (retaining wall)
Access - fills:	max 2.7m @ 38 deg
House - cuts:	~1m @ 60 deg
House - fills:	~1m @ 60 deg
Water Tank - cuts:	1.6m retaining wall
Water Tank - fills:	N/A
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Above driveway
Max height:	5.2m
Typical max batters:	40 deg (fill) and 90 deg (retaining wall)
Potential Hazard:	Failure through slope
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes, road
Scenario No	2
Situation:	
Max height:	2.7m
Typical max batters:	38 deg
Potential Hazard:	failure through fill
Likelihood:	likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	23 Karingal Drive
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	25 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	XW material over MW Siltstone
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	max 3m @ 50 deg
Access - fills:	1.3m @ 36 deg (fill) and 3m @ 63 deg (cut)
House - cuts:	0.5m @40 deg and 1.4m retaining wall, damaged
House - fills:	Negligible
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Cut
Max height:	3m
Typical max batters:	50 deg
Potential Hazard:	Failure through rock cut onto driveway
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	No
Scenario No	2
Situation:	Access Fill & Cut
Max height:	4.7m
Typical max batters:	36 deg (fill), 63 deg (cut)
Potential Hazard:	failure through slope onto Karingal drive
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	Yes - road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	24 Karingal Drive
Location:	East side of road, downslope
Previous SSA:	N/A
Field work:	09-Mar-16
Access onto site:	No
Overall groundslope:	26 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	
Access - fills:	max 3.6m @51 deg
House - cuts:	1.3m @ ? deg
House - fills:	at rear
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Fill
Max height:	3.6m
Typical max batters:	51 deg
Potential Hazard:	failure through car park area
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	
Scenario No	2
Situation:	Access Fill
Max height:	3.8m
Typical max batters:	42 deg
Potential Hazard:	failure of fill from road to driveway
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes - road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	25 Karingal Drive
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	08-Mar-16
Access onto site:	No
Overall groundslope:	25 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	Residual soil to XW overlying MW - HW siltstone
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	access through 23 Karingal Drive
Access - fills:	access through 23 Karingal Drive
House - cuts:	
House - fills:	
Water Tank - cuts:	
Water Tank - fills:	
Other - cuts:	2.1m @ 45 deg and 0.9m at 70 deg (HW siltstone)
Other - fills:	1.6m @ 40 deg
additional comments:	burn retaining wall, ~1m
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Other Cuts
Max height:	3.0m
Typical max batters:	45 deg (RS-XW), 70 deg (Siltstone)
Potential Hazard:	Failure through slope
Likelihood:	Unlikely
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	Yes, Road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	26 Karingal Drive
Location:	East side of road, downslope
Previous SSA:	N/A
Field work:	09-Mar-16
Access onto site:	No
Overall groundslope:	25 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	max 1.3m @45 deg
Access - fills:	max 2.6m @40 deg
House - cuts:	Negligible
House - fills:	Negligible
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	erosion on south side of site
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Access Fill
Max height:	2.6m
Typical max batters:	40 deg
Potential Hazard:	failure through drive way area, possible loss of access
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	30 Karingal Drive
Location:	South side of road, downslope
Previous SSA:	June 2001 - Bruce Holoake and Partners
Field work:	09-Mar-16
Access onto site:	No
Overall groundslope:	20 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	N/A
Access - fills:	max 2.0m (retained) & 1.7m @ 30 deg
House - cuts:	Negl.
House - fills:	Negl.
Water Tank - cuts:	Negl.
Water Tank - fills:	Negl.
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Access fill
Max height:	To 2.0m (retained)
Typical max batters:	90 deg.
Potential Hazard:	Failure of soil due to burnt out retaining walls
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	33 Karingal Drive
Location:	West side of road, upslope
Previous SSA:	N/A
Field work:	09-Mar-16
Access onto site:	No
Overall groundslope:	19 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	residual clay over XW material
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	
Access - fills:	3.4m @36 deg (fill) and 1.8m at 55 deg (cut of fill)
House - cuts:	1.9m @ 50 deg
House - fills:	2.0m @40 deg
Water Tank - cuts:	
Water Tank - fills:	~1.0m @ ~30 deg
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Access Cut
Max height:	1.5
Typical max batters:	65 deg
Potential Hazard:	failure through cut on driveway
Likelihood:	Likely
Consequence:	insignificant
Risk:	Low
Affects neighbour:	No
Scenario No	2
Situation:	
Max height:	5.2m
Typical max batters:	36 deg (fill) and 55 deg (cut)
Potential Hazard:	failure through cut and fill on Karingal Drive
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes, road
Scenario No	3
Situation:	
Max height:	1.9m
Typical max batters:	50 deg
Potential Hazard:	failure through building cut
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	no
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	34 Karingal Drive
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	09-Mar-16
Access onto site:	No
Overall groundslope:	23 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	N/A
Access - fills:	max 3.5m @37 deg
House - cuts:	Negl.
House - fills:	Negl.
Water Tank - cuts:	Negl.
Water Tank - fills:	Negl.
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Road Verge Fill
Max height:	3.5m
Typical max batters:	37 deg
Potential Hazard:	failure through fill and road verge
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	36 Karingal Drive
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	09-Mar-16
Access onto site:	No
Overall groundslope:	23 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	N/A
Access - fills:	max 3.2m @40 deg
House - cuts:	Negl.
House - fills:	Negl.
Water Tank - cuts:	Negl.
Water Tank - fills:	Negl.
Other - cuts:	
Other - fills:	
additional comments:	tension crack above burnt RW in driveway
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access fill
Max height:	1.9m (retained)
Typical max batters:	90 deg.
Potential Hazard:	Failure of soil due to burnt out retaining walls
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	2
Situation:	Access fill
Max height:	3.2m
Typical max batters:	40 deg.
Potential Hazard:	Failure of slope between road and driveway
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes, Road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	37 Karingal Drive
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	09-Mar-16
Access onto site:	Yes
Overall groundslope:	25 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	residual clay to XW material over HW Sandstone at 0.8m
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	2.5m @ 85 deg
Access - fills:	3.0m@40 deg (fill) and 1.8m@74 deg (cut) and 2.0m@40 deg (cut)
House - cuts:	
House - fills:	
Water Tank - cuts:	1.4m @60 deg
Water Tank - fills:	
Other - cuts:	
Other - fills:	
additional comments:	slope failure in fill slope on road
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Fill & Cut
Max height:	6.9m
Typical max batters:	41 deg
Potential Hazard:	failure through fill & nearby cut resulting in loss of driveway and road debris
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes, road
Scenario No	2
Situation:	Access Cut
Max height:	2.5m
Typical max batters:	85 deg
Potential Hazard:	failure of rock in cut
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	38 Karingal Drive
Location:	South side of Road, downslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	No
Overall groundslope:	20 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	residual clay
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	1.2m @ 70 deg
Access - fills:	1.3m @35 deg
House - cuts:	Negl
House - fills:	Negl
Water Tank - cuts:	
Water Tank - fills:	
Other - cuts:	
Other - fills:	
	1
additional comments:	1.8m high damaged retaining wall and tension crack in car port,
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Retaining Wall
Max height:	1.8m
Typical max batters:	90 deg
Potential Hazard:	failure through carport
Likelihood:	Almost Certain
Consequence:	Medium
Risk:	Very High
Affects neighbour:	No
Scenario No	2
Situation:	Access fill + cut
Max height:	2.5m
Typical max batters:	fill 35 deg, cut 70 deg
Potential Hazard:	failure from road verge
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	39 Karingal Drive
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	09-Mar-16
Access onto site:	No
Overall groundslope:	23 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	residual clay, XW clay at 1m depth, HW rock at 1.1m.
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	max 2.1m @65 deg
Access - fills:	max 6.7m @38 deg
House - cuts:	Negl.
House - fills:	Negl.
Water Tank - cuts:	not visible
Water Tank - fills:	not visible
Other - cuts:	
Other - fills:	
additional comments:	site features a series of criss-crossed logs for retention systems
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access fill
Max height:	6.7m
Typical max batters:	38 deg.
Potential Hazard:	Failure of soil from car park and on to road
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes, road
Scenario No	2
Situation:	Access cut at road
Max height:	2.1m
Typical max batters:	65 deg
Potential Hazard:	failure on to driveway
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	43 Karingal Drive
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	09-Mar-16
Access onto site:	No
Overall groundslope:	22 deg.
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	XW clay
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	max 1.4m @70 deg (in rock)
Access - fills:	max 2.0m @40 deg
House - cuts:	Negl.
House - fills:	max 1.5m (retained)
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Burnt retaining wall
Max height:	1.5m
Typical max batters:	90 deg
Potential Hazard:	Failure of previously retained soil
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	Access fill
Max height:	2.0m
Typical max batters:	40 deg
Potential Hazard:	failure on to the driveway
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	44 Karingal Drive
Location:	South side of Road, downslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	Yes
Overall groundslope:	25 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	sand, dense
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	1.3m @32 deg (in fill) and 0.3m (retaining wall) or 3.2m @30 deg
Access - fills:	max 1.2m at 25 deg and 0.8m (retaining wall)
House - cuts:	0.5m @ 60 deg or 1m @ 40 deg
House - fills:	
Water Tank - cuts:	unknown
Water Tank - fills:	
Other - cuts:	
Other - fills:	
additional comments:	0.8m retaining wall damaged
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Retaining wall
Max height:	0.8m
Typical max batters:	90 deg
Potential Hazard:	failure through carport
Likelihood:	Almost certain
Consequence:	Minor
Risk:	High
Affects neighbour:	
Scenario No	2
Situation:	Access cut
Max height:	3.2m
Typical max batters:	30 deg
Potential Hazard:	failure of cut
Likelihood:	Rare
Consequence:	Minor
Risk:	Very Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	46 Karingal Drive
Location:	South side of Road, downslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	No
Overall groundslope:	18 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	sand, dense
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	0.5m @14 deg (in fill) + 0.9m @29 deg (in fill) + 1.2m @55 deg (cut)
Access - fills:	3.2m @29 deg
House - cuts:	1.2m @53 deg
House - fills:	
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	old slip failure in existing driveway fill
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Failure through access cut
Max height:	2.6m
Typical max batters:	varies to 55 deg
Potential Hazard:	Failure through cut
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	48 Karingal Drive
Location:	South side of Road, downslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	No
Overall groundslope:	23 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	residual clay, hard
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	2m retaining wall, damaged
Access - fills:	1m @30 deg (fill) and 0.9m at 42 deg (cut)
House - cuts:	Negl.
House - fills:	Negl.
Water Tank - cuts:	0.3m retaining wall, damaged
Water Tank - fills:	
Other - cuts:	max 1.7m @ 51 deg
Other - fills:	
additional comments:	tension cracks along retaining wall in driveway, failure in cut on Koonya Ave boundary and timber retaining walls up to 1m damaged
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Failure through driveway
Max height:	2m
Typical max batters:	retaining wall, damaged
Potential Hazard:	Failure through driveway
Likelihood:	Almost Certain
Consequence:	Medium
Risk:	Very High
Affects neighbour:	
Scenario No	2
Situation:	Other Cuts
Max height:	1.2m
Typical max batters:	49 deg
Potential Hazard:	Failure through cut onto Koonya Ave
Likelihood:	Likely
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	50 Karingal Drive
Location:	South side of Road, downslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	Yes
Overall groundslope:	23 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	residual clay, hard
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	
Access - fills:	2.4m @ 31 deg
House - cuts:	Negl.
House - fills:	Negl.
Water Tank - cuts:	0.5m @ 70 deg
Water Tank - fills:	0.5m retaining wall, damaged
Other - cuts:	1.2m @49 deg
Other - fills:	
additional comments:	failure in cut on Koonya Ave boundary, timber retaining walls up to 1m damaged
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Other Cuts
Max height:	1.3m
Typical max batters:	49 deg
Potential Hazard:	Failure through cut onto Koonya Ave
Likelihood:	Likely
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	51 Karingal Drive
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	Yes
Overall groundslope:	24 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	silt subsoil overlying residual clay
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	1m Retaining wall - undamaged
Access - fills:	1.7m @45 deg (fill) + 1.7m @55 deg cut
House - cuts:	
House - fills:	max 1m @40 deg
Water Tank - cuts:	max 1m, concrete block lined at base
Water Tank - fills:	max 1m @40 deg
Other - cuts:	
Other - fills:	
additional comments:	failure exists in cut along road
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Access Fill
Max height:	3.4m
Typical max batters:	45 deg (fill) to 55 deg (cut)
Potential Hazard:	failure through cut and fill leading to road debris & loss of some driveway
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	52 Karingal Drive
Location:	South side of Road, downslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	Yes - Assessed as Unsafe
Overall groundslope:	15
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	residual clay, high plasticity, brown, hard
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	
Access - fills:	max 5.3m @ 30 deg
House - cuts:	
House - fills:	1.5m @ 32 deg
Water Tank - cuts:	1m @ 60 deg
Water Tank - fills:	
Other - cuts:	2.5m @ 50 deg
Other - fills:	1.34m @30 deg (fill) and 0.8m @ 30 deg (fill) and 1.7m @17 deg (natural) and 1m @ 40 deg (cut), all terraced along eastern side of property
additional comments:	two failures along Koonya Ave boundary
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Other Cuts
Max height:	2.5m
Typical max batters:	50 deg
Potential Hazard:	Failure through cut onto Koonya Ave
Likelihood:	Possible
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	55 Karingal Drive
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	No
Overall groundslope:	20 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	2.0m @ 70 deg
Access - fills:	max 4.3m @ 40 deg
House - cuts:	Unkown
House - fills:	Unkown
Water Tank - cuts:	unknown
Water Tank - fills:	~0.5m burnt retaining wall
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Access Cut
Max height:	2
Typical max batters:	70 deg
Potential Hazard:	Failure through cut leading to loss of access to driveway
Likelihood:	Likely
Consequence:	Insignificant
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	Water Tank Fill
Max height:	0.5m
Typical max batters:	90 deg
Potential Hazard:	failure through fill, damage to water tank
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	No
Scenario No	3
Situation:	
Max height:	4.3m
Typical max batters:	40 deg
Potential Hazard:	failure through fill onto road and No. 57
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes, road, No 57
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	57 Karingal Drive
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	Yes
Overall groundslope:	26 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	residual clay overlying XW material at toe of slope
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	1.75m @ 51 deg
Access - fills:	max 1.5m @ 37 deg
House - cuts:	
House - fills:	
Water Tank - cuts:	Concrete Retaining wall, unknown height
Water Tank - fills:	
Other - cuts:	
Other - fills:	
additional comments:	pipe/culvert extends out from the property under the road
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Cut
Max height:	1.75m
Typical max batters:	51 deg
Potential Hazard:	failure of cut leading to restriction of access to neighbours driveway
Likelihood:	Possible
Consequence:	Insignificant
Risk:	Medium
Affects neighbour:	Yes
Scenario No	2
Situation:	Access Fill
Max height:	1.5m
Typical max batters:	37 deg
Potential Hazard:	failure through fill undermining car park
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	59 Karingal Drive
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	No
Overall groundslope:	20 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	residual soil, hard
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	max 1.5m @47 deg
Access - fills:	max 2.0m @42 deg
House - cuts:	max 1m @ near 90 deg
House - fills:	
Water Tank - cuts:	Negl
Water Tank - fills:	Negl
Other - cuts:	
Other - fills:	
additional comments:	700mm damaged retaining wall
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Fill
Max height:	2
Typical max batters:	42 deg
Potential Hazard:	failure through fill, loss of access across road
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	
Scenario No	2
Situation:	Access Cut
Max height:	1.5m
Typical max batters:	47 deg
Potential Hazard:	failure of fill from cut to driveway
Likelihood:	Possible
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	61 Karingal Drive
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	Yes
Overall groundslope:	22 deg
On known landslide:	No
Drainage:	well drained
Exposed subsurface conditions:	dense sand overlying HW, moderate strength sandstone in toe of cuts
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	1.9m @ 35 deg (of fill) + 0.7m @ 20 deg (natural) + 1.3m @65 deg (cut)
Access - fills:	1m retaining wall (damaged), 1.2m @36 deg (fill), 0.5m @ 19 deg (natural) and 1.3m @ 60 deg (cut)
House - cuts:	Negl
House - fills:	Negl
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	small failure in access cut and larger failure on access fill
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Cut
Max height:	3.9m
Typical max batters:	35 deg in fill), 20 deg in natural and 65 deg in cut
Potential Hazard:	Failure through access cut, loss of access to driveway
Likelihood:	Likely
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	Yes, road
Scenario No	2
Situation:	Fill near house
Max height:	1.1
Typical max batters:	35 deg
Potential Hazard:	failure through fill
Likelihood:	Unlikely
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	1 Koonya Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	11-Mar
Access onto site:	No
Overall groundslope:	26 deg
On known landslide:	No
Drainage:	erosion channel beneath driveway entrance
Exposed subsurface conditions:	XW - HW Sandstone
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	max 2.3m @ 43 deg (fill)
Access - fills:	4.8m @ 42 deg. + 1.0m @90 deg. (retaining wall - damaged)
House - cuts:	Negl
House - fills:	Negl
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	N/A
Other - fills:	Driveway fill (likely in road reserve) 4.4m @ 47 deg.
additional comments:	Steep fill to south west of property
RISK TO PROPERTY	
No of scenarios:	3
Scenario No 1	
Situation:	Access Cut
Max height:	2.3m
Typical max batters:	43 deg
Potential Hazard:	Failure of cut causing slump onto driveway
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No 2	
Situation:	Access Fill
Max height:	5.8m
Typical max batters:	42-90 deg
Potential Hazard:	Failure of fill slope and unsupported soil behind damaged retaining wall causing partial loss of driveway
Likelihood:	Almost Certain
Consequence:	Medium
Risk:	Very High
Affects neighbour:	Yes - Road?
Scenario No 3	
Situation:	Driveway Fill
Max height:	4.4m
Typical max batters:	47 deg.
Potential Hazard:	Failure of fill slope, resulting in driveway being undermined
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes - Road reserve
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	see text

Site summary	
BASIC DATA	
Address:	2 Koonya Avenue
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	11-Mar
Access onto site:	No
Overall groundslope:	20 deg
On known landslide:	No
Drainage:	erosion channel west of water tanks
Exposed subsurface conditions:	Sandy Clay (XW) overlying HW Sandstone
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	N/A
Access - fills:	N/A
House - cuts:	
House - fills:	approx 0.7m @ 25 deg
Water Tank - cuts:	1.8m @ 57 deg
Water Tank - fills:	max approx 1m @ 30 deg
Other - cuts:	2.1 m@ 43 deg, 1.8m @ 52 deg, 2.4m @ 32 deg.
Other - fills:	
additional comments:	small failure observed in cut slope along western boundary road reserve
RISK TO PROPERTY	
No of scenarios:	3
Scenario No 1	
Situation:	Other Cuts
Max height:	2.1m
Typical max batters:	43 deg
Potential Hazard:	Failure of slope causing slump onto Koonya Ave
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes - Koonya Avenue
Scenario No 2	
Situation:	Water tank Cuts
Max height:	1.8m
Typical max batters:	57 deg
Potential Hazard:	failure of cut onto water tank
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No 3	
Situation:	Other Cut
Max height:	1.8m
Typical max batters:	52 deg.
Potential Hazard:	failure of cut slope forming a slump at Wallace Avenue
Likelihood:	Likely
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	Yes - Wallace Avenue
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	see text

Site summary	
BASIC DATA	
Address:	9 Koonya Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	11-Mar
Access onto site:	Yes
Overall groundslope:	18 deg
On known landslide:	No
Drainage:	
Exposed subsurface conditions:	Sandy Clay (XW) overlying L-M strength HW Sandstone
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	2.1m @ 85 deg, parts oversteep
Access - fills:	0.8m @ 52 deg (fill), 0.4m @ 70 deg (backscarp) and 2m @ 38 deg (failed slope)
House - cuts:	max 1m @ 70 deg
House - fills:	1m @ 35 deg
Water Tank - cuts:	
Water Tank - fills:	Septic - 1.2m @ 90 deg. (retained - damaged)
Other - cuts:	
Other - fills:	
additional comments:	Terraced area below house with 4 burnt retaining walls max 0.7m, possible failure on Access Fill
RISK TO PROPERTY	
No of scenarios:	4
Scenario No	1
Situation:	Access Cut
Max height:	2.1m
Typical max batters:	85 deg
Potential Hazard:	Failure through cut causing slump onto driveway
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	2
Situation:	Access Fill
Max height:	3.2m
Typical max batters:	38 to 70 deg
Potential Hazard:	Failure of slope forming a slump onto Koonya Ave and potentially undermining driveway
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes - Koonya Avenue
Scenario No	3
Situation:	Septic Fill
Max height:	1.2m
Typical max batters:	90 deg.
Potential Hazard:	Failure of unsupported soil behind septic retaining wall
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	4
Situation:	House Cut
Max height:	1.0m
Typical max batters:	70 deg.
Potential Hazard:	Failure of cut slope forming a slump behind the building
Likelihood:	Possible
Consequence:	Insignificant
Risk:	Low
Affects neighbour:	No
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	13 Koonya Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	11-Mar-16
Access onto site:	Yes
Overall groundslope:	22 deg
On known landslide:	No
Drainage:	
Exposed subsurface conditions:	Residual Clay, brown, overlying HW Sandstone
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	2m @ 35 deg (fill) + 2m @ 43 deg (cut)
Access - fills:	3m @ 51 deg
House - cuts:	max 4.1m @ 51 deg
House - fills:	Fill at top of House Cut
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	At Road - 2.8m @38 deg. (fill) + 1.7m @ 72-85 deg. (cut - scarp) + 1.7m @ 40 deg. (cut - slump)
additional comments:	2 minor failures at rear of property in house cut, 1 major failure in access fill 1.7m backscarp at 72-85
RISK TO PROPERTY	
No of scenarios:	4
Scenario No 1	
Situation:	Access Fill
Max height:	3m
Typical max batters:	51 deg
Potential Hazard:	Failure of slope causing slump onto Koonya Avenue, possible loss of part of driveway
Likelihood:	Almost Certain
Consequence:	Medium
Risk:	Very High
Affects neighbour:	Yes - Koonya Avenue
Scenario No 2	
Situation:	Access Cut/House Fill
Max height:	4m
Typical max batters:	35 deg (fill), 43 deg (cut)
Potential Hazard:	failure through slope causing slump onto driveway and loss of support from edge of building pad
Likelihood:	Possible
Consequence:	Medium
Risk:	Moderate
Affects neighbour:	No
Scenario No 3	
Situation:	House Cuts
Max height:	4.1m
Typical max batters:	51 deg
Potential Hazard:	Failure of slope causing slump
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No 4	
Situation:	At Road
Max height:	6.2m
Typical max batters:	38-85 deg.
Potential Hazard:	Failure of slope causing slump onto Koonya Avenue
Likelihood:	Almost Certain
Consequence:	Medium
Risk:	Very High
Affects neighbour:	Yes - Koonya Avenue
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	15 Koonya Avenue
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	11-Mar-16
Access onto site:	Yes
Overall groundslope:	Approx 20 deg
On known landslide:	No
Drainage:	
Exposed subsurface conditions:	Residual Clay overlying HW Sandstone
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	3.3m concrete retaining wall
Access - fills:	3m @51 deg
House - cuts:	max 1m @ 70-80 deg
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	3.5m @ 40 deg
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	3
Scenario No 1	
Situation:	Access Cut
Max height:	0.5m
Typical max batters:	90 deg
Potential Hazard:	Failure of backfill through damaged retaining wall
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No 2	
Situation:	Other Cut
Max height:	3.5m
Typical max batters:	40 deg
Potential Hazard:	failure of cut slope causing slump onto Koonya Avenue
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes, road
Scenario No 3	
Situation:	Access Fill
Max height:	3m
Typical max batters:	51 deg
Potential Hazard:	
Likelihood:	Almost Certain
Consequence:	Medium
Risk:	Very High
Affects neighbour:	no
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	see text

Site summary	
BASIC DATA	
Address:	17 Koonya Avenue
Location:	North Side of road, upslope
Previous SSA:	N/A
Field work:	11-Mar-16
Access onto site:	Yes
Overall groundslope:	Approx 20 deg
On known landslide:	No
Drainage:	
Exposed subsurface conditions:	Residual Clay overlying HW Sandstone
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	0.8m @ 70 deg
Access - fills:	2.6m @ 40 deg
House - cuts:	Negl
House - fills:	Negl
Water Tank - cuts:	N/A
Water Tank - fills:	2 x partially damaged timber retaining walls, 1m high at 1.7m spacing
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	large failure south down slope of driveway
RISK TO PROPERTY	
No of scenarios:	1
Scenario No 1	
Situation:	Access Fill
Max height:	2.6m
Typical max batters:	40 deg
Potential Hazard:	Fill situated above already failed slope, potential for further slumping of slope
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	see text

Site summary	
BASIC DATA	
Address:	5 Mitchell Grove
Location:	North of road, upslope
Previous SSA:	N/A
Field work:	03-Mar-16
Access onto site:	No - assessed as unsafe on site
Overall groundslope:	10 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Grey residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.5m @ 30 deg. (fill) + 1.0m @ 45 deg. (cobble lined slope)
Access - fills:	N/A
House - cuts:	N/A
House - fills:	approx 2.5m @ 32 deg.
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	Property located on a gentle ridge
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	House fill
Max height:	approx 2.5m
Typical max batters:	32 deg.
Potential Hazard:	Failure of fill slope resulting in slight undermine of building pad.
Likelihood:	Rare
Consequence:	Minor
Risk:	Very Low
Affects neighbour:	No
Scenario No	2
Situation:	Access Cut
Max height:	To 2.5m
Typical max batters:	30-45 deg.
Potential Hazard:	Failure of slope above driveway, forming a small slump on the access.
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	9 Mitchell Grove
Location:	North of road, upslope
Previous SSA:	N/A
Field work:	03-Mar-16
Access onto site:	Yes
Overall groundslope:	15-25 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	<1.0m @ 25 deg.
Access - fills:	negligible
House - cuts:	N/A
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	Property located on a gentle ridge
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Access cut
Max height:	<1.0m
Typical max batters:	25 deg.
Potential Hazard:	Failure of cut slope forming a small slump onto Mitchell Grove.
Likelihood:	Rare
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	10 Mitchell Grove
Location:	South of road, downslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	13 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Brown residual clay, stiff or better
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	2.5m @ 25 deg. (fill)
Access - fills:	1.5m @ 30 deg. (fill) + 1.0m @ 90 deg. (Cut - retained - damaged)
House - cuts:	2.0m @ 90 deg. (retained - destroyed)
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Fill
Max height:	2.5m
Typical max batters:	30-90 deg.
Potential Hazard:	Failure of soil behind damaged retaining wall, forming a small slump on the property
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	2
Situation:	House Cut
Max height:	2.0m
Typical max batters:	90 deg.
Potential Hazard:	Failure of soil behind damaged retaining wall, forming a slump on the building pad.
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	11 Mitchell Grove
Location:	North of road, upslope
Previous SSA:	N/A
Field work:	03-Mar-16
Access onto site:	Yes
Overall groundslope:	15-25 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Orange brown residual clay
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	negligible
Access - fills:	N/A
House - cuts:	N/A
House - fills:	4.0m @ 35 deg.
Water Tank - cuts:	2.0m @ 45 deg. (previously failed - slumping)
Water Tank - fills:	N/A
Other - cuts:	1.5m @ 90 deg. (retained) at eastern boundary
Other - fills:	
additional comments:	Property located on a gentle ridge
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Water tank cut
Max height:	2.0m
Typical max batters:	45 deg.
Potential Hazard:	Failure of cut slope forming a slump on the water tank pad
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	House fill
Max height:	4.0m
Typical max batters:	35 deg.
Potential Hazard:	Failure of fill slope undermining pad behind house
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	12 Mitchell Grove
Location:	West of road, downslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	10-18 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	
Access - fills:	3.2m @ 45 deg. (maybe completely within road reserve)
House - cuts:	not accessible - minor cuts observed
House - fills:	not accessible
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	
Other - fills:	1.7m @ 60 deg. (stone covered slope)
additional comments:	minor failure has occurred between road and driveway
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Fill
Max height:	3.2m
Typical max batters:	45 deg.
Potential Hazard:	Failure of fill slope between Mitchell Grove and driveway, forming a slump on the access road and
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes - Mitchell Grove
Scenario No	2
Situation:	Other Fill
Max height:	To 1.7m
Typical max batters:	60 deg.
Potential Hazard:	Failure of stone covered sill slope, forming a slump on the property.
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	14 Mitchell Grove
Location:	West of road, downslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No
Overall groundslope:	approx 20 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	
Access - fills:	3.5m @ 45 deg
House - cuts:	not accessible
House - fills:	not accessible - fill observed at building pad
Water Tank - cuts:	not accessible - approx 4.0m @ 30 deg.
Water Tank - fills:	not accessible
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Fill
Max height:	3.5m
Typical max batters:	45 deg.
Potential Hazard:	Failure of fill slope between Mitchell Grove and driveway, forming a slump on the access and
Likelihood:	Possible
Consequence:	Medium
Risk:	Moderate
Affects neighbour:	Yes - Mitchell Grove
Scenario No	2
Situation:	Access Fill (beneath driveway)
Max height:	unknown
Typical max batters:	unknown
Potential Hazard:	Failure of stone covered fill slope, forming a small slump on the property.
Likelihood:	
Consequence:	
Risk:	unknown
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	15 Mitchell Grove
Location:	East of road, upslope
Previous SSA:	N/A
Field work:	03-Mar-16
Access onto site:	Yes
Overall groundslope:	approx 20 deg.
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Brown residual clay, very stiff
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	2.7m @ 45 deg. (at road cut)
Access - fills:	N/A
House - cuts:	4.0m @ 30 deg.
House - fills:	approx 1.5-2.0m @35 deg.
Water Tank - cuts:	not measured
Water Tank - fills:	not measured
Other - cuts:	
Other - fills:	Building fill to driveway cut (approx) - 1.5-2.0m @35 deg. + 1.0m @ 20 deg. + 2.0m @ 45 deg.
additional comments:	
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	House Fill
Max height:	approx 1.5-2.0m
Typical max batters:	35 deg.
Potential Hazard:	Failure of fill slope beneath building pad, forming a small slump on the property and possibly
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	No
Scenario No	2
Situation:	Building Cut
Max height:	4.0m
Typical max batters:	30 deg.
Potential Hazard:	Failure of cut slope behind building, forming a small slump behind the building.
Likelihood:	Rare
Consequence:	Minor
Risk:	Very Low
Affects neighbour:	No
Scenario No	3
Situation:	Access Cut
Max height:	2.7m
Typical max batters:	45 deg.
Potential Hazard:	Failure of cut slope along Mitchell Grove, forming a slump on the road
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes - Mitchell Grove
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	17 Mitchell Grove
Location:	East of road, upslope
Previous SSA:	N/A
Field work:	03-Mar-16
Access onto site:	No
Overall groundslope:	
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	1.2m @ 90 deg. (retained - damaged)
Access - fills:	N/A
House - cuts:	not accessible - approx 3.0m @ 40-45 deg. + 2.0m @80-90 deg. (retained - damaged)
House - fills:	not accessible - approx 2.0-3.0m @ 40 deg.
Water Tank - cuts:	on house pad
Water Tank - fills:	on house pad
Other - cuts:	
Other - fills:	
additional comments:	
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Building Cut
Max height:	To 5.0m (approx)
Typical max batters:	40-90 deg.
Potential Hazard:	Failure of cut slope behind damaged retaining wall, forming a moderate slump on the building pad.
Likelihood:	Almost Certain
Consequence:	Major
Risk:	Very High
Affects neighbour:	yes, 15 Mitchell is upslope
Scenario No	2
Situation:	Access cut
Max height:	1.2m
Typical max batters:	90 deg.
Potential Hazard:	Failure of soil behind damaged retaining wall, forming a small slump in the driveway.
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	3
Situation:	House Fill
Max height:	2.0-3.0m
Typical max batters:	40 deg.
Potential Hazard:	Failure of fill slope beneath building pad, undermining a small portion of the building pad.
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	10 Olive Street
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	04-Mar-16
Access onto site:	No, viewing also very restricted
Overall groundslope:	not measured
On known landslide:	no
Drainage:	well drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not observed
Cuts and fills:	
Access - cuts:	not accessible - 2.0m @ 60 deg. (approx, Olive Street cut)
Access - fills:	not accessible - approx 30 deg.
House - cuts:	not accessible
House - fills:	not accessible - 2.0m @ 35 deg. (approx)
Water Tank - cuts:	not accessible
Water Tank - fills:	not accessible
Other - cuts:	
Other - fills:	shed fill - not accessible - 2.0m @ 35 deg. (approx)
additional comments:	access and site viewing very limited, therefore limited assessment completed only
RISK TO PROPERTY	
No of scenarios:	2
Scenario No 1	
Situation:	Access Cut (Olive Street) / Access Fill
Max height:	not accessible - >2.0m
Typical max batters:	30-60 deg.
Potential Hazard:	Failure of slope between driveway and Olive Grove, forming a small slump on the road and undermining a portion of the driveway.
Likelihood:	Possible
Consequence:	Minor to Insignificant
Risk:	Moderate to Very Low
Affects neighbour:	Yes - Olive Street
Scenario No 2	
Situation:	Shed Fill
Max height:	not accessible - >2.0m
Typical max batters:	35 deg. Approx
Potential Hazard:	Failure of slope between shed fill and driveway, forming a small slump in driveway and potentially undermining part of the shed pad.
Likelihood:	Possible
Consequence:	Minor to Insignificant
Risk:	Very Low to Moderate
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	31 Riverside Drive
Location:	South side of road, downslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	No
Overall groundslope:	35 deg
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	unknown
Evidence of groundwater:	Not Observed
Cuts and fills:	
Access - cuts:	0.3m retaining wall, burnt
Access - fills:	max 4.3m @ 45 deg
House - cuts:	Negl.
House - fills:	Negl.
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	Negl.
Other - fills:	1.45m @ 30 deg
additional comments:	
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Other Fill
Max height:	1.3m
Typical max batters:	30 deg
Potential Hazard:	
Likelihood:	Unlikely
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	No
Scenario No	2
Situation:	Access Fill
Max height:	4.3m
Typical max batters:	45 deg
Potential Hazard:	
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	36 Riverside Drive
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	No - Poor visibility, limited assessment only
Overall groundslope:	30 deg
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	unknown
Evidence of groundwater:	Not Observed
Cuts and fills:	
Access - cuts:	unknown
Access - fills:	unknown
House - cuts:	unknown
House - fills:	unknown
Water Tank - cuts:	unknown
Water Tank - fills:	unknown
Other - cuts:	timber retaining walls, burnt
Other - fills:	unknown
additional comments:	failure along Riverside Drive boundary, backscarp 2m @ 82 deg, collapse is 4m @ 38 deg
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Riverside Drive Boundary Failure
Max height:	8m
Typical max batters:	42 deg
Potential Hazard:	Further failure of slope
Likelihood:	Possible
Consequence:	Medium
Risk:	Moderate
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	40 Riverside Drive
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	No - Poor visibility, limited assessment only
Overall groundslope:	Not Measured
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	Moderately weathered siltstone and sandstone
Evidence of groundwater:	Not Observed
Cuts and fills:	
Access - cuts:	unknown
Access - fills:	unknown
House - cuts:	unknown
House - fills:	unknown
Water Tank - cuts:	unknown
Water Tank - fills:	unknown
Other - cuts:	timber retaining walls, burnt
Other - fills:	unknown
additional comments:	failure along Riverside Drive boundary, backscarp 3m @ 65 deg, collapse is 2m @ 38 deg, exposed moderately weathered siltstone and sandstone
RISK TO PROPERTY	
No of scenarios:	1
Scenario No	1
Situation:	Riverside Drive Boundary Failure
Max height:	8m
Typical max batters:	65 deg
Potential Hazard:	Further failure of slope
Likelihood:	Possible
Consequence:	Medium
Risk:	Moderate
Affects neighbour:	Yes, road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	42 Riverside Drive
Location:	East side of road, upslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	No - Poor visibility, limited assessment only
Overall groundslope:	Not Measured
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	
Evidence of groundwater:	Not Observed
Cuts and fills:	
Access - cuts:	2m @ 42 deg (fill) and 1.2m (retaining wall, burnt)
Access - fills:	1m @ 70 deg (fill), 3.3m @ 41 deg (natural) and 2m @ 38 deg (in failure)
House - cuts:	unknown
House - fills:	unknown
Water Tank - cuts:	unknown
Water Tank - fills:	unknown
Other - cuts:	unknown cuts from 44 Riverside Drive
Other - fills:	unknown
additional comments:	multiple failures along Riverside Drive boundary, small lumping failures along slope above existing failures at the road cuts
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Cut
Max height:	3.2m
Typical max batters:	42 deg (fill), 90 deg (retaining wall)
Potential Hazard:	failure through Access cut blocking driveway
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	Access Fill
Max height:	7.5m
Typical max batters:	41 deg (natural), 70 deg (fill)
Potential Hazard:	Failure through access fill onto Riverside drive, potential loss to part of driveway
Likelihood:	Possible
Consequence:	Medium
Risk:	Moderate
Affects neighbour:	Yes, Road
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	43 Riverside Drive
Location:	West side of road, downslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	Yes
Overall groundslope:	35 deg
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	XW material over low strength Sandstone
Evidence of groundwater:	Not Observed
Cuts and fills:	
Access - cuts:	max 1.5m @ 35 deg and 1.3m retaining wall (damaged)
Access - fills:	max 2.5m @ 40 deg
House - cuts:	1.5m timber retaining walls, burnt
House - fills:	
Water Tank - cuts:	
Water Tank - fills:	
Other - cuts:	
Other - fills:	
additional comments:	erosion channel along northern boundary of property
RISK TO PROPERTY	
No of scenarios:	2
Scenario No	1
Situation:	Access Fill
Max height:	2.5m
Typical max batters:	40 deg
Potential Hazard:	failure through slope and loss of part of driveway onto second access driveway
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	No
Scenario No	2
Situation:	Access fill/ House Fill
Max height:	Up to 1.5m
Typical max batters:	90 deg (retaining wall)
Potential Hazard:	Failure through access fill onto driveway
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	44 Riverside Drive
Location:	East side of road, upslope
Previous SSA:	April 2013 - Saunders Consulting Group Pty Ltd
Field work:	10-Mar-16
Access onto site:	Yes
Overall groundslope:	Not Measured
On known landslide:	No
Drainage:	Well Drained
Exposed subsurface conditions:	0.15m topsoil, 0.5m colluvium - gravelly clay, 1.4m XW material, HW low strength Siltstone
Evidence of groundwater:	Not Observed
Cuts and fills:	
Access - cuts:	max 1.6m - 2.0m @ 66 deg
Access - fills:	N/A
House - cuts:	
House - fills:	
Water Tank - cuts:	1m @ `90 deg
Water Tank - fills:	
Other - cuts:	
Other - fills:	4.7m @ 40 deg
additional comments:	small failure in driveway cut and failure along Riverside Drive, 3 backscars, total of 1.6m high
RISK TO PROPERTY	
No of scenarios:	2
Scenario No 1	
Situation:	Other Fill
Max height:	4.7m
Typical max batters:	40 deg
Potential Hazard:	failure through fill slope placing debris on Riverside Drive
Likelihood:	Likely
Consequence:	Medium
Risk:	High
Affects neighbour:	Yes, road
Scenario No 2	
Situation:	Access Cut
Max height:	up to 2m
Typical max batters:	66 deg
Potential Hazard:	failure of rock blocks on other sites access cut
Likelihood:	Unlikely
Consequence:	Minor
Risk:	Low
Affects neighbour:	yes, access to other sites
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	see text

Site summary	
BASIC DATA	
Address:	3 Wallace Street
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	10-Mar-16
Access onto site:	Yes
Overall groundslope:	22 deg
On known landslide:	No
Drainage:	
Exposed subsurface conditions:	Sandy Clay (XW) overlying HW Sandstone
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	2.4m @ 68 deg
Access - fills:	max 1.4m @34 deg (fill) + 0.5m @ 70 deg (cut) + 1.7m (retaining wall)
House - cuts:	1.6m @ 50 deg
House - fills:	0.5m @ 30 deg
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	1.5m @ 50 deg
Other - fills:	N/A
additional comments:	Other Cut is possible failure
RISK TO PROPERTY	
No of scenarios:	3
Scenario No 1	
Situation:	Access Fill
Max height:	2.6m
Typical max batters:	30 deg (fill), 50 deg (cut) 0.7m (retaining wall)
Potential Hazard:	Failure of slope through burnt out retaining wall onto driveway
Likelihood:	Almost Certain
Consequence:	Minor
Risk:	High
Affects neighbour:	No
Scenario No 2	
Situation:	Other Cuts
Max height:	1.5m
Typical max batters:	50 deg
Potential Hazard:	Failure of slope onto back of property
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No 3	
Situation:	Access Cut
Max height:	2.4m
Typical max batters:	68 deg
Potential Hazard:	Failure through XW material in top 0.5m of slope
Likelihood:	Unlikely
Consequence:	Insignificant
Risk:	Very Low
Affects neighbour:	Yes, Road
RISK TO LIFE	see text

Site summary	
BASIC DATA	
Address:	5 Wallace Street
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	11-Mar-16
Access onto site:	No
Overall groundslope:	25 deg
On known landslide:	No
Drainage:	
Exposed subsurface conditions:	Sandy Clay (XW) overlying HW Sandstone
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	1.4m @34 deg (fill), 0.5m @ 70 deg (cut) 1.7m (retaining wall)
Access - fills:	1.5m @ 28 deg
House - cuts:	N/A
House - fills:	N/A
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	N/A
Other - fills:	N/A
additional comments:	timber retaining walls up to 2.5m line the driveway and back of the property, all undamaged
RISK TO PROPERTY	
No of scenarios:	0
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
Scenario No	
Situation:	
Max height:	
Typical max batters:	
Potential Hazard:	
Likelihood:	
Consequence:	
Risk:	
Affects neighbour:	
RISK TO LIFE	
	see text

Site summary	
BASIC DATA	
Address:	6 The Boulevard
Location:	North side of road, upslope
Previous SSA:	N/A
Field work:	11-Mar-16
Access onto site:	No
Overall groundslope:	25 deg
On known landslide:	No
Drainage:	
Exposed subsurface conditions:	residual Sandy Clay, overlying XW material
Evidence of groundwater:	N/A
Cuts and fills:	
Access - cuts:	max 2.6m @ 50 deg
Access - fills:	max 1m @ 35 deg (fill) + 2m @ 52 deg (cut)
House - cuts:	Negl
House - fills:	Negl
Water Tank - cuts:	N/A
Water Tank - fills:	N/A
Other - cuts:	1m @ 60 deg
Other - fills:	N/A
additional comments:	
RISK TO PROPERTY	
No of scenarios:	3
Scenario No	1
Situation:	Access Cut
Max height:	2.6
Typical max batters:	50
Potential Hazard:	failure of cut onto driveway
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	2
Situation:	Access Cut
Max height:	3.6m
Typical max batters:	36 deg (fill), 60 deg (cut)
Potential Hazard:	Failure of slope onto driveway
Likelihood:	Likely
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	No
Scenario No	3
Situation:	Access Fill
Max height:	3m
Typical max batters:	35 deg (fill), 52 deg (cut)
Potential Hazard:	Failure of slope causing slump onto The Boulevard
Likelihood:	Possible
Consequence:	Minor
Risk:	Moderate
Affects neighbour:	Yes, Road
RISK TO LIFE	see text

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Appendix C – Copy of Appendix C from AGS 2007

Also includes a copy of Coffey document 'Important Information about AGS 2007 Appendix C'

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PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: LANDSLIDE RISK ASSESSMENT

QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

QUALITATIVE MEASURES OF LIKELIHOOD

Approximate Annual Probability		Implied Indicative Landslide Recurrence Interval	Description	Descriptor	Level	
Indicative Value	Notional Boundary					
10 ⁻¹	5x10 ⁻²	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10 ⁻²		100 years		The event will probably occur under adverse conditions over the design life.	LIKELY	B
10 ⁻³	5x10 ⁻³	1000 years	200 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10 ⁻⁴	5x10 ⁻⁴	10,000 years	2000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10 ⁻⁵	5x10 ⁻⁵	100,000 years	20,000 years	The event is conceivable but only under exceptional circumstances over the design life.	RARE	E
10 ⁻⁶	5x10 ⁻⁶	1,000,000 years	200,000 years	The event is inconceivable or fanciful over the design life.	BARELY CREDIBLE	F

Note: (1) The table should be used from left to right; use Approximate Annual Probability or Description to assign Descriptor, not *vice versa*.

QUALITATIVE MEASURES OF CONSEQUENCES TO PROPERTY

Approximate Cost of Damage		Description	Descriptor	Level
Indicative Value	Notional Boundary			
200%	100%	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequence damage.	CATASTROPHIC	1
60%		Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequence damage.	MAJOR	2
20%	40%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequence damage.	MEDIUM	3
5%	10%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	MINOR	4
0.5%	1%	Little damage. (Note for high probability event (Almost Certain), this category may be subdivided at a notional boundary of 0.1%. See Risk Matrix.)	INSIGNIFICANT	5

- Notes:** (2) The Approximate Cost of Damage is expressed as a percentage of market value, being the cost of the improved value of the unaffected property which includes the land plus the unaffected structures.
- (3) The Approximate Cost is to be an estimate of the direct cost of the damage, such as the cost of reinstatement of the damaged portion of the property (land plus structures), stabilisation works required to render the site to tolerable risk level for the landslide which has occurred and professional design fees, and consequential costs such as legal fees, temporary accommodation. It does not include additional stabilisation works to address other landslides which may affect the property.
- (4) The table should be used from left to right; use Approximate Cost of Damage or Description to assign Descriptor, not *vice versa*

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: – QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY (CONTINUED)

QUALITATIVE RISK ANALYSIS MATRIX – LEVEL OF RISK TO PROPERTY

LIKELIHOOD		CONSEQUENCES TO PROPERTY (With Indicative Approximate Cost of Damage)				
	Indicative Value of Approximate Annual Probability	1: CATASTROPHIC 200%	2: MAJOR 60%	3: MEDIUM 20%	4: MINOR 5%	5: INSIGNIFICANT 0.5%
A – ALMOST CERTAIN	10 ⁻¹	VH	VH	VH	H	M or L (5)
B - LIKELY	10 ⁻²	VH	VH	H	M	L
C - POSSIBLE	10 ⁻³	VH	H	M	M	VL
D - UNLIKELY	10 ⁻⁴	H	M	L	L	VL
E - RARE	10 ⁻⁵	M	L	L	VL	VL
F - BARELY CREDIBLE	10 ⁻⁶	L	VL	VL	VL	VL

Notes: (5) For Cell A5, may be subdivided such that a consequence of less than 0.1% is Low Risk.

(6) When considering a risk assessment it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

RISK LEVEL IMPLICATIONS

Risk Level		Example Implications (7)
VH	VERY HIGH RISK	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 value of the property.
H	HIGH RISK	Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.
M	MODERATE RISK	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 practicable.
L	LOW RISK	Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.
VL	VERY LOW RISK	Acceptable. Manage by normal slope maintenance procedures.

Note: (7) The implications for a particular situation are to be determined by all parties to the risk assessment and may depend on the nature of the property at risk; these are only given as a general guide.



Landslide Risk Management

Important Information about AGS 2007 Appendix C (1 of 2)

INTRODUCTION

This sheet provides important information on the following Appendix C which has been copied from "Practice note guidelines for landslide risk management 2007". The "Practice Note" and accompanying "Commentary" (References 1 & 2, hereafter referred to as AGS2007) are part of a series of documents on landslide risk management prepared on behalf of, and endorsed by, the Australian Geomechanics Society. These documents were primarily prepared to apply to residential or similar development.

It should be noted that AGS2007 define landslides as "the movement of a mass of rock, debris or earth down a slope". This definition includes falls, topples, slides, spreads and flows from both natural and artificial slopes.

LANDSLIDE LIKELIHOOD ASSESSMENT

The assessment of the likelihood of landsliding requires evidence-based judgements.

Judging how often and how much an existing landslide will move is difficult. Judging the likelihood of a new landslide occurring is even harder. Records of past landslides can provide some information on what has happened, but are invariably incomplete and often provide little or no guidance on less frequent events that may occur. Often judgements have to be made about the likelihood of infrequent events with serious consequences, with little or no help from historical records. Slope models, which reflect evidence-based knowledge of how a slope was formed, how it behaved in the past and how it might behave in the future, are used to support judgements about what might happen. Because of the difficulties in assessing landslide likelihood, different assessors may make different judgements when presented with the same information.

The likelihood terms in Appendix C can be taken to imply that it is possible to distinguish between low probability events (e.g. between events having a probability of 1 in 10,000 and 1 in 100,000). In many circumstances it will not be possible to develop defensibly realistic judgements to do so, and so joint terms need to be used (e.g. Likely or Possible). For further discussion on landslide likelihood and other matters see References 3, 4 and 5.

CONSEQUENCES OF LANDSLIDES

There can be direct (e.g. property damage, injury / loss of life) and indirect (e.g. litigation, loss of business confidence) consequences of a landslide. The assessment of the importance (seriousness) of the consequences is a value judgement best made by those most affected (e.g. client, owner, regulator, public). The main role of the expert is usually to understand and explain what and who might be affected, and what damage or injury might occur.

Appendix C implies that we can anticipate total cost (direct and indirect) of landslide damage to about half an order of magnitude (e.g. the difference between \$30,000 and \$100,000). This involves predicting the location, size, travel distance and speed of a landslide, the response of a building (often before it has been built), the nature and the extent of damage, repair costs as well as indirect consequences such as legal costs, accommodation etc. There can be other direct and indirect consequences of a landslide which can be difficult to anticipate, let alone quantify and cost. The situation is analogous to the cost of work place accidents where the hidden costs can range from less than one to more than 20 times the visible direct costs (Reference 5).

In many circumstances it will not be possible to develop defensibly realistic judgements to enable use of a single consequence descriptor from Appendix C, and so joint terms need to be used (e.g. Minor or Medium). In our experience, explicit descriptions of potential consequences (e.g. rocks up to 0.5m across may fall on a parked car) help those affected to make their own judgements about the seriousness of the consequences.

RISK MATRIX

The main purpose of a risk matrix is to help rank risks, set priorities and help the decision making process. The risk terms should be regarded only as a guide to the relative level of risk as they are the product of an evidence-based quantitative judgement of likelihood and a value judgement about consequences, both of which involve considerable uncertainty. Different assessors may arrive at different judgements on the risk level.

Using Appendix C, many existing houses on sloping land will be assessed to have a Moderate Risk.



Landslide Risk Management

Important Information about AGS 2007 Appendix C (2 of 2)

RISK LEVEL IMPLICATIONS

In general, it is the responsibility of the client and/or owner and/or regulatory authority and/or others who may be affected to decide whether to accept or treat the risk. The risk assessor and/or other advisers may assist by making risk comparisons, discussing treatment options, explaining the risk management process, advising how others have reacted to risk in similar situations, and making recommendations. Attitudes to risk vary widely and risk evaluation often involves considering more than just property damage (e.g. environmental effects, public reaction, political consequences, business confidence etc).

The risk level implications in Appendix C represent a very specific example and are unlikely to be generally applicable. In our experience the typical response of regulators to assessed risk is as follows:

Assessed risk	Typical response of client/ owner/ regulator/ person affected
Very High, High ¹	Treats seriously. Usually requires action to reduce risk. Will generally avoid development.
Moderate	May accept risk. Usually looks for ways to reduce risk if reasonably practicable.
Low, Very Low ¹	Usually regards risk as acceptable. May reduce risk if reasonably practicable.

¹ The distinctions between Very High and High and between Low and Very Low risks are usually used to help set priorities.

REFERENCES

1. AGS (2007). "Practice note guidelines for landslide risk management 2007". Australian Geomechanics, Vol. 42, No. 1, pp 63-114.
2. AGS (2007). "Commentary on practice note guidelines for landslide risk management 2007". Australian Geomechanics, Vol. 42, No. 1, pp 115-158.
3. Baynes, F.J., Lee I.K. and Stewart, I.E., (2002). "A study of the accuracy and precision of some landslide risk analyses." Australian Geomechanics, Vol. 37, No. 2, pp 149-156.
4. Baynes, et. al., (2007). "Concerns about the Practice Note Guidelines for Landslide Risk Management 2007." Letter to the editor, Australian Geomechanics, Vol. 2, No. 4, pp 63-114.
5. Moon, A.T., and Wilson, R.A., (2004). "Will it happen? – Quantitative judgements of landslide likelihood". Proceedings of the Australia New Zealand conference on Geomechanics, Centre of continuing education, University of Auckland, Vol. 2, pp 754-760.

**Appendix D - Copy of Appendix G from AGS 2007
'Good Hillside Practice'**

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PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX G - SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

GOOD ENGINEERING PRACTICE

POOR ENGINEERING PRACTICE

ADVICE

GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical practitioner at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
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PLANNING

SITE PLANNING	Having obtained geotechnical advice, plan the development with the risk arising from the identified hazards and consequences in mind.	Plan development without regard for the Risk.
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DESIGN AND CONSTRUCTION

HOUSE DESIGN	Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING	Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS	Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	Retain natural contours wherever possible.	Indiscriminatory bulk earthworks.
CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements
FILLS	Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use clean fill materials and compact to engineering standards. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill, which if it fails, may flow a considerable distance including onto property below. Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc in fill.
ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may have unacceptable risk. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS	Engineer design to resist applied soil and water forces. Found on rock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut/fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOOTINGS	Found within rock where practicable. Use rows of piers or strip footings oriented up and down slope. Design for lateral creep pressures if necessary. Backfill footing excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS	Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE		
SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide general falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to dissipate energy at changes of slope and/or direction.	Discharge at top of fills and cuts. Allow water to pond on bench areas.
SUBSURFACE	Provide filter around subsurface drain. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	Discharge roof runoff into absorption trenches.
SEPTIC & SULLAGE	Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some areas if risk is acceptable. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes. Use absorption trenches without consideration of landslide risk.
EROSION CONTROL & LANDSCAPING	Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.

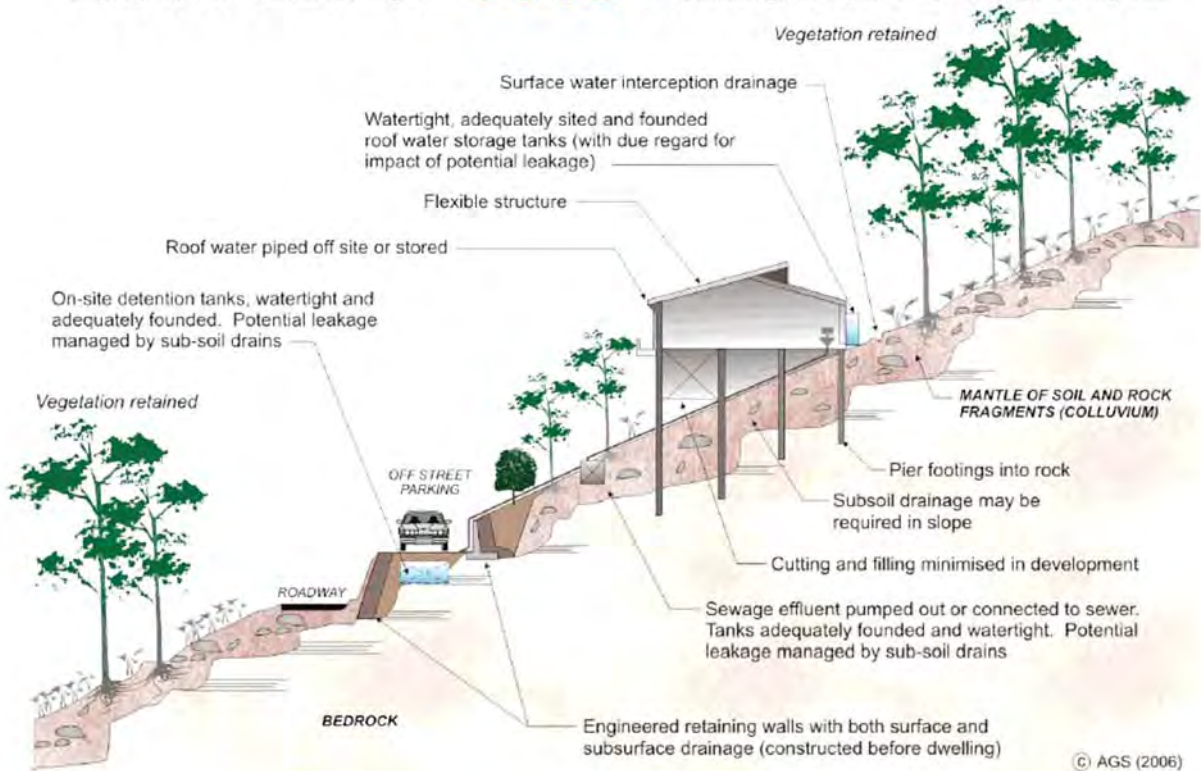
DRAWINGS AND SITE VISITS DURING CONSTRUCTION

DRAWINGS	Building Application drawings should be viewed by geotechnical consultant	
SITE VISITS	Site Visits by consultant may be appropriate during construction/	

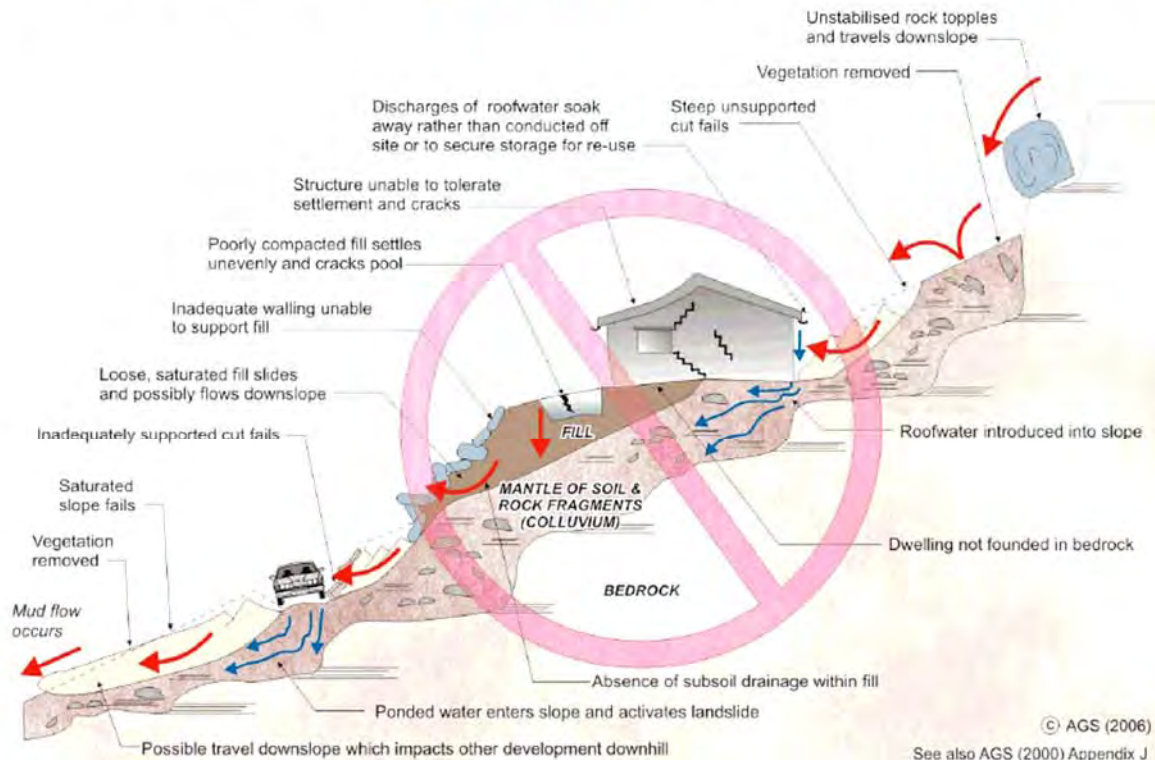
INSPECTION AND MAINTENANCE BY OWNER

OWNER'S RESPONSIBILITY	Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident see advice. If seepage observed, determine causes or seek advice on consequences.	
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EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE



Appendix E – Risk to life calculations

Landslide hazard	Fill failure
Likely initiating circumstances	Heavy rainstorm
Size of failure	Small to very small
Velocity of failure	Very rapid
Judged recurrence interval of triggering event	1 in 30 years
Annual probability of landslide, R(h)	0.03
Number of people on or immediate adjacent to landslide or in part of house affected	1
Spatial impact by the hazard given the event and taking into account travel distance, R(s:h)	0.1
Temporal probability of persons present given the spatial impact, R(t:s)	0.1
Probability of death or serious injury to an individual given the impact, V(d:t)	0.05
Risk, R(di) = annual probability of death of an individual	2×10^{-5}
Notes For loss of life, the individual risk can be calculated as $R(di) = R(h) \times R(s:h) \times R(t:s) \times V(d:t)$.	