

**GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1 – To be submitted with Development Application**

Development Application for D & J Suttie
Name of Applicant

Address of site 67 Florence Terrace, Scotland Island

Declaration made by geotechnical engineer or engineering geologist or coastal engineer (where applicable) as part of a geotechnical report

I, Peter Thompson on behalf of Hodgson Consulting Engineers Pty Ltd
(insert name) (Trading or Company Name)

on this the 10th September, 2019 certify that I am a geotechnical engineer or engineering geologist or coastal engineer as defined by the Geotechnical Risk Management Policy for Pittwater - 2009 and I am authorised by the above organisation/company to issue this document and to certify that the organisation/company has a current professional indemnity policy of at least \$2million.

Please mark appropriate box

- ☒ Prepared the detailed Geotechnical Report referenced below in accordance with the Australia Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009
- ☒ I am willing to technically verify that the detailed Geotechnical Report referenced below has been prepared in accordance with the Australian Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009
- ☐ Have examined the site and the proposed development in detail and have carried out a risk assessment in accordance with paragraph 6.0 of the Geotechnical Risk Management Policy for Pittwater - 2009. I confirm the results of the risk assessment for the proposed development are in compliance with the Geotechnical Risk Management Policy for Pittwater - 2009 and further detailed geotechnical reporting is not required for the subject site.
- ☐ Have examined the site and the proposed development/alteration in detail and am of the opinion that the Development Application only involves Minor Development/Alterations that do not require a Detailed Geotechnical Risk Assessment and hence my report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements for Minor Development/Alterations.
- ☐ Have examined the site and the proposed development/alteration is separate form and not affected by a Geotechnical Hazard and does not require a Geotechnical report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements
- ☐ Provided the coastal process and coastal forces analysis for inclusion in the Geotechnical Report

Geotechnical Report Details:

Report Title: RISK ANALYSIS & MANAGEMENT FOR PROPOSED BOAT SHED AND SKID RAMP AT 67 FLORENCE TERRACE, SCOTLAND ISLAND- PX 00007

Report Date: 10th September, 2019

Author : GARTH HODGSON, REVIEWED PETER THOMPSON

Author's Company/Organisation : HODGSON CONSULTING ENGINEERS PTY LTD

Documentation which relate to or are relied upon in report preparation:

Architectural drawings prepared by Stephen Crosby & Associates, Drawing Nos: 2069-DA -01 to 02, dated February, 2019.

I am aware that the above Geotechnical Report, prepared for the abovementioned site is to be submitted in support of a Development Application for this site and will be relied on by Pittwater Council as the basis for ensuring that the Geotechnical Risk Management aspects of the proposed development have been adequately addressed to achieve an "Acceptable Risk Management" level for the life of the structure, taken as at least 100 years unless otherwise stated and justified in the Report and that reasonable and practical measures have been identified to remove foreseeable risk.

Signature



Name Peter Thompson

Chartered Professional Status MIE Aust CPEng

Membership No. 146800

Company Hodgson Consulting Engineers Pty Ltd

GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1(a) - Checklist of Requirements for Geotechnical Risk Management Report for Development Application

Development Application for D & J Suttie Name of Applicant
 Address of site 67 Florence Terrace, Scotland Island

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk Management Geotechnical Report. This checklist is to accompany the Geotechnical Report and its certification (Form No. 1).

Geotechnical Report Details:

Report Title: RISK ANALYSIS & MANAGEMENT FOR PROPOSED BOAT SHED AND SKID RAMP AT 67 FLORENCE TERRACE, SCOTLAND ISLAND- PX 00007

Report Date: 10th September, 2019

Author: GARTH HODGSON, REVIEWED PETER THOMPSON

Author's Company/Organisation: HODGSON CONSULTING ENGINEERS PTY LTD

Please mark appropriate box

- ☒ Comprehensive site mapping conducted 27/08/2019
 (date)
- ☒ Mapping details presented on contoured site plan with geomorphic mapping to a minimum scale of 1:200 (as appropriate)
- ☒ Subsurface investigation required
☒ No Justification Previous testing and visible rock
☐ Yes Date conducted
- ☒ Geotechnical model developed and reported as an inferred subsurface type-section
- ☒ Geotechnical hazards identified
☐ Above the site
☒ On the site
☐ Below the site
☐ Beside the site
- ☒ Geotechnical hazards described and reported
- ☒ Risk assessment conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
☒ Consequence analysis
☒ Frequency analysis
- ☒ Risk calculation
- ☒ Risk assessment for property conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- ☒ Risk assessment for loss of life conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- ☒ Assessed risks have been compared to "Acceptable Risk Management" criteria as defined in the Geotechnical Risk Management Policy for Pittwater - 2009
- ☒ Opinion has been provided that the design can achieve the "Acceptable Risk Management" criteria provided that the specified conditions are achieved.
- ☒ Design Life Adopted:
☒ 100 years
☐ Other specify
- ☒ Geotechnical Conditions to be applied to all four phases as described in the Geotechnical Risk Management Policy for Pittwater - 2009 have been specified
- ☒ Additional action to remove risk where reasonable and practical have been identified and included in the report.
- ☐ Risk Assessment within Bushfire Asset Protection Zone

I am aware that Pittwater Council will rely on the Geotechnical Report, to which this checklist applies, as the basis for ensuring that the geotechnical risk management aspects of the proposal have been adequately addressed to achieve an "Acceptable Risk Management" level for the life of the structure, taken as at least 100 years unless otherwise stated, and justified in the Report and that reasonable and practical measures have been identified to remove foreseeable risk.

Signature Peter Thompson
 Name Peter Thompson
 Chartered Professional Status MIE Aust CPEng
 Membership No. 146800
 Company Hodgson Consulting Engineers Pty Ltd

**RISK ANALYSIS & MANAGEMENT
FOR
PROPOSED BOAT SHED AND SKID RAMP
AT
67 FLORENCE TERRACE, SCOTLAND ISLAND**

1. INTRODUCTION.

1.1 This assessment has been prepared to accompany an application for Development Approval with Northern Beaches Council - Pittwater. The requirements of the Geotechnical Risk Management Policy for Pittwater, 2009 have been met.

1.2 The definitions used in this Report are those used in the Geotechnical Risk Management Policy for Pittwater, 2009.

1.3 The methods used in this Assessment are based on those described in Landslide Risk Management March 2007, published by the Australian Geomechanics Society and as modified by the Geotechnical Risk Management Policy for Pittwater, 2009.

1.4 The experience of the principal of Hodgson Consulting Engineers spans a time period over 25 years in the Northern Beaches Council area and Greater Sydney Region.

2. PROPOSED DEVELOPMENT.

2.1 Construct new boat shed and skid ramp.

2.2 Details of the proposed development are shown on a series of architectural drawings prepared by Stephen Crosby & Associates, Drawing Nos: 2069-DA -01 to 02, dated February, 2019.

3. DESCRIPTION OF SITE & SURROUNDING AREA.

3.1 The site was inspected on the 27th August, 2019.

3. DESCRIPTION OF SITE & SURROUNDING AREA. (Continued)

3.2 This rectangular shaped block is located on the low side of the road and has a north easterly aspect. It is located near the toe of a slope that rises from the waters of Pittwater to the crest of the hill in Elizabeth Park. The slope rises across the site at an average gradient of some 20 to 30 degrees. The slope extends above the property some 250 metres to the crest in Elizabeth Park.

3.3 The site is accessed from Florence Terrace or the water front. From the water front a stairway leads up to the residence, Photo 1. At the top of the sea wall there is a level lawn area. A block retaining wall is at the toe of the vegetated slope rises up to the residence from the level area. An 'S' shaped stone stairway leads up to the residence from the waterfront, Photo 2. At the top of the stairs a path with a railing runs across the eastern side of the house and around the corner to the main entrance to the existing residence. Along the south eastern side of the residence is a paved path with steps that leads to the rear of the property, Photo 3. The rear of the property is accessed up some wooden stairs that leads to garden area at the south western end of the block. The slope continues to rise up to and beyond Florence Terrace, Photo 4. Florence Terrace can be accessed via path with handrail. There are two tanks in the north western corner of the property, Photo 5.

3.4 The multi-storey timber clad residence steps down the natural slope and is supported on concrete pad and strip footings and is fair to good condition. No significant movement attributed slope instability was observed in the existing residence.

3.5 The subject property and adjoining properties are mapped as H1 hazard areas on the Council Geotechnical Hazard Map. Our observations indicate the surrounding slopes do not present a significant risk of instability to the subject property.

4. GEOLOGY OF THE SITE.

4.1 The Sydney geological series sheet, at a scale of 1:100,000 indicates the site is underlain by interbedded sandstones, siltstones and shales of the Upper Narrabeen Group. The Narrabeen Group Rocks are Late Permian to Middle Triassic in age with the early rocks not outcropping in the area under discussion. The materials from which the rocks were formed consist of gravels, coarse to fine sands, silts and clays. They were deposited in a riverine type environment with larger floods causing fans of finer materials. The direction of deposition changed during the period of formation. The lower beds are very variable with the variations decreasing as the junction with the Hawkesbury Sandstones is approached. This is marked by the highest of persistent shale beds over thicker sandstone beds which are similar in composition to the Hawkesbury Sandstones.

4.2 The slope materials are colluvial in origin at the surface and become residual with depth. They consist of topsoil over sandy clays and clays that merge into the weathered rock at depths varying from 0.5 to 1.5 metres or deeper where filling has been carried out.

5. SUBSURFACE INVESTIGATION AND SITE CLASSIFICATION.

5.1 Based on visual observation the site is considered consistent with adjacent local sites previously inspected and reported and accordingly physical subsurface investigation has not been conducted at this stage on this proposed development. The rock shelf is visible some 1.5 metres below the level lawn area as seen in Photo 1.

5.2 SITE CLASSIFICATION.

The natural soil profile of the existing site is classified Class M, defined as 'Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes' as defined by AS 2870 - 2011. Where bedrock is encountered the site is classified as Class A.

6. DRAINAGE OF THE SITE.

6.1 ON THE SITE.

The site is naturally well drained with surface and subsurface runoff draining toward the rear north eastern boundary and to Pittwater. No natural watercourses were observed on site.

6. **DRAINAGE OF THE SITE. (Continue)**

6.2 **SURROUNDING AREA.**

Overland stormwater flow entering the site from the adjoining properties and the surrounding road was not evident. Normal overland runoff could enter the site from above during heavy or extended rainfall.

7. **GEOTECHNICAL HAZARDS.**

7.1 **ABOVE THE SITE.**

No geotechnical hazards likely to adversely affect the subject property were observed above the site.

7.2 **ON THE SITE.**

The site is classed slip affected under Council's Policy and a H1 Hazard. A failure of the slope across the property is considered to be a potential hazard (**HAZARD ONE**).

7.3 **BELOW THE SITE.**

No geotechnical hazards likely to adversely affect the subject property were observed below the site.

7.4 **BESIDE THE SITE.**

The areas beside the site are also classed slip affected hazard areas. These blocks have similar elevation and geomorphology to the subject property. No geotechnical hazards likely to adversely affect the subject property were observed beside the site.

8. **RISK ASSESSMENT.**

8.1 **ABOVE THE SITE.**

As no geotechnical hazards likely to adversely affect the subject site were observed above the site, no risk analysis is required.

8. RISK ASSESSMENT. (Continued)

8.2 ON THE SITE.

8.2.1 HAZARD ONE Qualitative Risk Assessment on Property

From the north eastern boundary the slope of the land surface rises toward the south west at approximate average angles of 20 to 30 degrees. Trees stand vertically across the block. While considered stable in its current condition the likelihood of the slope failing and impacting on the house is assessed as 'Unlikely' (10^{-4}). The consequences to property of such a failure are assessed as 'Minor' (5%). The risk to property is 'Low' (5×10^{-6}).

8.2.2 HAZARD ONE Quantitative Risk Assessment on Life

For loss of life risk can be calculated as follows:

$$R_{(LoL)} = P_{(H)} \times P_{(SH)} \times P_{(TS)} \times V_{(DT)} \text{ (See Appendix for full explanation of terms)}$$

8.2.2.1 **Annual Probability**

No evidence of significant movement was observed on the site.

$$P_{(H)} = 0.0001/\text{annum}$$

8.2.2.2 **Probability of Spatial Impact**

The house is situated towards the toe of the moderate steep slope.

$$P_{(SH)} = 0.2$$

8.2.2.3 **Possibility of the Location Being Occupied During Failure**

The average household is taken to be occupied by 4 people. It is estimated that 1 person is in the house for 20 hours a day, 7 days a week. It is estimated 3 people are in the house 12 hours a day, 5 days a week.

For the person most at risk:

$$\frac{20}{24} \times \frac{7}{7} = 0.83$$

$$P_{(TS)} = 0.83$$

8.2.2.4 **Probability of Loss of Life on Impact of Failure**

Based on the volume of land sliding and its likely velocity when it hits the house, it is estimated that the vulnerability of a person to being killed in the house when a landslide hits is 0.01

$$V_{(DT)} = 0.01$$

8. RISK ASSESSMENT. (Continued)

8.2.2.5 Risk Estimation

$$R_{(LoI)} = 0.0001 \times 0.2 \times 0.83 \times 0.01 \\ = 0.000000166$$

$R_{(LoI)} = 1.66 \times 10^{-7}$ /annum. **NOTE:** This level of risk is 'ACCEPTABLE', provided the recommendations in **Section 10** are followed.

8.3 BELOW THE SITE.

As no geotechnical hazards likely to adversely impact upon the subject site were observed below the site, no risk analysis is required.

8.4 BESIDE THE SITE.

As no geotechnical hazards likely to adversely impact upon the subject site were observed beside the site, no risk analysis is required.

9. SUITABILITY OF DEVELOPMENT FOR SITE.

9.1 GENERAL COMMENTS.

The proposed development is considered suitable for the site.

9.2 GEOTECHNICAL COMMENTS.

No geotechnical hazards will be created by the completion of the proposed development in accordance with the requirements of this Report and good engineering and building practice.

9.3 CONCLUSIONS.

The site and the proposed development can achieve the Acceptable Risk Management criteria outlined in the Pittwater Geotechnical Risk Policy provided the recommendations given in **Section 10** are undertaken.

10. RISK MANAGEMENT.

10.1. TYPE OF STRUCTURE.

The proposed structures are considered suitable for this site.

10. RISK MANAGEMENT. (Continued)

10.2. EXCAVATIONS.

10.2.1 All excavation recommendations as outlined below should be read in conjunction with Safe Work Australia's 'Excavation Work – Code of Practice', published October, 2013.

10.2.2 Excavations for the proposed foundations of the boat shed and skid ramp will require minimal excavation for the piered footings. These piered footings will encounter fill material and clays overlying the weathered rock of the Narrabeen Group to approximate depths of 1.5 metres or deeper where filling has been carried out.

10.2.3 All excavated materials left onsite will need to comply with the conditions in Section 10.3 or be retained by an engineer designed retaining wall or structure.

10.2.4 All excavated material is to be removed from the site in accordance with current Office of Environment and Heritage (OEH) regulations.

10.3. FILLS.

10.3.1 If filling is required, all fills are to be placed in layers not more than 250 mm thick and compacted to not less than 95% of Standard Optimum Dry Density at plus or minus 2% of Standard Optimum Moisture Content.

10.3.2 The fill batters are to be not steeper than 1 vertical to 1.7 horizontal or they are to be supported by properly designed and constructed retaining walls.

10.4. FOUNDATION MATERIALS AND FOOTINGS.

It is recommended that all footings be supported on and socketed into the underlying bedrock, using piers as necessary. The design allowable bearing pressures are 400 kPa for spread footings or shallow piers. All footings are to be founded on material of similar consistency to minimise potential for differential settlement.

10. RISK MANAGEMENT. (Continued)

Note: The local geology is comprised of highly variable interbedded clays, shales and sandstones, with abundant detached joint blocks and sandstone floaters at surface and in the upper profile. Conditions may alter significantly across short distances. This variability should be anticipated and accounted for in the design and construction of any new foundations.

10.5. STORM WATER DRAINAGE.

All storm water runoff from the development is to be connected to the existing storm water system for the block through any tanks or onsite detention systems that may be required by the regulating authorities. This drainage work is to comply with the relevant Australian standards (AS/NZS 3500 Plumbing and Drainage).

10.6. SUBSURFACE DRAINAGE.

Any retaining walls are to be back filled with non-cohesive free draining material to provide a drainage layer immediately behind the wall. The free draining material is to be separated from the ground materials by geotextile fabric. Standard under pool drainage is acceptable.

10.7. INSPECTIONS.

It is essential that the foundation materials of all footing excavations be inspected and approved before concrete is placed. This includes retaining wall footings. Failure to advise the geotechnical engineer for these inspections could delay or stop the issuance of relevant certificates.

11. GEOTECHNICAL CONDITIONS FOR ISSUE OF CONSTRUCTION CERTIFICATE.

It is recommended that the following geotechnical conditions be applied to the Development Approval:-

The work is to be carried out in accordance with the Risk Management Report PX 00007 dated 10th September, 2019.

The Geotechnical Engineer is to inspect and approve the foundation materials of any footing excavations before concrete is placed.

12. GEOTECHNICAL CONDITIONS FOR ISSUE OF OCCUPATION CERTIFICATE.

The Geotechnical Engineer is to certify the following geotechnical aspects of the development:-

The work was carried out in accordance with the Risk Management Report PX 00007 dated 10th September, 2019.

The Geotechnical Engineer inspected and approved the foundation material of all footing excavations.

13. RISK ANALYSIS SUMMARY.

HAZARDS	Hazard One
TYPE	The site is classed slip affected under Council's Policy and a H1 Hazard. A failure of the slope across the property is considered to be a potential hazard.
LIKELIHOOD	'Unlikely' (10^{-4})
CONSEQUENCES TO PROPERTY	'Minor' (5%)
RISK TO PROPERTY	'Low' (5×10^{-6})
RISK TO LIFE	1.66×10^{-7} /annum
COMMENTS	This level of risk is 'ACCEPTABLE' provided the conditions in Section 10 are followed.

HODGSON CONSULTING ENGINEERS PTY. LTD.



Garth Hodgson MIE Aust
Member No. 2211514
Civil/Geotechnical & Structural
Engineer



Peter Thompson MIE Aust CPEng
Member No. 146800
Civil/Geotechnical Engineer



Photo 1



Photo 2



Photo 3



Photo 4

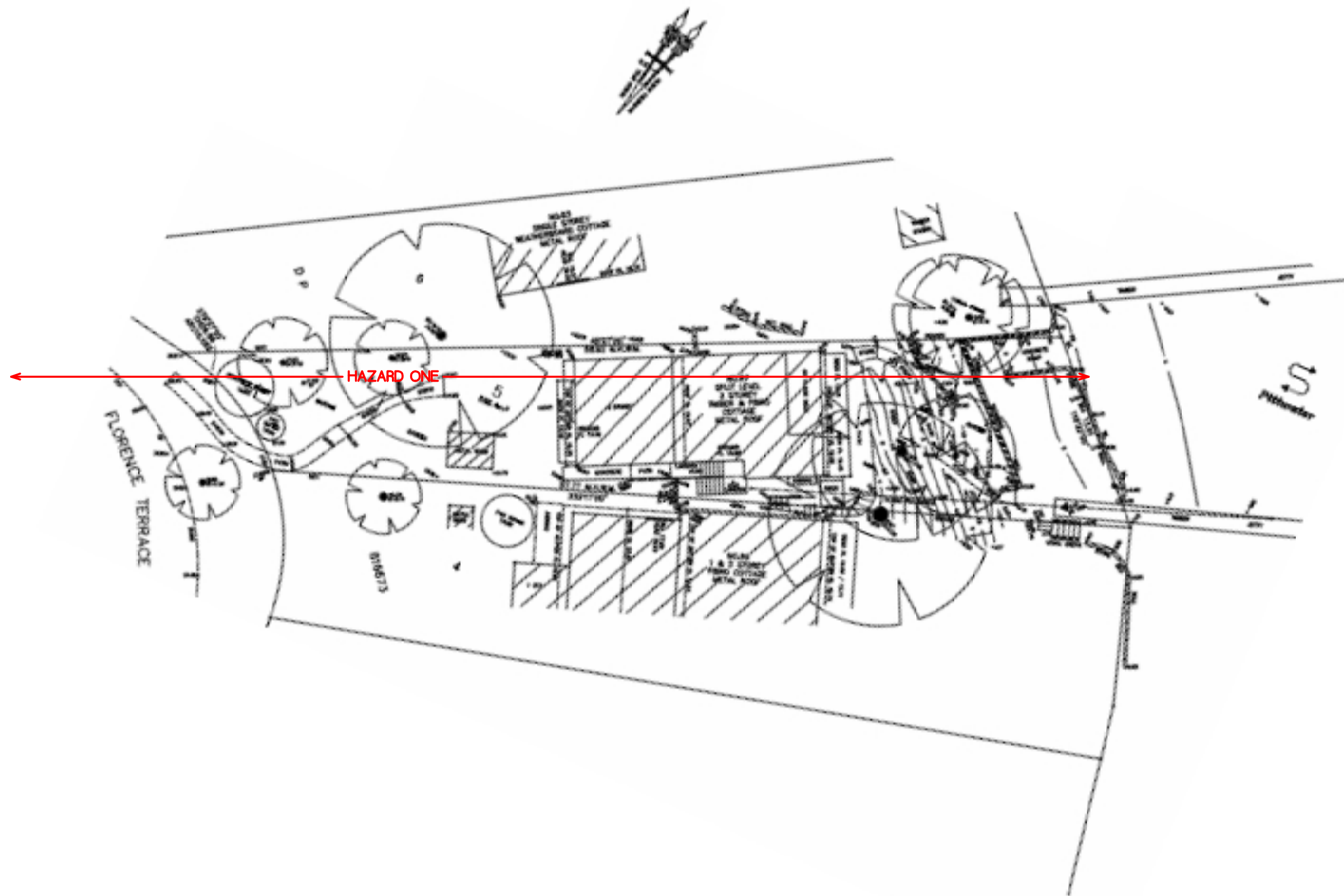


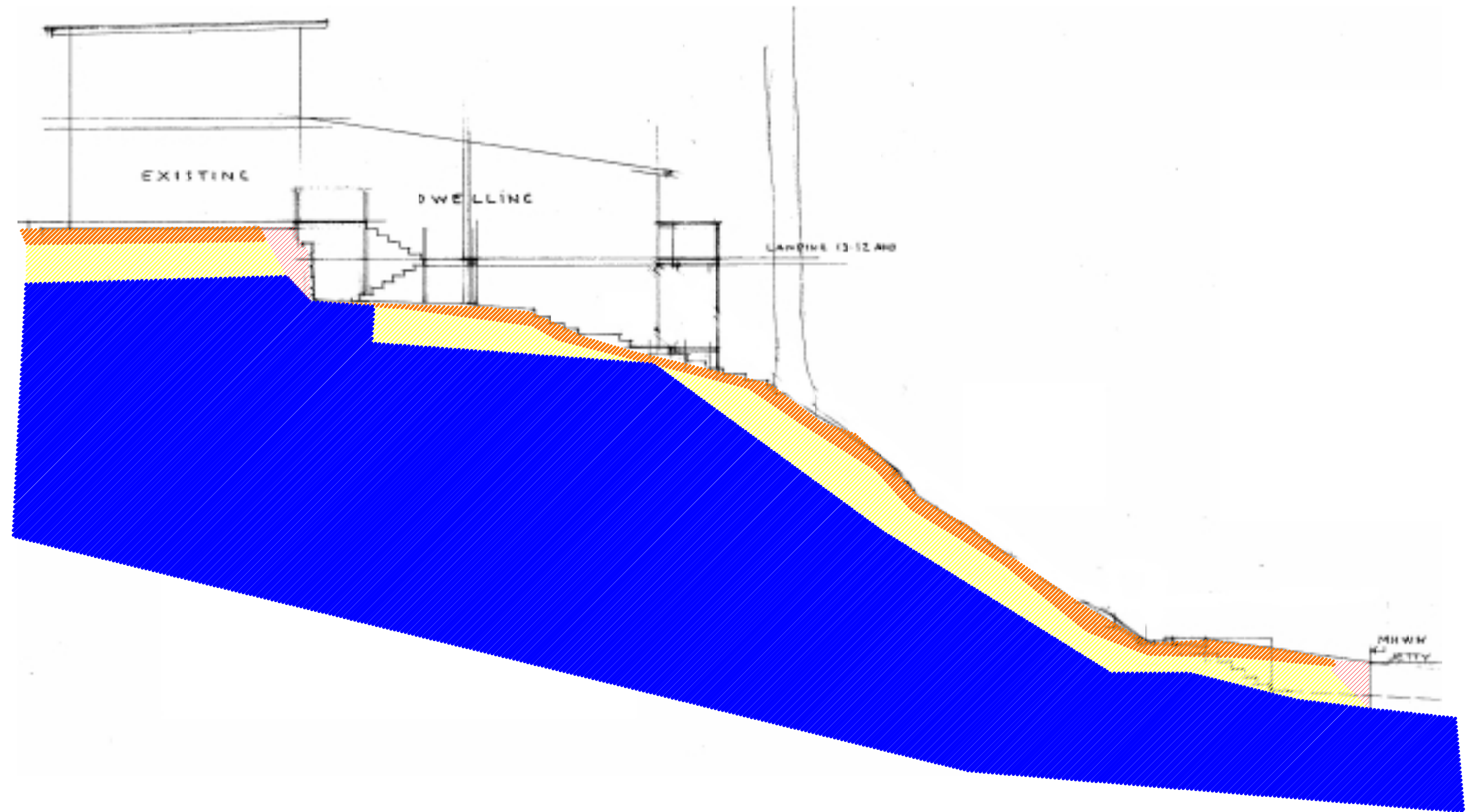
GEOTECHNICAL | CIVIL | STRUCTURAL

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2019
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Photo 5





TYPE SECTION

Job No
PX 00007

Scale
NTS

Address
67 FLORENCE TERRACE
SCOTLAND ISLAND
NSW

STRATA PROFILE LEGEND

- | | | | |
|---|---------------|---|-----------------------|
|  | Fill |  | Narrabeen Group Rocks |
|  | Sandy Topsoil |  | Hawkesbury Sandstone |
|  | Sandy Clay | | |

7 RISK ESTIMATION

7.1 QUANTITATIVE RISK ESTIMATION

Quantitative risk estimation involves integration of the frequency analysis and the consequences.

For property, the risk can be calculated from:

$$R_{(Prop)} = P_{(H)} \times P_{(S:H)} \times P_{(T:S)} \times V_{(Prop:S)} \times E \quad (1)$$

Where

$R_{(Prop)}$ is the risk (annual loss of property value).

$P_{(H)}$ is the annual probability of the landslide.

$P_{(S:H)}$ is the probability of spatial impact by the landslide on the property, taking into account the travel distance and travel direction.

$P_{(T:S)}$ is the temporal spatial probability. For houses and other buildings $P_{(T:S)} = 1.0$. For Vehicles and other moving elements at risk $1.0 > P_{(T:S)} > 0$.

$V_{(Prop:S)}$ is the vulnerability of the property to the spatial impact (proportion of property value lost).

E is the element at risk (e.g. the value or net present value of the property).

For loss of life, the individual risk can be calculated from:

$$R_{(LoL)} = P_{(H)} \times P_{(S:H)} \times P_{(T:S)} \times V_{(D:T)} \quad (2)$$

Where

$R_{(LoL)}$ is the risk (annual probability of loss of life (death) of an individual).

$P_{(H)}$ is the annual probability of the landslide.

$P_{(S:H)}$ is the probability of spatial impact of the landslide impacting a building (location) taking into account the travel distance and travel direction given the event.

$P_{(T:S)}$ is the temporal spatial probability (e.g. of the building or location being occupied by the individual) given the spatial impact and allowing for the possibility of evacuation given there is warning of the landslide occurrence.

$V_{(D:T)}$ is the vulnerability of the individual (probability of loss of life of the individual given the impact).

A full risk analysis involves consideration of all landslide hazards for the site (e.g. large, deep seated landsliding, smaller slides, boulder falls, debris flows) and all the elements at risk.

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

For comparison with tolerable risk criteria, the individual risk from all the landslide hazards affecting the person most at risk, or the property, should be summed.

The assessment must clearly state whether it pertains to 'as existing' conditions or following implementation of recommended risk mitigation measures, thereby giving the 'residual risk'.