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

Development Application for _____
Name of Applicant

Address of site **19 WALLUMATTA ROAD, NEWPORT**

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* Jack Hodgson Consultants Pty Ltd
(insert name) (Trading or Company Name)

on this the 11TH JANUARY, 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 fro 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 SWIMMING POOL, DECK AND CABANA AT 19 WALLUMATTA ROAD NEWPORT – MT 31655

Report Date: 11TH JANUARY, 2019

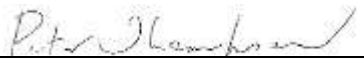
Author : PETER THOMPSON

Author's Company/Organisation : JACK HODGSON CONSULTANTS PTY LTD

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

Architectural drawings prepared by Marika Jarv Job No: 38, Dwg No: WHO01-DA to WHO07-DA dated 14th November, 2018

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 Jack Hodgson Consultants 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 _____
Name of Applicant
Address of site **19 WALLUMATTA ROAD NEWPORT**

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 SWIMMING POOL, DECK AND CABANA AT 19 WALLUMATTA ROAD NEWPORT– MT 31655

Report Date: 11TH JANUARY, 2019

Author: PETER THOMPSON

Author's Company/Organisation: JACK HODGSON CONSULTANTS PTY LTD

Please mark appropriate box

☒ Comprehensive site mapping conducted 10/01/2019 (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 .....
- ☒ Yes Date conducted 10/01/2019

☒ 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 

Name Peter Thompson

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

Development Application for _____
Name of Applicant

Address of site **19 WALLUMATTA ROAD, NEWPORT**

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☐ 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 SWIMMING POOL, DECK AND CABANA AT 19 WALLUMATTA ROAD NEWPORT – MT 31655

Report Date: 11TH JANUARY, 2019

Author : PETER THOMPSON

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

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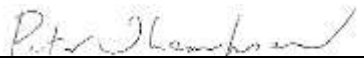
I am aware that the above Geotechnical Report, prepared for the abovementioned site is to be submitted in support of a Development Application for this site and will be relied on by Pittwater Council as the basis for ensuring that the Geotechnical Risk Management aspects of the proposed development have 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 Jack Hodgson Consultants 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 _____
Name of Applicant
Address of site **79 FLORIDA ROAD PALM BEACH**

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 ALTERATIONS & ADDITIONS AT 79 FLORIDA ROAD PALM BEACH – MT 31649

Report Date: 9TH JANUARY, 2019

Author: PETER THOMPSON

Author's Company/Organisation: JACK HODGSON CONSULTANTS PTY LTD

Please mark appropriate box

☒ Comprehensive site mapping conducted 8/12/2019 (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 .....
- ☒ Yes Date conducted 8/11/2019

☒ 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
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☒ 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.

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Company Jack Hodgson Consultants Pty Ltd

Jack Hodgson Consultants Pty Limited
CONSULTING CIVIL, GEOTECHNICAL AND STRUCTURAL ENGINEERS
ABN: 94 053 405 011

RISK ANALYSIS & MANAGEMENT FOR PROPOSED SWIMMING POOL, DECK AND CABANA AT 19 WALLUMATTA ROAD NEWPORT

1. INTRODUCTION.

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

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

1.4 The experience of Jack Hodgson Consultants spans a time period of over 40 years in the Northern Beaches Council area and greater Sydney region.

2. PROPOSED DEVELOPMENT.

2.1 Proposed new swimming pool and cabana.

2.2 Details of the proposed development are shown on a set of architectural drawings prepared by Marika Jarv, Job No:- 38, Dwg No: WH01-DA to WH07-DA dated 14th November, 2018.

3. DESCRIPTION OF SITE & SURROUNDING AREA.

3.1 The site was inspected for the purpose of this assessment on the 10th January, 2019. We have inspected the subject address before on the 26th May, 2010 for a previous development application.

3.2 The property is located on the low side of the road and has a southerly aspect. The slope across the site drops at angles of approximately 10 degrees and the property is situated half way up a slope which drops from Bilgola Plateau in the north. Above the northern boundary, the block rises to the north east at increasing gradients for 450

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

metres to the edge of the plateau. The slope below the property drops at angles of approximately 10 degrees for 160 metres before easing in grade to the toe of the slope.

3.3 From the road frontage a paved concrete driveway leads to a double gravel surfaced level car parking area in front of the existing residence, Photo 1. The fill batter for the road above merges into a garden bed in the front yard. The garden bed is supported by a mortared stack rock wall that is in good condition, Photo 2. The northern side of the property is a lawn covered area and a small area of timber deck. The double car parking area is supported by a low keystone retaining wall and shows no evidence of movement, Photo 3. Access to the southern downhill side of the property is via a part soil and part paved concrete path around the western side of the house. A cut in the natural slope has been made to fit the house. The cut batter below the house is supported by a concrete block retaining wall which appears well constructed and shows no evidence of movement, Photo 4. From the southern side of the house a level stone paved area extends into the backyard, Photo 5. Concrete block retaining walls on the western side of the paved area support garden beds and appear well constructed. The paved area is supported by a timber pole retaining wall which appears to be in need of remedial work, Photo 6. South of the paved area stone steps lead down slope to a second level paved area and a studio on the eastern side of the property. The studio is founded on brick piers which were observed to be tilting from vertical. This tilting is attributed to settlement. A fill batter below the studio stands approximately 1.0 to 1.5m high and is currently unsupported, Photo 7. The fill batter appears stable and is covered with some vegetation. A stack rock retaining wall supports the western side of the fill batter and shows no evidence of instability, Photo 8. Down slope from the second paved area, a lawn covered area extends to a brick retaining wall on the southern boundary which appears stable, Photo 9.

3.4 The part two storey brick and timber house is in good condition. It is supported on brick walls that appear stable and displayed no signs of significant movement that could be attributed to slope instability.

4. GEOLOGY OF THE SITE.

4.1 Referencing the Sydney 1:100,000 Geological Series Sheet 9130 indicates the site is underlain by the interbedded sandstones, siltstones and shales of the Narrabeen Group that do not outcrop on the site. There are some sandstone exposures on the site. 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

4. GEOLOGY OF THE SITE. (Continued)

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 at the surface and residual at depth. They consist of sandy loam over sandy clays and clay with rock fragments and some floaters throughout the profile. The sandy clays and clays merge into the weathered zone of the under lying rocks at depths expected to be in the range of 1.0 to 2.0 metres.

5. SUBSURFACE INVESTIGATION AND SITE CLASSIFICATION.

5.1 Three Dynamic Cone Penetrometer (DCP) tests were conducted in the locations shown on the site plan. The tests were conducted to the Australian Standard for ground testing: AS 1289.6.3.2 – 1997 (R2013). The results of these tests are as follows:

NUMBER OF BLOWS - Conducted using a 9kg hammer, 510mm drop and conical tip.			
DEPTH (m)	**DCP 1**	**DCP 2**	**DCP 3**
0.0 to 0.3	3	7	6
0.3 to 0.6	7	31	12
0.6 to 0.9	**6/0.092**	21	13
0.9 to 1.2		15	15
1.2 to 1.5		19	24
1.5 to 1.8		**8/0.065**	38
1.8 to 2.1			**4/0.005**
	End of Test @ 0.692m	**End of Test @ 1.565m**	**End of Test @ 1.805m**
~ Top RL	**41.50**	**41.70**	**40.00**
~ EOT RL	**40.808**	**40.135**	**38.195**

DCP TESTING NOTES:

DCP#1	6 Blows for 0.092m then 8 blows for 0.017m. Slight Double bounce. Refusal on floater rock or weathered rock. Most likely floater. Tip – Dry with Orange Fragments.
DCP#2	8 Blows for 0.005m then 8 blows for 0.020m. Slight Double bounce. Refusal on floater rock or weathered rock. Tip – Dry and clean.
DCP#3	4 Blows for 0.092m then 8 blows for 0.017m. Slight Double bounce. Refusal on floater rock or weathered rock. Tip – Dry with Orange Fragments.
Further Notes	When ringing bouncing rock is not encountered, end of test occurs when there is less than 0.02m of penetration for 8 blows or danger of equipment damage is imminent. No significant standing water table was identified in our testing.

5. SUBSURFACE INVESTIGATION AND SITE CLASSIFICATION. (Continued)

5.2 The equipment chosen to undertake ground investigations provides the most cost effective method for understanding the subsurface conditions. Our interpretation of the subsurface conditions is limited to the results of testing undertaken and the known geology in the area. While every care is taken to accurately identify the subsurface conditions on-site, variation between the interpreted model presented herein, and the actual conditions onsite may occur. Should actual ground conditions vary from those anticipated, we would recommend the geotechnical engineer be informed as soon as possible to advise if modifications to our recommendations are required.

5.3 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 the foundations are taken to the underlying rock then the site can be classified as Class A.

6. DRAINAGE OF THE SITE.

6.1 ON THE SITE.

The site is well drained with no natural water courses on the property. Roof water from the existing house appears to be taken to the rear yard.

6.2 SURROUNDING AREA.

Overland stormwater flow entering the site from the adjoining properties 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.

The slope above the site has a similar grade to that seen on the site and no geotechnical hazards that could adversely affect the site were observed.

7. GEOTECHNICAL HAZARDS. (Continued)

7.2 ON THE SITE.

7.2.1 The property is mapped as an H1 hazard area on the Council Geotechnical Hazard Map. A failure of the slope across the property is considered 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 properties beside the site are at similar elevations and have similar geomorphology to the subject property. The house and grounds of these properties are in good condition as observed from 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 impact upon the subject site were observed above the site, no risk analysis is required.

8.2 ON THE SITE.

8.2.1 HAZARD ONE Qualitative Risk Assessment on Property

The slope of the land surface falls across the property at angles of an average 10 to 15 degrees in a moderate to steep slope. No evidence of tension cracking, slumping or any other signs of movement were observed on the site. The likelihood of the slope failing and impacting on the house and proposed development 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}).

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8. RISK ASSESSMENT. (Continued)

8.2.2 HAZARD ONE Quantitative Risk Assessment on Life

For loss of life risk can be calculated as follows:-
$R_{(LoI)} = P_{(H)} \times P_{(SH)} \times P_{(TS)} \times V_{(DT)}$ (See Appendix for full explanation of terms)

8.2.2.1 Annual Probability

Competent rock is encountered at relatively shallow depths across the block. No evidence of significant movement was observed on the site.
$P_{(H)} = 0.0001$/annum

8.2.2.2 Probability of Spatial Impact

The existing residence is situated toward the upper half of the 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:

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

$P_{(TS)} = 0.83$

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 fails, it is estimated that the vulnerability of a person to being killed in the house when a landslide occurs is 0.01
$V_{(DT)} = 0.01$

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 given 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.

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8. RISK ASSESSMENT. (Continued)

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 types of structures are considered suitable for the proposed development

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 Northern Beaches Council - 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 suitable for this site.

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 March, 2015.

10.2.2 Excavations to a depth of some 2.0m may be required for the proposed new swimming pool. These excavations are expected to be through sandy topsoils and firm clays with weathered rock being encountered at depths ranging from 1.0 to 2.0 metres. The cut batters will stand unsupported for a short period of time provided cut faces are kept dry.

10. RISK MANAGEMENT. (Continued)

10.2.3 Care will need to be taken to identify large rock floaters. When encountered these floaters will need to be broken up and removed or excavated through to actual bedrock below.

10.2.4 All cut batters are to be covered to prevent loss of moisture in dry weather and to prevent access of moisture in wet weather. Upslope runoff must be diverted from the cut faces by sandbag mounds or similar diversion works. Temporary support may be necessary depending upon the material encountered in the cuts, the likelihood of heavy rain and the length of period before permanent support is installed. The design Coefficient of Lateral Pressure for the soil portion of the cut is 0.6. Temporary support may be necessary depending upon the material encountered in the cuts, the likelihood of heavy rain and the length of period before permanent support is installed.

10.2.5 All excavated material is to be removed from the site in accordance with current Office of Environment and Heritage (OEH) regulations. Otherwise where possible excavated material could be placed on site using properly engineered designed retaining walls

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.

10.3.3 New retaining walls will be required to contain the fill in some parts of the proposed development. These retaining walls are to be designed by the structural engineer with any foundations support by piers and footings taken to a minimum very stiff clay or to weathered rock material as required.

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10. RISK MANAGEMENT. (Continued)

10.4 FOUNDATION MATERIALS AND FOOTINGS.

It is recommended that any new footings for the proposed swimming pool are to be supported on and potted into the underlying rock, using piers as necessary. The design allowable bearing pressures are 600 kPa for spread footings or piers. The new deck and cabana footings could be taken to natural, very stiff clay material with the design allowable bearing pressures are 300 kPa. However, we recommend that the swimming pool, deck and cabana footings are to be founded on material of similar consistency to minimise potential for differential settlement.

10.5 STORM WATER DRAINAGE.

All storm water generated from any new works is to be piped to the stormwater system for the block and through any water tanks or onsite detention systems that may be required by the regulating authorities. A suitable method of disposal is to be confirmed with council. This drainage work is to comply with the relevant Australian standards (AS/NZS 3500 Plumbing and Drainage).

10.6 SUBSURFACE DRAINAGE.

10.6.1 All retaining walls new and replaced are to have adequate back wall drainage.

10.6.2 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 materials by geotextile fabric ground.

10.7 INSPECTIONS.

10.7.1 It is recommended that the excavation be inspected at regular intervals during the course of the works.

10.7.2 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 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 MT 31655 dated 11th January, 2019.

The Geotechnical Engineer is to inspect the excavations works on regular basis and approve the support structures for the excavations.

The Geotechnical Engineer is to inspect and approve the foundation materials of any additional 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 MT 31655 dated 11th January, 2019.

The Geotechnical Engineer has inspected and approved the excavations works on regular basis and approved the support structures for the excavations.

The Geotechnical Engineer inspected and approved the foundation materials of all footing excavations before concrete was placed.

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CONSULTING CIVIL, GEOTECHNICAL AND STRUCTURAL ENGINEERS
ABN: 94 053 405 011

13. RISK ANALYSIS SUMMARY.

HAZARDS	Hazard One
TYPE	By reference to Pittwater Councils Geotechnical Hazard mapping, the block is identified as an H1 Hazard Zone. The slope of the land surface that falls across the property is considered 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.

JACK HODGSON CONSULTANTS PTY. LIMITED.

Peter Thompson

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

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

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) x **P**(S:H) x **P**(T:S) x **V**(Prop:S) x **E** **(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 risk1.0< **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) x **P**(S:H) x **P**(T:S) x **V**(D:T) **(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.

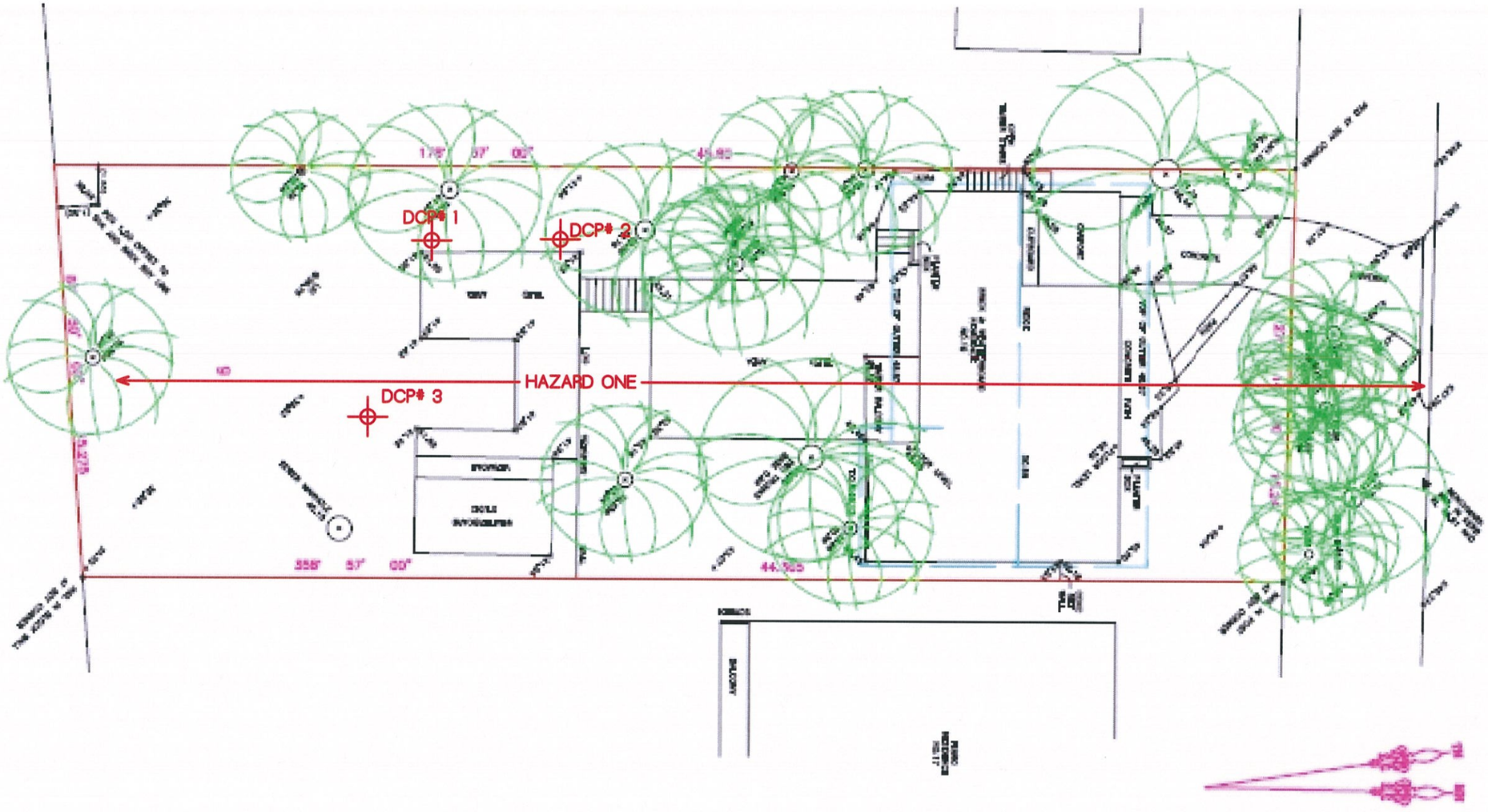
P(S:H) is the probability of spatial impact of the landslide impacting a building (location) taking into account
the travel distance and travel direction given the event.

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.

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'.



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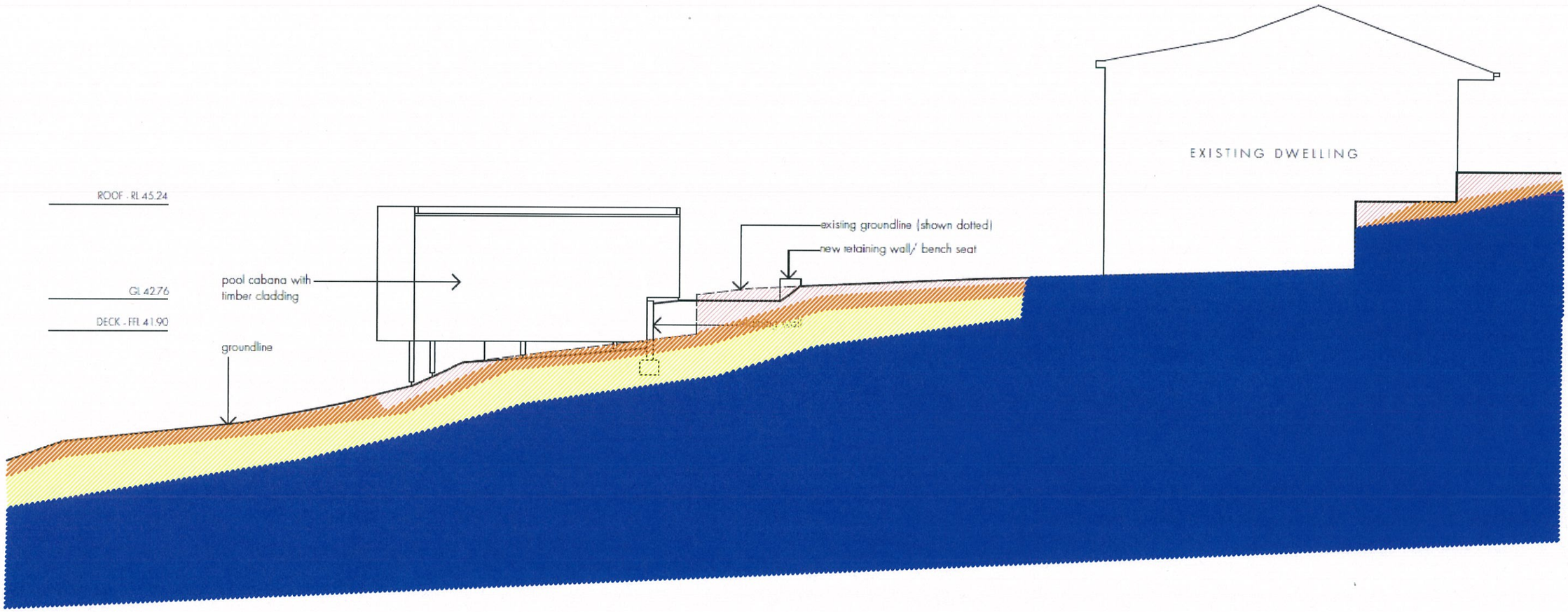
SITE PLAN – DCP LOCATIONS & HAZARD

Job No	Address
MT 31655	19 WALLUMATTA ROAD
Scale	NEWPORT
NTS	NSW



NOTE
INTERPRETED SUB SURFACE SECTION ONLY.
ACTUAL GROUND CONDITIONS MAY VARY.

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TYPE SECTION

Job No	Address
MT 31655	19 WALLUMATTA ROAD
Scale	NEWPORT
NTS	NSW

STRATA PROFILE LEGEND

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