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

Development Application for _____
Name of Applicant

Address of site 129 Riverview Road, Avalon

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk ***Declaration made by geotechnical engineer or engineering geologist or coastal engineer (where applicable) as part of a geotechnical report***

I, Ben White *on behalf of* White Geotechnical Group Pty Ltd
(Insert Name) (Trading or Company Name)

on this the 30/5/19 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 $10million.

I:
Please mark appropriate box

☒ have 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

☒ 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 Section 6.0 of the Geotechnical Risk Management Policy for Pittwater - 2009. I confirm that 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 I am of the opinion that the Development Application only involves Minor Development/Alteration that 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.

☐ have examined the site and the proposed development/alteration is separate from and is 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.

☐ have provided the coastal process and coastal forces analysis for inclusion in the Geotechnical Report

Geotechnical Report Details:

Report Title: Geotechnical Report **129 Riverview Road, Avalon**

Report Date: 29/5/19

Author: BEN WHITE

Author's Company/Organisation: **WHITE GEOTECHNICAL GROUP PTY LTD**

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

Australian Geomechanics Society Landslide Risk Management March 2007.

White Geotechnical Group company archives.

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 Ben White

Chartered Professional Status MScGEOLAusIMM CP GEOL

Membership No. 222757

Company White Geotechnical Group 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 129 Riverview Road, Avalon

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: Geotechnical Report **129 Riverview Road, Avalon**

Report Date: 29/5/19

Author: BEN WHITE

Author's Company/Organisation: WHITE GEOTECHNICAL GROUP PTY LTD

Please mark appropriate box

☒ Comprehensive site mapping conducted **27/5/19**
(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 **27/5/19**

☒ 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 Ben White

Chartered Professional Status MScGEOLAusIMM CP GEOL

Membership No. 222757

Company White Geotechnical Group Pty Ltd

GEOTECHNICAL INVESTIGATION:

New Inclinator at **129 Riverview Road, Avalon**

1. Proposed Development

1.1 Construct a new inclinator on the downhill side of the property including an excavation to a maximum depth of ~3.9m for the lower landing.

1.2 Other various external modifications.

1.3 Details of the proposed development are shown on 4 drawings prepared by Peter Downes Designs, drawings numbered A1 1907 01 to 04, dated 13/5/19.

2. Site Description

2.1 The site was inspected on the 27th May, 2019.

2.2 This waterfront residential property is on the low side of the road and has a W aspect. From the road frontage, the natural surface falls at moderate to steep angles to the waterfront. The slope above the property continues at moderate angles.

2.3 At the road frontage, a concrete driveway runs down the slope to a garage on the uphill side of the property (Photo 1). A moderately sloping lawn falls from the downhill side of the garage to a patio area that has been cut into the slope on the uphill side of the house (Photo 2). The cut for the patio area is supported by a stable ~2.0m high rendered masonry retaining wall. The part five-storey brick, sandstone, and concrete block house steps down the slope and is supported on brick, sandstone, and concrete block walls and brick piers (Photo 3). No significant signs of movement were observed in the supporting walls of the house and the supporting piers stand vertical. Some of the walls and piers were observed to be supported directly off an outcrop of competent Medium Strength Sandstone bedrock that runs the width of the property (Photos 4 & 5). A steep, densely-vegetated slope falls from the downhill side of the house to the top of a ~7m high cliff at the waterfront (Photo 6). The cliff face

consists of alternating bands of thinly-bedded Very Low Strength Shale and thicker bands of Low Strength Sandstone (Photo 7). The majority of the cliff face consists of thin sandstone beds. The weathering process of the cliff face is that the softer beds undercut the harder beds. Because the bedding is thin and tightly jointed, the resulting failures are very small in scale. Additionally, the weathering process is slow and the failures are not considered a threat to life or property. A stable boatshed has been constructed at the waterfront (Photo 8).

3. Geology

The Sydney 1:100 000 Geological sheet indicates the site is underlain by the Newport Formation of the Narrabeen Group. This is described as interbedded laminite, shale and quartz to lithic quartz sandstone. Medium Strength Sandstone bands were observed to be outcropping across the downhill side of the property and extend through the otherwise shale-dominated profile.

4. Subsurface Investigation

Four Dynamic Cone Penetrometer (DCP) tests were put down to determine the relative density of the overlying soil and the depth to bedrock. The locations of the tests are shown on the site plan. It should be noted that a level of caution should be applied when interpreting DCP test results. The test will not pass through hard buried objects so in some instances it can be difficult to determine whether refusal has occurred on an obstruction in the profile or on the natural rock surface. This is not expected to be an issue for the testing on this site and the results are as follows:

DCP RESULTS ON THE NEXT PAGE

DCP TEST RESULTS – Dynamic Cone Penetrometer				
Equipment: 9kg hammer, 510mm drop, conical tip.			Standard: AS1289.6.3.2 - 1997	
Depth(m) Blows/0.3m	**DCP 1** (~RL26.7)	**DCP 2** (~RL22.6)	**DCP 3** (~RL17.9)	**DCP 4** (~RL13.7)
0.0 to 0.3	Rock Exposed at Surface	6	10	10
0.3 to 0.6		8	5	24
0.6 to 0.9		9	8	17
0.9 to 1.2		20	16	#
1.2 to 1.5		#	22	
1.5 to 1.8			#	
		Refusal on Rock @ 1.1m	Refusal on Rock @ 1.5m	Refusal on Rock @ 0.7m

#refusal/end of test. F = DCP fell after being struck showing little resistance through all or part of the interval.

DCP Notes:

DCP1 – Rock exposed at surface.
DCP2 – Refusal on rock @ 1.1m, DCP bouncing off rock surface, orange sandstone fragments on dry tip.
DCP3 – Refusal on rock @ 1.5m, DCP bouncing off rock surface, orange and maroon shale fragments on dry tip.
DCP4 – Refusal on rock @ 0.7m, DCP bouncing off rock surface, white sandstone fragments on dry tip.

5. Geological Observations/Interpretation

The slope materials are colluvial at the near surface and residual at depth. A cliff face at the waterfront reveals the underlying bedrock (Photo 7). The cliff face consists of alternating bands of thinly-bedded Very Low Strength Shale and thicker bands of Low Strength Sandstone. The majority of the cliff face consists of thin sandstone beds. This ground profile is expected to extend upslope under the entire proposed works. In the test locations, where rock was not exposed at the surface, it was encountered at depths of between 0.7 to 1.5m

below the current surface. See Type Section attached for a diagrammatical representation of the expected ground materials.

6. Groundwater

Normal ground water seepage is expected to move over the buried surface of the rock and through the cracks. Due to the slope and elevation of the block, the water table is expected to be many metres below the base of the proposed excavation.

7. Surface Water

No evidence of significant surface flows were observed on the property during the inspection. Normal sheet wash from the slope above will be intercepted by the street drainage system for Riverview Road above.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed below or beside the property. The moderate to steeply graded land surface that falls across the property is a potential hazard (**Hazard One**). The cliff face that falls to the waterfront is a potential hazard (**Hazard Two**). The vibrations from the proposed excavation are a potential hazard (**Hazard Three**). The proposed excavation is a potential hazard until retaining walls are in place (**Hazard Four**).

RISK ANALYSIS SUMMARY ON NEXT PAGE

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The moderate to steep slope that falls across the property and continues above failing and impacting on the property.	The cliff face at the waterfront failing and impacting on the proposed works (Photo 7).
LIKELIHOOD	'Unlikely' (10^{-4})	'Rare' (10^{-5})
CONSEQUENCES TO PROPERTY	'Medium' (20%)	'Major' (40%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Low' (6×10^{-5})
RISK TO LIFE	8.3×10^{-7}/annum	9.96×10^{-6}/annum
COMMENTS	'ACCEPTABLE' level of risk to life & property.	'ACCEPTABLE' level of risk to life & property.

HAZARDS	Hazard Three	Hazard Four
TYPE	The vibrations produced during the proposed excavation impacting on the surrounding structures.	The excavation collapsing onto the work site before retaining walls are in place.
LIKELIHOOD	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (15%)	'Medium' (30%)
RISK TO PROPERTY	'Moderate' (2×10^{-4})	'Moderate' (2×10^{-4})
RISK TO LIFE	5.3×10^{-7}/annum	3.8×10^{-4}/annum
COMMENTS	This level of risk to property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels, the recommendations in **Section 12** are to be followed.	This level of risk to life and property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels, the recommendations in **Section 13** are to be followed.

(See Aust. Geomech. Jnl. Mar 2007 Vol. 42 No 1, for full explanation of terms)

9. Suitability of the Proposed Development for the Site

The proposed development is suitable for the site. No geotechnical hazards will be created by the completion of the proposed development provided it is carried out in accordance with the requirements of this report and good engineering and building practice.

10. Stormwater

There is fall to the waterfront below. All stormwater or drainage runoff from the proposed development is to be piped to the waterfront.

11. Excavations

An excavation to a maximum depth of ~3.9m is required to construct the lower landing of the inclinator. The excavation is expected to be entirely through Very Low to Low Strength Rock.

It is envisaged that excavations through rock will require grinding or rock sawing and breaking.

12. Vibrations

The majority of the excavation is expected to be through jointed Low Strength Rock that can be excavated with a bucket and excavator without vibrations reaching threshold limits for building damage. In isolated patches where excavations are through Medium Strength Rock, they should be carried out to minimise the potential to cause vibration damage to the subject boatshed and S neighbouring boatshed. The subject boatshed will be immediately beside the proposed excavation and the S neighbouring boatshed will be as close as ~1.0m from the edges of the excavation. Close controls by the contractor over excavations through Medium Strength Rock or better are recommended so excessive vibrations are not generated.

Excavation methods are to be used that limit peak particle velocity to 10mm/sec at the supporting walls of the subject boatshed and property boundaries. Vibration monitoring will be required to verify this is achieved.

If a milling head is used to grind the rock, vibration monitoring will not be required. Alternatively, if rock sawing is carried out around the perimeter of the excavation boundaries

in not less than 1.0m lifts, a rock hammer up to 300kg could be used to break the rock without vibration monitoring. Peak particle velocity will be less than 10mm/sec at the supporting walls of the subject house and property boundaries using this method provided the saw cuts are kept well below the rock to broken.

It is worth noting that vibrations that are below thresholds for building damage may be felt by the occupants of the subject and neighbouring properties.

13. Excavation Support Requirements

The excavation will come close to flush with the S common boundary. However, the excavation will be taken almost entirely through Low Strength Sandstone. This material will stand unsupported at near-vertical angles until retaining walls are in place subject to approval by the geotechnical consultant.

Upslope runoff is to be diverted from the cut faces by sandbag mounds or other diversion works. The materials and labour to construct the retaining walls are to be organised so on completion of the excavation they can be constructed as soon as possible. The excavation is to be carried out during a dry period. No excavations are to commence if heavy or prolonged rainfall is forecast.

During the excavation process, the geotechnical consultant is to inspect the excavation as it is lowered in 1.5m intervals to ensure the ground materials are as expected and no wedges or other geological defects are present that could require additional support. Should additional ground support be required, this will likely involve the use of mesh, sprayed concrete, and rock bolts.

Upon completion of the excavations, it is recommended all cut faces be supported with retaining walls to prevent any potential future movement of joint blocks in the cut faces that can occur over time, when unfavourable jointing is obscured behind the excavation faces. Additionally, retaining walls will help control seepage and to prevent minor erosion and sediment movement.

Excavation spoil is to be removed from site.

14. Retaining Walls

For cantilever or singly-propped retaining walls, it is suggested the design be based on a triangular pressure distribution of lateral pressures using the parameters shown in Table 1.

Table 1 – Likely Earth Pressures for Retaining Walls

Unit	Earth Pressure Coefficients		
	Unit weight (kN/m^3)	'Active' K_a	'At Rest' K_0
Soil and Residual Clays	20	0.40	0.55
Very Low Strength Rock - Jointed	22	0.25	0.38
Low Strength Sandstone - Jointed	24	0.20	0.34

For rock classes refer to Pells et al "Design Loadings for Foundations on Shale and Sandstone in the Sydney Region". Australian Geomechanics Journal 1978.

It is to be noted that the earth pressures in Table 1 assume a level surface above the wall, do not account for any surcharge loads and assume retaining walls are fully drained. Rock strength and relevant earth pressure coefficients are to be confirmed on site by the geotechnical consultant.

All retaining walls are to have sufficient back-wall drainage and be backfilled immediately behind the wall with free-draining material (such as gravel). This material is to be wrapped in a non-woven Geotextile fabric (i.e. Bidim A34 or similar), to prevent the drainage from becoming clogged with silt and clay. If no back-wall drainage is installed in retaining walls, the likely hydrostatic pressures are to be accounted for in the structural design.

15. Foundations

Concrete slabs supported directly off Low Strength Rock are suitable footings for the proposed inclinator landings. This ground material is expected to be exposed across the entire base of the excavation, and exposed at the surface in the location of the proposed upper landing (Photo 4).

Piers supported off medium strength rock are suitable footings for the proposed inclinator rail. This material is expected at a maximum depth of ~1.5m below the current surface.

A maximum allowable bearing pressure of 600kPa can be assumed for footings on medium strength rock.

Naturally occurring vertical cracks (known as joints) commonly occur in sandstone. These are generally filled with soil and are the natural seepage paths through the rock. They can extend to depths of several metres and are usually relatively narrow but can range between 0.1 to 0.8m wide. If a footing falls over a joint in the rock, the construction process is simplified if, with the approval of the structural engineer, the joint can be spanned or, alternatively, the footing can be repositioned so it does not fall over the joint.

NOTE: If the contractor is unsure of the footing material required, it is more cost-effective to get the geotechnical consultant on site at the start of the footing excavation to advise on footing depth and material. This mostly prevents unnecessary over-excavation in clay-like shaly rock but can be valuable in all types of geology.

REQUIRED INSPECTIONS ARE ON THE NEXT PAGE

16. Inspections

The client and builder are to familiarise themselves with the following required inspections as well as council geotechnical policy. We cannot provide geotechnical certification for the owners or the regulating authorities if the following inspections have not been carried out during the construction process.

- During the excavation process, the geotechnical consultant is to inspect the cut faces as they are lowered in 1.5m intervals to ensure ground materials are as expected and that there are no wedges or other defects present in the rock that may require additional support.

- All footings are to be inspected and approved by the geotechnical consultant while the excavation equipment is still onsite and before steel reinforcing is placed or concrete is poured.

White Geotechnical Group Pty Ltd.

Ben White M.Sc. Geol.,
AusIMM., CP GEOL.
No. 222757
Engineering Geologist.

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Important Information about Your Report

It should be noted that Geotechnical Reports are documents that build a picture of the subsurface conditions from the observation of surface features and testing carried out at specific points on the site. The spacing and location of the test points can be limited by the location of existing structures on the site or by budget and time constraints of the client. Additionally, the test themselves, although chosen for their suitability for the particular project, have their own limiting factors. The testing gives accurate information at the location of the test, within the confines of the test's capability. A geological interpretation or model is developed by joining these test points using all available data and drawing on previous experience of the geotechnical consultant. Even the most experienced practitioners cannot determine every possible feature or change that may lie below the earth. All of the subsurface features can only be known when they are revealed by excavation. As such, a Geotechnical report can be considered an interpretive document. It is based on factual data but also on opinion and judgement that comes with a level of uncertainty. This information is provided to help explain the nature and limitations of your report.

With this in mind, the following points are to be noted:

- If upon the commencement of the works the subsurface ground or ground water conditions prove different from those described in this report, it is advisable to contact White Geotechnical Group immediately, as problems relating to the ground works phase of construction are far easier and less costly to overcome if they are addressed early.

- If this report is used by other professionals during the design or construction process, any questions should be directed to White Geotechnical Group as only we understand the full methodology behind the report's conclusions.

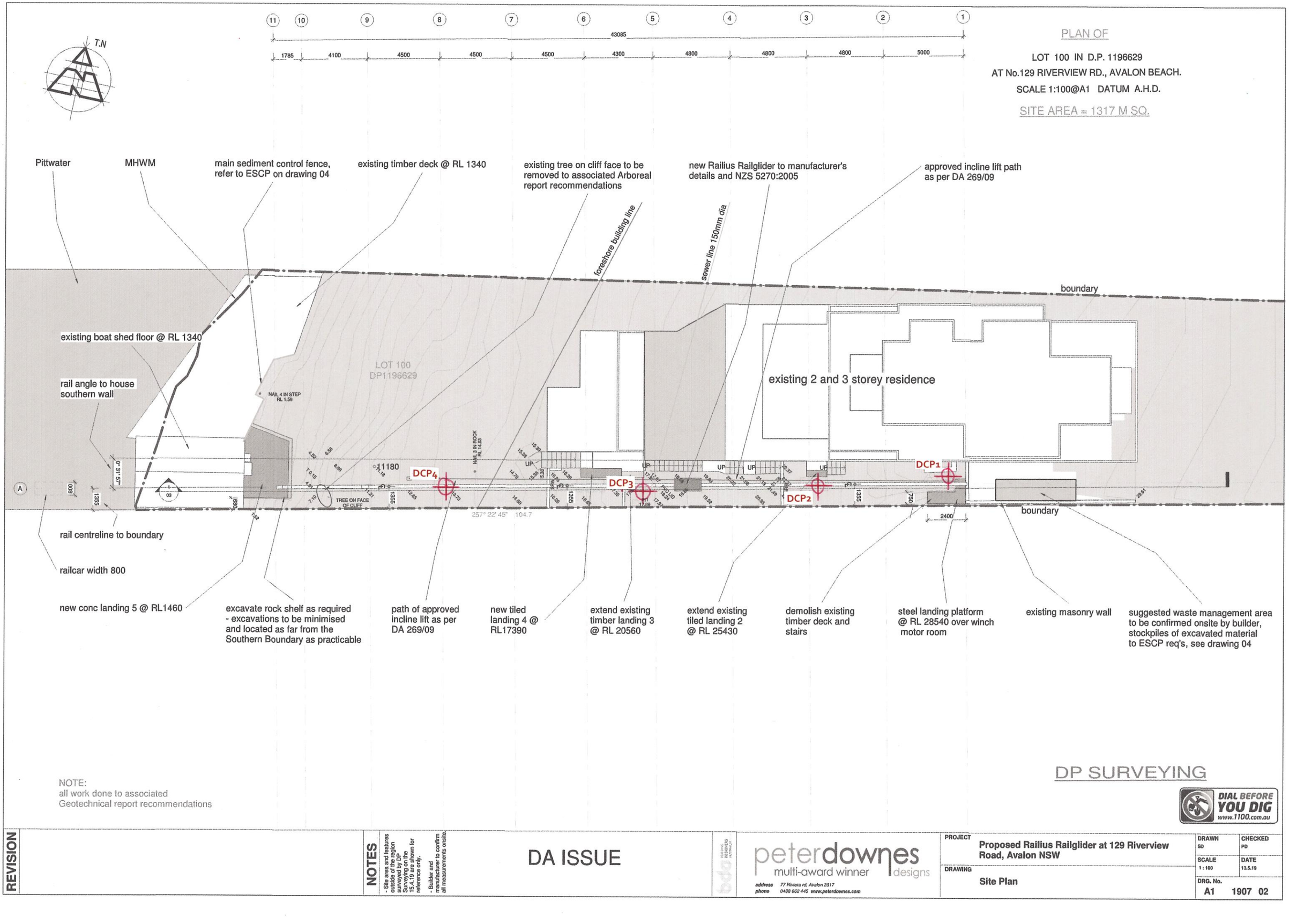
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- This report should not be applied to any other project other than that outlined in section 1.0.

- This report is to be read in full and should not have sections removed or included in other documents as this can result in misinterpretation of the data by others.

- It is common for the design and construction process to be adapted as it progresses (sometimes to suit the previous experience of the contractors involved). If alternative design and construction processes are required to those described in this report, contact White Geotechnical Group. We are familiar with a variety of techniques to reduce risk and can advise if your proposed methods are suitable for the site conditions.

SITE PLAN – showing test locations



NOTE:
all work done to associated
Geotechnical report recommendations

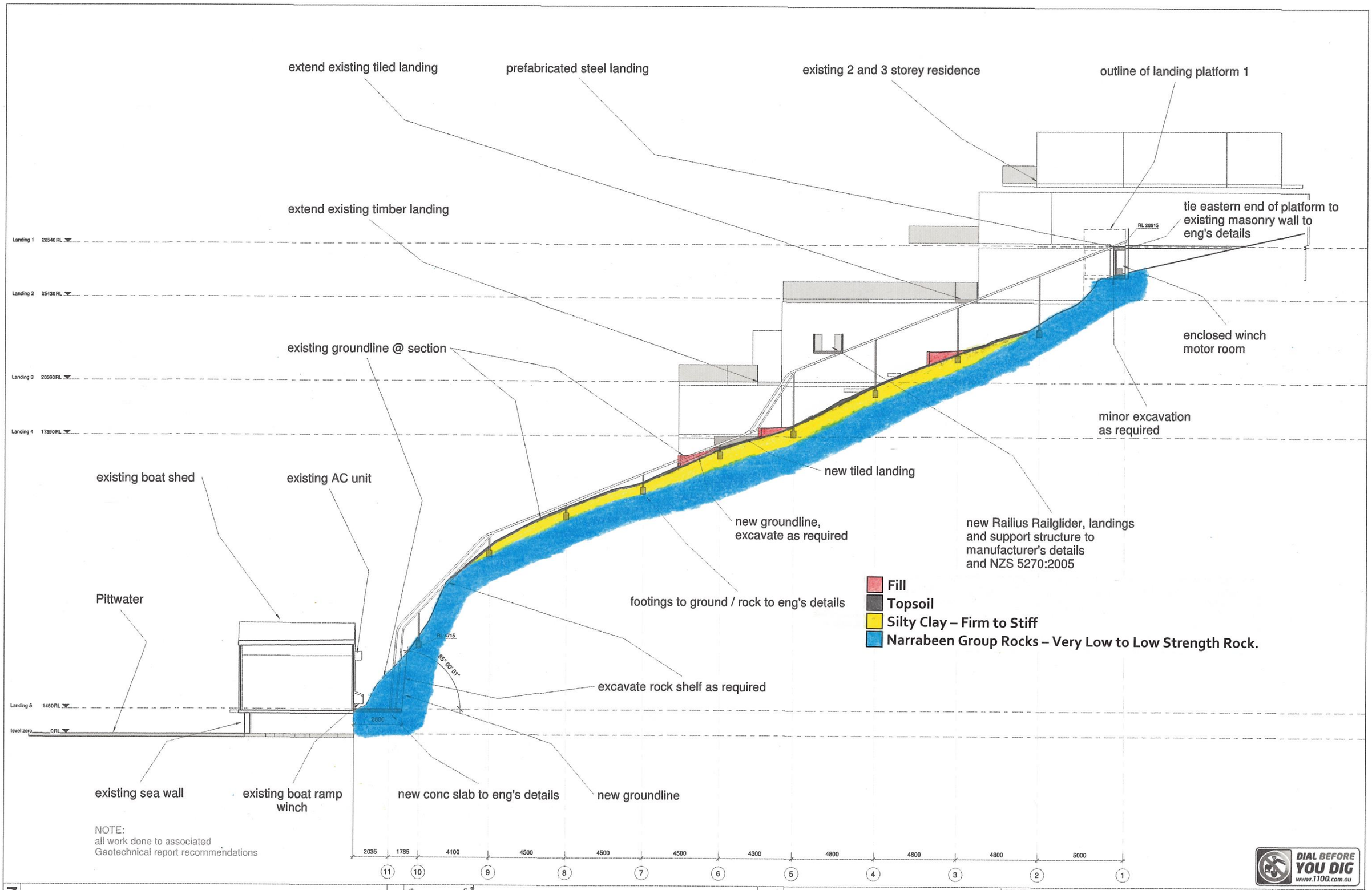
DP SURVEYING

DIAL BEFORE YOU DIG www.1100.com.au

REVISION	NOTES	DA ISSUE	peterdownes multi-award winner designs
	- Site area and features outside of the region surveyed by DP Surveying on the 15.4.19 are shown for reference only. - Builder and manufacturer to confirm all measurements onsite.		address 77 Riviera rd, Avalon 2017 phone 0488 662 445 www.peterdownes.com

PROJECT	Proposed Railius Railglider at 129 Riverview Road, Avalon NSW	DRAWN SD	CHECKED PD
DRAWING	Site Plan	SCALE 1 : 100	DATE 13.5.19
		DRG. No. A1	1907 02

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



NOTE:
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Geotechnical report recommendations

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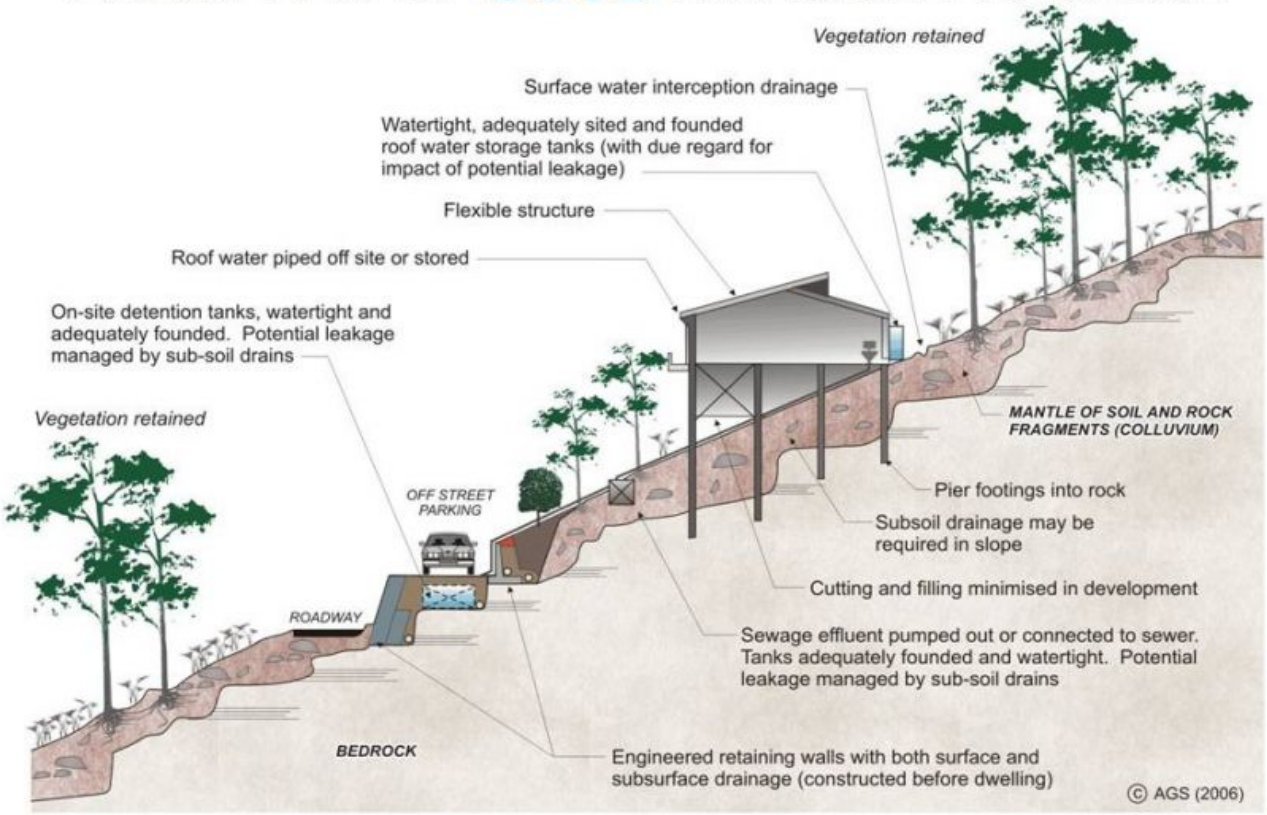
REVISION	NOTES			
	- Site area and features outside of the region surveyed by DP surveying on the 15.4.19 are shown for reference only. - Builder and manufacturer to confirm all measurements onsite.	DA ISSUE	peterdownes multi-award winner designs address 77 Riviera rd, Avalon 2017 phone 0488 662 445 www.peterdownes.com	PROJECT: Proposed Railius Railglider at 129 Riverview Road, Avalon NSW DRAWING: Section 1 DRAWN: SD CHECKED: PD SCALE: 1 : 100 DATE: 13.5.19 DRG. No. A1 1907 03

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE