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

Development Application for _____
Name of Applicant

Address of site **56 Central Road, Avalon**

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 13/04/16 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.
I have:

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.

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

Geotechnical Report Details:

Report Title: Geotechnical Report **56 Central Road, Avalon**

Report Date: 08/04/16

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 **56 Central 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 **56 Central Road, Avalon**

Report Date: 08/04/16

Author : BEN WHITE

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

Please mark appropriate box

- ☒ Comprehensive site mapping conducted 07/04/16 (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 07/04/16
- ☒ 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:

Alterations & Additions at **56 Central Road, Avalon**

1. Proposed Development

1.1 Widen the existing driveway.

1.2 Extend the lower and upper sides of the house.

1.3 Various internal and external modifications.

1.4 Details of the proposed development are shown on 8 drawings prepared by Sammy Fedele Architectural Drafting Services, job number 24/16, drawings numbered DA01a, 02, 03, 05, 06, 08 & 09 are dated 16/02/16 and DA07 is dated 29/09/15.

2. Site Description

2.1 The site was inspected on the 7th April, 2016.

2.2 This residential property is on the high side of the road and has a S aspect. The block is located on the moderately graded middle reaches of a hillslope that rises to a NW trending ridge. From the road frontage the slope rises uniformly at an average angle of ~13° to the upper boundary. The slope above the property continues at gradually increasing angles. The land surface below gradually eases as the toe of the slope is approached.

2.3 At the road frontage a concrete driveway extends up and across the slope to a car parking area below the house (Photo 1 & 2). The cut batters for the road and driveway are mostly supported by treated pine retaining walls that appear well constructed. A small portion of the cut is supported by concrete block and formed concrete retaining walls that are currently considered stable and will be demolished as part of the proposed works. The two storey brick and timber framed house is in good condition for its age. No signs of movement were observed in its external supporting brick walls. Access to the interior of the house was not available at the time of the inspection. A cut has been made into the slope for the lower ground floor level. A band of competent, medium strength sandstone outcrops in this area and the lower half of the cut has been made through the rock (Photo 3 & 4). The upper portion of the cut has been slightly battered upslope and is covered with Geotextile fabric and wire mesh that is pinned to the rock and soil (Photo 5). From what could be seen the covered ground materials consist of a shallow sandy soil and a low fill from excavations uphill. No significant signs of movement were observed in this area

and it is currently considered stable. Another low cut to a maximum height of ~1.0m has been made upslope, above the deck. It is supported by a stable, mortared rock retaining wall. The land surface above is lawn covered with a scattering of sandstone exposed at the surface. A well-constructed timber framed studio is located near the upper boundary of the property and a large sandstone floater is located on the upper boundary (Photo 6 to 8). The floater is partially embedded in the slope and shows no signs of movement.

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.

4. Subsurface investigation

Seven Dynamic Cone Penetrometer (DCP) tests were put down to determine the relative density of the overlying soil and the depth to weathered rock. The location 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. With this in mind the results are as follows:

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	DCP 2	DCP 3	DCP 4	DCP 5	DCP 6	DCP 7
0.0 to 0.3	1F	1F	#	#	1F	6	1F
0.3 to 0.6	4	7			13	13	16
0.6 to 0.9	17	12			24	28	42
0.9 to 1.2	21	20			11	#	
1.2 to 1.5	25	37			#		
1.5 to 1.8	42	#					
1.8 to 2.1	#						
	End of Test @ 1.8m	End of Test @ 1.6m	Medium Strength sandstone exposed	Medium Strength sandstone exposed	Refusal on Rock @ 1.0m	Refusal on Rock @ 0.9m	End of Test @ 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 – End of test @ 1.8m, DCP still very slowly going down, wet muddy tip.
DCP2 – End of test @ 1.6m, DCP still very slowly going down, clean dry tip, yellow sandy clay in collar above tip.
DCP3 – Medium strength sandstone exposed at the surface.
DCP4 – Medium strength sandstone exposed at the surface.
DCP5 – Refusal on rock @ 1.0m, DCP bouncing off rock surface, red rock fragments on wet tip.
DCP6 – Refusal on rock @ 0.9m, DCP bouncing off rock surface, clean dry tip.
DCP7 – End of test @ 0.7m, DCP thudding on rock, clean dry tip.

5. Geological Interpretation

The slope materials are colluvial at the near surface and residual at depth. DCP 1 and 2 indicate the lower half of the property is underlain by clays and shales of the Narrabeen Group. Visual observations of exposed sandstone and DCP's 5 to 7 indicate a band of medium strength sandstone underlies the upper half of the property. The shales are overlain by a thin sandy topsoil over sandy clays and clays with extremely low strength shale expected at an average depth of ~1.7m below the current surface. It is to be noted that this material is a soft rock and can appear as a mottled stiff clay when it is cut up by excavation equipment. Where sandstone is not exposed it is expected at a maximum depth of ~1.0m below the current surface.

6. Groundwater

Normal ground water seepage is expected to move over the buried surface of the clay and rock and through the cracks in the rock.

Due to the slope and elevation of the block, the water table in the location 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. It is expected that normal sheet wash from the slope above moves onto the property during heavy downpours.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above, beside or below the property. The proposed excavations are a potential hazard until retaining walls are in place (**Hazard One & Two**). The vibrations that will be produced during the proposed excavations for the upper extension are a potential hazard (**Hazard Three**).

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two	Hazard Three
TYPE	The proposed excavation to lower the existing driveway that lines the lower wall of the house undercutting its footings and causing failure.	The proposed excavations collapsing onto the work site before the retaining walls are in place.	The vibrations produced during the proposed excavations for the upper extension impacting on the supporting brick walls of the house.
LIKELIHOOD	'Likely' (10^{-2})	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (20%)	'Medium' (25%)	'Medium' (15%)
RISK TO PROPERTY	'High' (2×10^{-3})	'Moderate' (2×10^{-4})	'Moderate' (2×10^{-4})
RISK TO LIFE	6.5×10^{-5}/annum	8.4×10^{-6}/annum	5.8×10^{-7}/annum
COMMENTS	This level of risk to life and property is 'UNACCEPTABLE'. To move the risk levels to acceptable levels the recommendations in **Section 13** are to be followed.	This level of risk to life and property is 'UNACCEPTABLE'. To move the risk levels to acceptable levels the recommendations in **Section 13** are to be followed.	This level of risk to property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels the recommendations in **Section 12** 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.

The fall is to the street below. All stormwater or drainage runoff from the proposed development is to be piped to the street drainage system below.

11. Excavations.

An excavation to a maximum depth of ~1.0m will be required to lower the existing driveway. This is expected to be through a shallow topsoil over a firm to stiff clay. A stepped excavation is required to install the uphill extension. The lower step is some 2.4m in height and the upper will reach a depth of ~1.5m. The two steps are at least ~3.0m apart. Where rock is not exposed at the surface it is expected to be overlain by a shallow fill and sandy soil over a sandy clay with rock expected at average depth of ~0.8m below the current surface. It is envisaged that excavations through fill, sandy soil and sandy clays can be carried out with a bucket and excavations through rock will require grinding or rock sawing and breaking.

12. Vibrations.

Possible vibrations generated during excavations through fill, sandy soils and sandy clays will be below the threshold limit for building damage.

It is expected that most of the excavations for the upper extension will be through medium strength sandstone or better. Excavations through rock should be carried out to minimise the potential to cause vibration damage to the existing house and neighbouring properties. The proposed excavations will be immediately beside the supporting walls of the house and the W common boundary will be as close as ~1.5m. Close controls by the contractor over rock excavation are recommended so excessive vibrations are not generated.

Excavation methods are to be used that limit peak particle velocity to 10mm/sec at the common boundaries or the supporting brick walls of the house, whichever is closer. 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 common boundaries and supporting brick walls of the house 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 apartment block and neighbouring properties.

13. Excavation Support Requirements

The proposed excavation to lower the existing driveway will be immediately below the downhill supporting wall of the house.

Before any excavations for the driveway lowering can commence the depth of the footing for the downhill wall of the house is to be confirmed. This can be completed with small pits dug by the builder beside the wall to expose the footing material. Upon completion the pits are to be inspected by the geotechnical professional to confirm the footing material. Given the age and construction of the house it is likely supported on shallow strip footings taken to the natural firm to stiff sandy clays. Where the footings of the house are within the excavations zone of influence they are to be underpinned to below it. In this instance the zone of influence is the area above a theoretical 45^{o} line from the base of the excavation towards the surrounding footings.

Any underpinning is to follow an underpinning sequence as specified by the structural engineer. Under no circumstances is the bulk excavation to be taken to the edge of the house wall or footing and then underpinned. The underpins are to be carried out in drives pushed forward from beyond the zone of influence following the underpinning sequence. Under pins should not exceed 0.6m in width. Allowances are to be made for drainage through the underpinning to prevent a build-up of hydrostatic pressure. Underpins that are not designed as retaining walls are to be supported by retaining walls. The void between the retaining walls and the underpinning is to be filled with free draining material such as gravel.

Where underpinning is not required for the excavation to lower the existing driveway, the soil and clay portions of the cut will stand at near vertical angles for short periods of time until the retaining walls are installed provided the cut batters are kept from becoming saturated.

The portion of the house above the lower cut for the uphill extension will be demolished as part of the proposed works. The fill and soil portions of both lower and upper cut batters for the uphill extension are to be battered temporarily at 1.0 Vertical: 1.7 Horizontal (30°) until retaining walls are in place. The firm to stiff sandy clay portions of the cuts will stand for a short period of time until retaining walls are installed provided they are prevented from becoming saturated. Excavations through medium strength sandstone will stand at vertical angles unsupported subject to approval by the geotechnical professional.

The geotechnical professional is to inspect the lower cut face for the uphill extension during the excavation process to ensure ground materials are as expected and no additional support is required.

Exposed cut batters through fill, soil and clay are to be covered to prevent access of water in wet weather and loss of moisture in dry weather. The covers are to be tied down with metal pegs or other suitable fixtures so they can't blow off in a storm. 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 excavations they can be constructed as soon as possible. The excavations are to be carried out during a dry period. No excavations are to commence if heavy or prolonged rainfall is forecast.

All excavation spoil is to be removed from site, be battered back to an angle of 1.0 Vertical to 2.0 Horizontal (26°) or be supported by engineered retaining walls.

14. Retaining Walls

Retaining walls supporting soil and clay can be designed for a lateral earth pressure coefficient K_a of 0.35 and assume a bulk density of 20kN/m^3. Cuts through medium strength sandstone or better will exert no earth pressure, subject to confirmation from the geotechnical professional.

Any surcharge loads that may act on the walls are to be accounted for in the design.

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 design.

15. Site Classification

The site classification in accordance with AS2870-2011 is Class M.

16. Foundations

The footing material for the lower supporting wall of the house could not be observed during the site visit. It is expected that it is supported on the underlying firm to stiff clays of the natural profile. As exploration pits will already be required to determine the footing material of this wall (See **Section 13**), we recommend the footings for the proposed downhill extension be taken to the same ground material that is observed in the pits.

The upper walls of the house can be seen to be supported on the exposed medium strength sandstone. Pads, shallow piers or strip footings supported on the underlying medium strength sandstone are suitable footings for the proposed uphill extension. Where this ground material is not exposed at the base of the cut it is expected at a maximum depth of ~1.0m below the current surface. A maximum allowable bearing pressure of 1.2MPa can be assumed for footings on medium strength sandstone.

A concrete slab supported on the underlying firm to stiff clays is a supporting footing for the proposed driveway. A maximum allowable bearing pressure of 200kPa can be assumed for footings on firm to stiff clay.

As the bearing capacity of clay reduces when it is wet we recommend the footings be dug, inspected and poured in quick succession (ideally the same day if possible). If the footings get wet they will have to be drained and the soft layer of wet clay or shale on the footing surface will have to be removed before concrete is poured.

If a rapid turnaround from footing excavation to the concrete pour is not possible a sealing layer of concrete may be added to the footing surface after it has been cleaned.

NOTE: If the contractor is unsure of the footing material required it is more cost effective to get the geotechnical professional 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.

SEE THE REQUIRED INSPECTIONS OVER THE PAGE

17. 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 Occupation Certificate if the following inspections have not been carried out during the construction process.

- The geotechnical professional is to inspect any exploration pits that will be required to confirm the depth and ground materials at the base of the footings for the downhill wall of the house.

- The geotechnical professional is to inspect the lower cut face for the uphill extension during the excavation process to ensure ground materials are as expected and no additional support is required.

- All footings are to be inspected and approved by the geotechnical professional before concrete is placed.

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 tests 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 professional. 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.

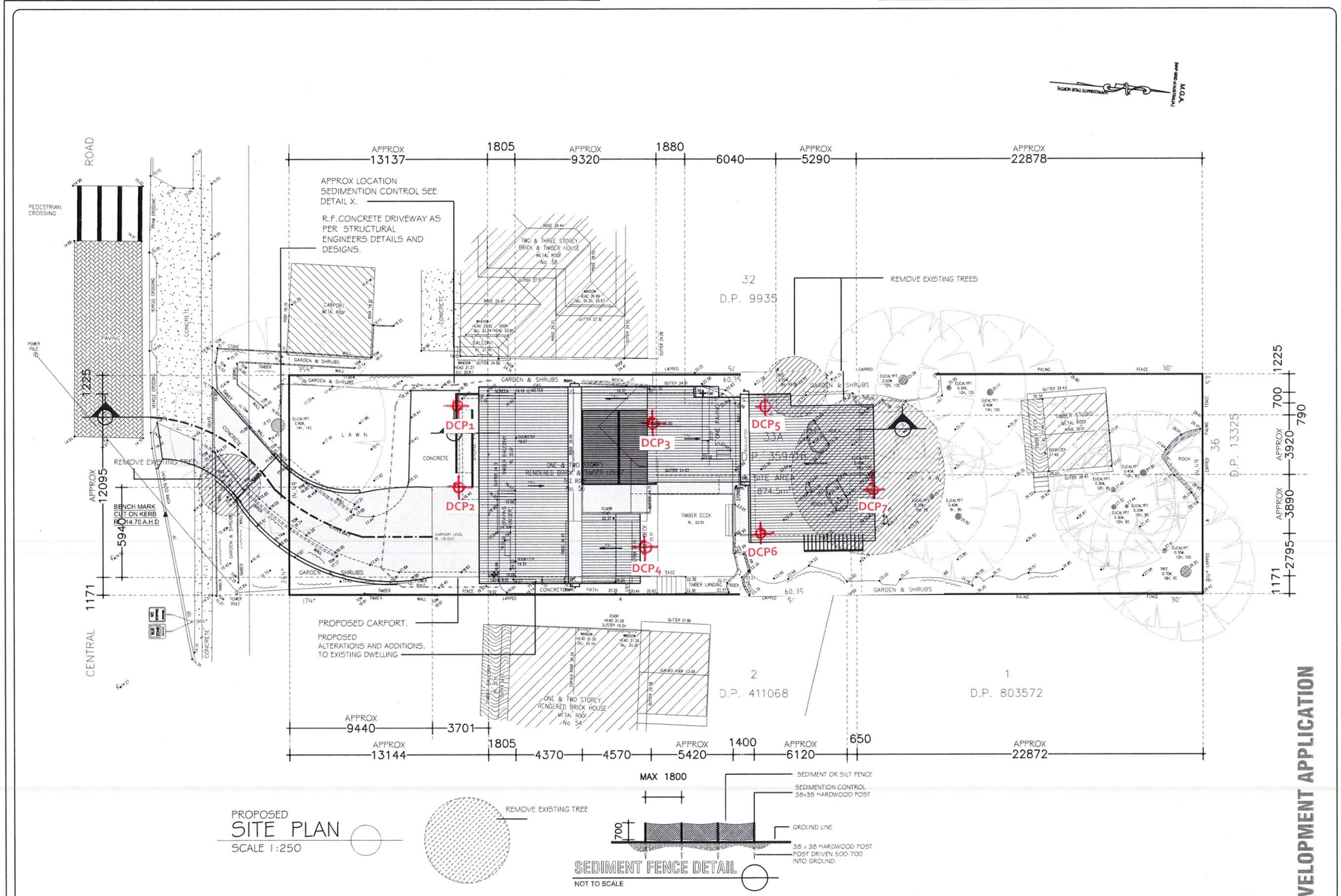
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



PROPOSED
SITE PLAN
SCALE 1:250

SEDIMENT FENCE DETAIL
NOT TO SCALE

DEVELOPMENT APPLICATION

A3

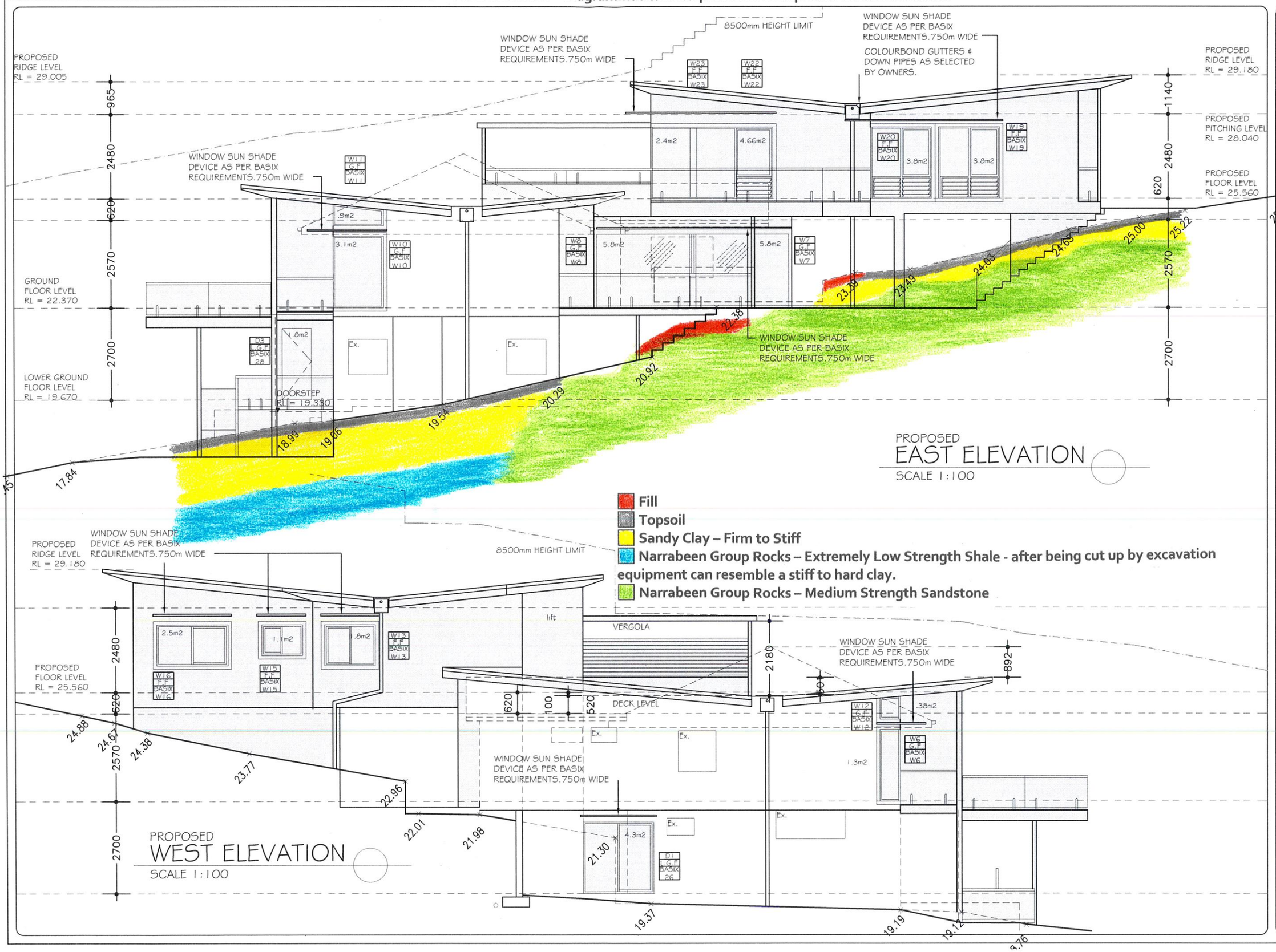
SITE PLAN

SCALE: 1:250
DATE: 16.02.2016
REV:
SHEET No : DA01a
JOB: 24/15

CLIENT : Mr & Mrs R. & J. RAINE
PROPOSED : ALTERATIONS AND ADDITIONS TO EXISTING RESIDENCE.
ADDRESS : 56 CENTRAL ROAD, DP 359416
AVALON LOT 33A
NSW 2107 LGA PITTWATER COUNCIL

Architectural Drafting Services
0404 037 606
email:sammyfedele@iprimus.com.au
Sammy Fedele
abn 36 627 684 311

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



A3

ELEVATION

SCALE: 1:100 | DATE: 16.02.2016 | REV: | JOB: 24/15 | SHEET No : DA09

CLIENT : Mr & Mrs R. & J. RAINE

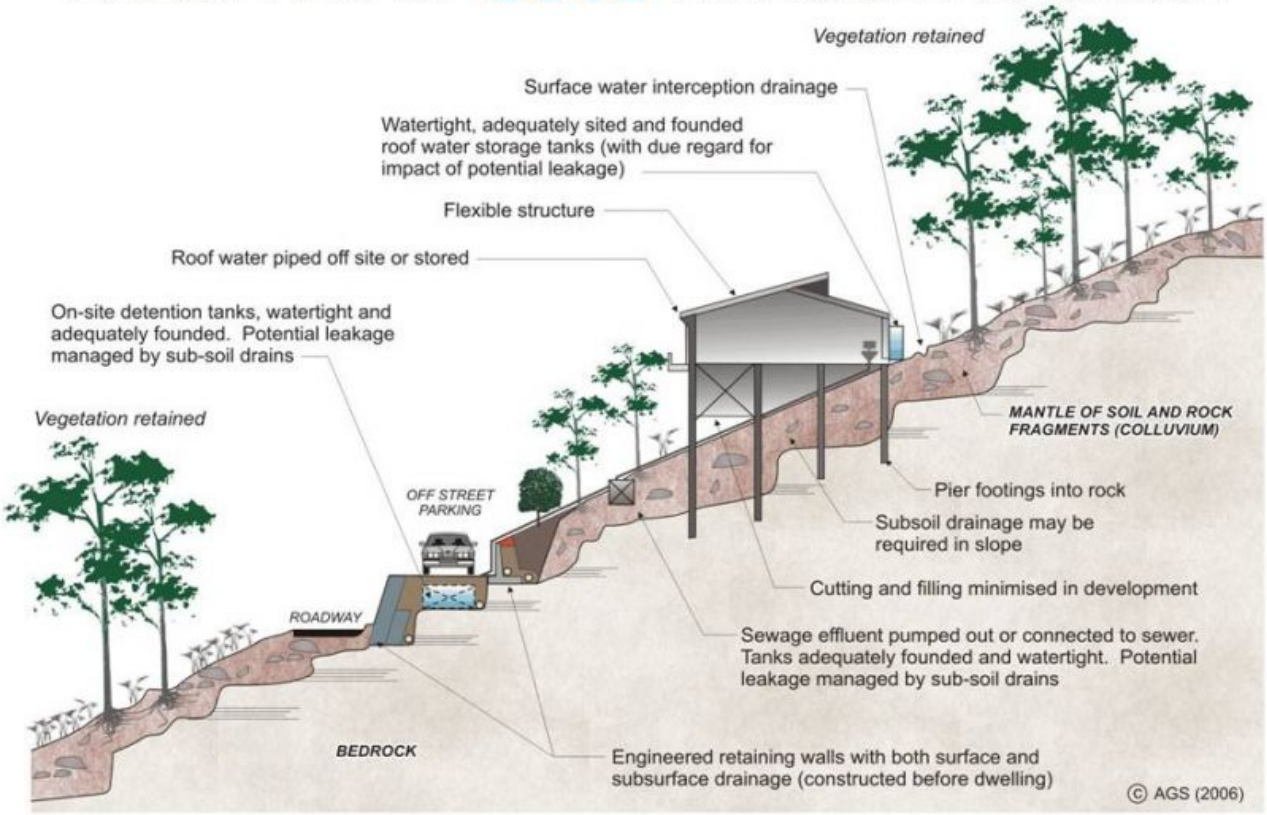
PROPOSED : ALTERATIONS AND ADDITIONS TO EXISTING RESIDENCE.

ADDRESS : 56 CENTRAL ROAD, AVALON NSW 2107

DP 359416
LOT 33A
LGA PITTWATER COUNCIL

Architectural Drafting Services
0404 037 606
email:sammyfedele@iprimus.com.au
Sammy Fedele
abn 36 627 864 311

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE