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

Development Application for _____
Name of Applicant

Address of site **37 Hilltop 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 19/10/16 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 **37 Hilltop Road, Avalon**

Report Date: 14/10/16

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 **37 Hilltop 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 **37 Hilltop Road, Avalon**

Report Date: 14/10/16

Author : BEN WHITE

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

Please mark appropriate box

☒ Comprehensive site mapping conducted 13/10/16 (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 13/10/16

☒ 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 **37 Hilltop Road, Avalon**

1. Proposed Development

1.1 Construct a garage, additional level and staircase under the existing house.

1.2 Various internal and external modifications.

1.3 Details of the proposed development are shown on 5 drawings prepared by Stephen Crosby & Associates, drawings numbered 2136-DA01 to 05 dated September, 2016.

2. Site Description

2.1 The site was inspected on the 13th October, 2016.

2.2 This residential property is on the high side of the road and has a NW aspect. It is located on the gentle to steeply graded upper W flank of a NE trending ridge. From the road frontage the slope briefly rises at gentle angles over the road reserve before quickly increasing to an average angle of ~20° that gradually increases to a maximum angle of ~30° across the upper three quarters of the block. The slope below the property continues at similar angles. The grade above quickly eases as the crest of the slope is approached.

2.3 At the road frontage a concrete driveway runs up the slope to a parking area and shed under the house (Photo 1). This area has been cut into the slope. The upper S portion of the cut is supported by stepped brick, concrete crib and concrete block retaining walls (Photo 2 & 3). The upper concrete crib and concrete block walls display movement but will be demolished as part of the proposed works. The lower brick retaining wall is in good condition. A supporting brick wall of the house is located to the N of the stepped retaining walls (Photo 4). Below the wall a cut has been made into the slope to widen the existing parking area and to install a shed. The uphill side of the cut has undercut the supporting brick wall of the house (Photo 5). The excavation is either supported by the walls of the shed or a door with sandstone blocks holding it in place (Photo 5 & 6). The undercut footing and the unsupported cut below does not meet current engineering standards and our recommendations are outlined in **Section 17**. The shed will be demolished as part of the proposed works. Some loose soil has been scattered over the slope, under the N side of the house (Photo 7). We were informed by the owner that it will be removed

during the excavation process for the proposed works. The old single storey timber framed house is suspended on steel posts, brick walls and brick piers. One of the brick piers is tilting at a maximum angle of ~6° from vertical and two of the steel posts are tilting to a maximum angle of ~2° downslope (Photos 8 & 9). The remaining steel posts and brick piers stand vertical. It is likely the tilting brick pier will be replaced as part of the proposed works. If this is not the case we recommend it be rebuilt to current engineering standards. It should be noted that the tilting steel posts will be removed as part of the proposed works. A cut has been made into the slope for a level area above the house. It is supported by a combination of stack rock and dimensioned sandstone block retaining walls (Photo 10). The walls appear well constructed. The land surface above rises at steep angles and has a scattering of trees with a ground cover of shrubs (Photo 11). Competent, medium strength sandstone beds outcrop along the upper boundary of the property and likely mark the contact point with Hawkesbury Sandstone (Photo 12).

3. Geology

The Sydney 1:100 000 Geological sheet indicates the site is underlain by the Newport Formation of the Narrabeen Group with the contact point of Hawkesbury Sandstone near the upper boundary. The proposed works will be underlain by the Narrabeen Groups rock which is described as interbedded laminite, shale and quartz to lithic quartz sandstone.

4. Subsurface Investigation

One Hand Auger Hole (AH) was put down to identify the soil materials. Six DCP (Dynamic Cone Penetrometer) 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. This is not expected to be an issue for the testing on this site and the results are as follows:

AUGER HOLE 1 (~RL 55.8) **–** AH1 (Photo 13)

Depth	**Material Encountered**
0.0 to 0.5	**FILL & COLLUVIUM,** mixture of brown sandy soil with small rock fragments, dry.
0.5 to 1.0	**SANDY CLAY**, brown with small rock fragments throughout, dry.
1.0 to 1.2	**WEATHERED ROCK**, red/purple, sugary texture, dry, brown sandy clay throughout (fallen from above).

Refusal @ 1.2m, grinding on weathered rock. No watertable encountered.

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 (~RL 54.6)	DCP 2 (~RL 53.0)	DCP 3 (~RL 56.0)	DCP 4 (~RL 56.4)	DCP 5 (~RL 54.3)	DCP 6 (~RL 58.0)
0.0 to 0.3	7	8F	6F	1F	4F	1F
0.3 to 0.6	11	12	5			7
0.6 to 0.9	21	18	12	11	18	12
0.9 to 1.2	36	24	29	16	31	21
1.2 to 1.5	#	21	#	#	#	34
1.5 to 1.8		#				20
1.8 to 2.1						#
	End of Test @ 1.2m	End of Test @ 1.3m	Refusal on Rock @ 1.0m	Refusal on Rock @ 1.1m	End of Test @ 1.2m	End of Test @ 1.0m

#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 @ 1.2m, DCP still very slowly going down, small amount of red rock fragments on dry tip.
DCP2 – End of test @ 1.3m, DCP thudding on rock surface, clean dry tip.
DCP3 – Refusal on rock @ 1.0m, DCP bouncing off rock surface, clean dry tip.
DCP4 – Refusal on rock @ 1.1m, DCP bouncing off rock surface, clean dry tip.
DCP5 – End of test @ 1.2m, DCP thudding on rock surface, clean dry tip.
DCP6 – End of test @ 1.0m, DCP thudding on rock surface, small amount of red rock fragments on dry tip.

5. Geological Interpretation

The slope materials are colluvial at the near surface and residual at depth. They consist of a thin sandy topsoil over sandy clays and clays with rock fragments throughout the profile. In the test locations the sandy clays and clays merge into the weathered zone of the under lying rocks at an average depth of ~1.1m below the current surface. The weathered zone is interpreted to be very low strength rock that becomes progressively stronger with depth. See the 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 clay and rock and through the cracks in the rock. Due to the slope and elevation of the block, the water table will be many metres below the base of the proposed excavation.

7. Surface Water

No evidence of surface flows were observed on the property during the inspection. Sheet wash from the slope above the house will move across the property during heavy downpours. Due to the steep slope this may reach relatively high velocities towards the house and at the base of the slope.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above, below or beside the property. The steep slope that rises across the property is considered a potential hazard (**Hazard One**). The existing supporting brick wall of the house that has been undercut is a potential hazard (**Hazard Two**). The proposed excavations are a potential hazard until retaining walls are in place (**Hazard Three**).

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two	Hazard Three
TYPE	The steep portion of the slope that rises across the property failing and impacting on the existing house and proposed works.	The portion of the supporting brick wall of the house that has been undercut causing movement of the wall and house (Photo 5).	The proposed excavation for the garage, additional level and staircase undercutting the footings of the house and collapsing onto the work site before retaining walls are in place.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})	'Likely' (10^{-2})
CONSEQUENCES TO PROPERTY	'Medium' (15%)	'Medium' (20%)	'Medium' (35%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Moderate' (2×10^{-4})	'High' (2×10^{-3})
RISK TO LIFE	5.3×10^{-7}/annum	6.4×10^{-5}/annum	1.8×10^{-4}/annum
COMMENTS	'ACCEPTABLE' level of risk.	'UNACCEPTABLE' level of risk to life and property. To move risk to acceptable levels the recommendations in **Section 17** are to be followed.	'UNACCEPTABLE' level of risk to life and property. 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.

The fall is to the street. Roof water from the development is to be piped to the street drainage system through any tanks that may be required by the regulating authorities.

11. Excavations.

The excavation for the garage will mostly reach a maximum depth of ~1.8m however on its upper N corner it will quickly increase in depth to ~3.0m where it extends beyond the existing cut in this area. The excavation is expected to be through variable depths of shallow sandy soil over a firm to stiff sandy clay with very low strength rock encountered at an average depth of ~1.1m. A cut that reaches a maximum depth of ~1.6m is required to install the proposed additional level and staircase. They are expected to be through filling up to a maximum depth of ~0.6m over a shallow sandy soil and firm to stiff sandy clay with very strength low rock expected at an average depth of ~1.1m below the current surface. It is envisaged the excavations through soil, clay and very low strength rock can be carried out with a bucket although rock will progressively become stronger with depth and it is possible that some ripping and hammering may be required. Excavation through medium strength rock or better will require grinding or rock sawing and breaking.

12. Vibrations.

Possible vibrations generated during excavations through soil, clay and very low strength rock will be below the threshold limit for building damage. These ground materials are expected across the majority of the excavations. It is possible medium strength rock or better will be encountered on the uphill, deeper areas of the cuts. These portions of the excavations will require grinding or rock sawing and breaking to reduce the vibrations produced.

Excavations through medium strength rock or better should be carried out to minimise the potential to cause vibration damage to the supporting walls, posts and piers of the existing house and neighbouring houses. The proposed garage excavation will be immediately beside the supporting walls, posts and piers

of the house and be as close as ~4.0m to the neighbouring houses. Close controls by the contractor over rock excavation are recommended so excessive vibrations are not generated.

Where the rock encountered is medium strength or better, excavation methods are to be used that limit peak particle velocity to 5mm/sec at the supporting walls, posts and piers of the house or common boundaries, whichever is closer. Vibration monitoring will be required to verify this is achieved if the excavation encounters medium strength rock or better. If a milling head is used to grind the rock out 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 5mm/sec at the supporting wall, posts and piers of the 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 adjoining houses.

13. Excavation Support Requirements

The proposed excavations for the garage, addition and staircase will surround the supporting brick walls, steel posts and brick piers of the house. It is assumed that the existing footings reach a depth of ~0.4m. The majority of the remaining supporting footings of the house will be inside the zone of influence of the excavation. In this instance the zone of influence is the area above a theoretical 45° line from the base of the excavation or the top of medium strength rock, whichever is encountered first.

The house is to be is to be adequately supported with propping or additional beams as required before any excavations commence. All existing footings that are to remain and that are within the zone of influence of the excavation are to be propped and underpinned to below the zone of influence or to medium strength rock, whichever is encountered first before any excavations commence. It should be noted that the N portion of the existing brick wall that has been undercut by a previous excavation will need to be underpinned as well (Photo 5).

All underpinning is to follow a 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 be underpinned. It is to be carried out prior to any excavation. 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.

Before the bulk excavation for the additional level can commence the loose soil that has been placed over the area is to be moved to below the downhill edge of the proposed excavation.

A stepped cut for the proposed additional level is shown on the plans. The distance between the steps in the excavation is to be at least equal to the largest vertical step.

Where underpinning is not required for the proposed excavations, the cut batters through fill and soil are to be battered temporarily at 1.0 Vertical: 1.7 Horizontal (30°). The clay and very low strength rock portions of the cuts will stand at near vertical angles for short periods of time until retaining walls are installed provided the cut batters are kept from becoming saturated.

All unsupported cut batters are to be covered to prevent access of water in wet weather and loss of moisture in dry weather. 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 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 0.4 and assume a bulk density of 20kN/m^3. Assume a bulk density of 22kN/m^3 and a K_a of 0.3 for very low strength rock.

Any surcharge loads that may act on the retaining 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 likely hydrostatic pressures are to be accounted for in the retaining wall design.

15. Site Classification

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

16. Foundations

A concrete slab supported on the underlying very low strength rock is a suitable footing for the proposed garage. Where this ground material is not exposed at the base of the excavation shallow piers or extended rafts will be required to ensure a uniform bearing material across the structure. A maximum allowable bearing pressure of 600kPa can be assumed for footings on very low strength rock. It should be noted that this material is a soft rock and a rock auger will cut through it so the builders should not be looking for refusal to end the footings.

The uphill side of the proposed additional level and stairway will be cut into the slope and its downhill edge will be suspended above the slope (where it is not above the proposed garage). Very low strength rock is expected to be exposed along the uphill cut face. To ensure a uniform bearing material across the structure pads, strip footings or piers supported on the underlying very low strength rock are suitable footings. The maximum required pier depth is not expected to exceed 1.1m below the current surface.

As the bearing capacity of very low strength rock 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 very low strength rock 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.

17. Remedial Works

The supporting brick wall of the house that has been undercut by an existing excavation (Photo 5 & 6) will require underpinning (See **Section 13** for general notes). The existing cut face that caused the undercutting of the wall will need to be supported by an engineering retaining wall, extending downhill from supporting

brick wall of the house to the upper retaining wall of the proposed garage. This work is to be completed before any excavations commence.

18. Ongoing Site Maintenance

Where slopes exceed 30° such as that above the house it is prudent for the owners to occasionally inspect the slope for signs of movement (say annually or after heavy rainfall events, whichever occurs first). Should this be observed, or any significant changes in the erosional process or drainage regime be noted a geotechnical professional should be consulted to assess the slope. The previous Risk Analysis is conditional on this general observation being carried out.

19. Inspections

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

- Any underpinning excavations are to be inspected and approved by the geotechnical professional before concrete is poured.

- All footings are to be inspected and approved by the geotechnical professional before concrete is placed while the excavation equipment is still onsite and before steel reinforcement is installed.

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

Photo 9

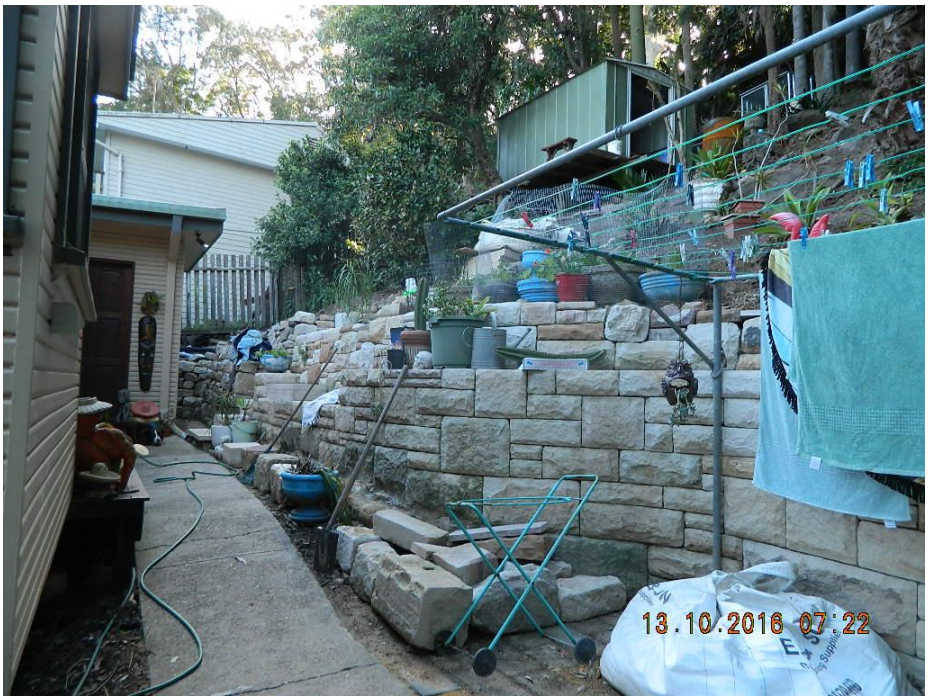


Photo 10

Photo 11

Photo 12

Photo 13 – Base of the auger is at the bottom of the picture

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.

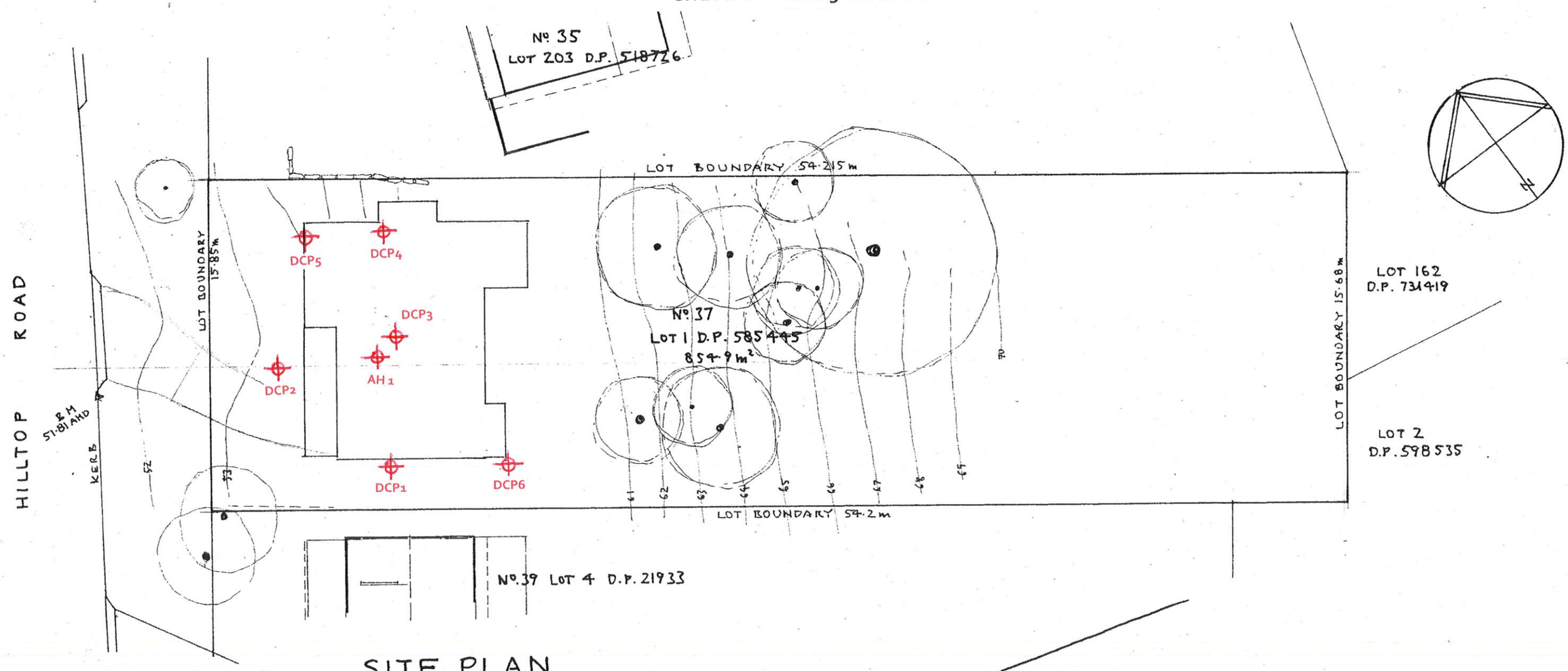
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

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

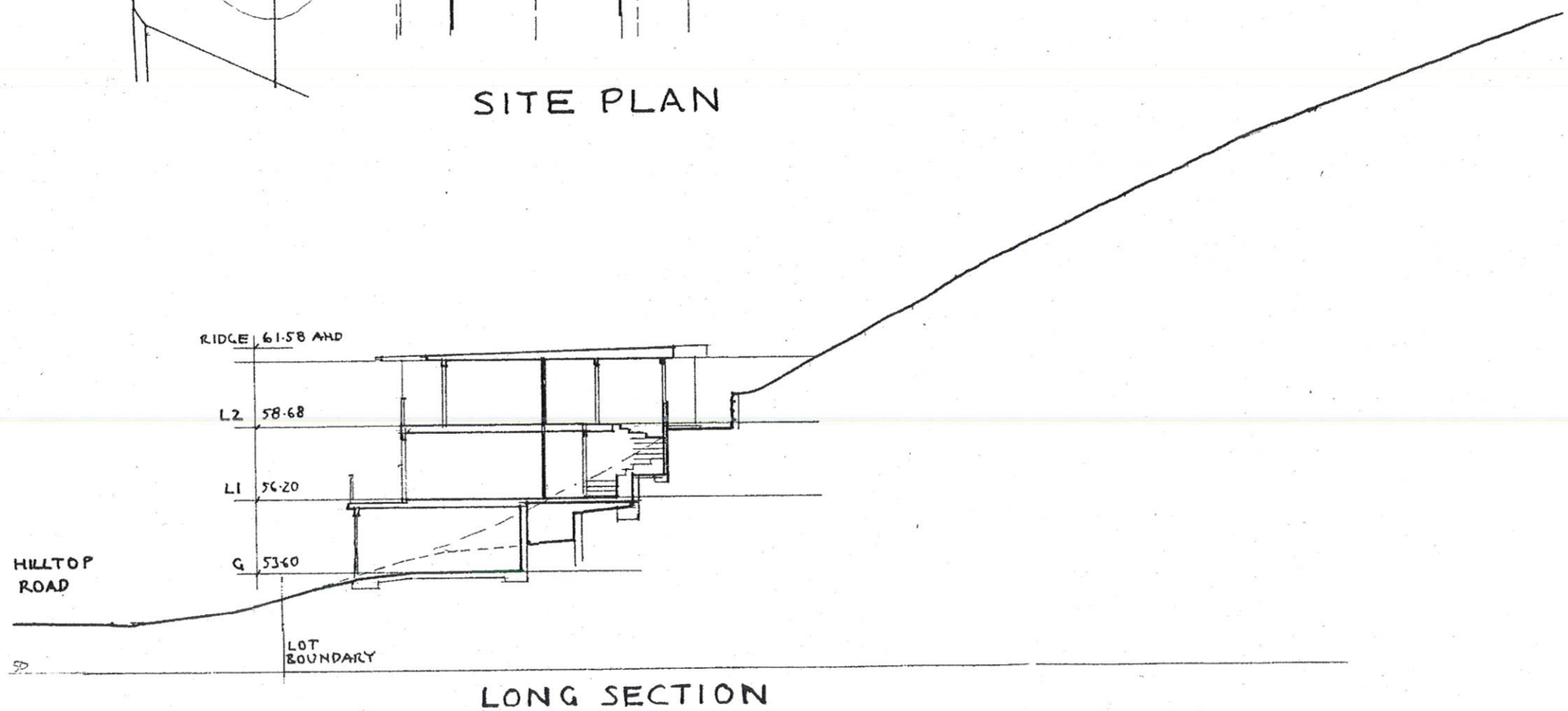
- This report is to be read in full and should not have sections removed or included in other documents as this can result in misinterpretation of the data by others.

- 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



SITE PLAN



LONG SECTION

Revisions Date

Stephen Crosby & Assoc. Pty. Ltd.

SCOTLAND ISLAND
PO Box 204 Church Pt. NSW 2105
Tel 0409 047 513 Fax (02) 9999 6272

Job

ALTERATIONS & ADDITIONS

37 HILLTOP ROAD
CLAREVILLE BEACH
Lot 1 DP 585445

For R. O'DONNELL & L. VERNON

Drawing

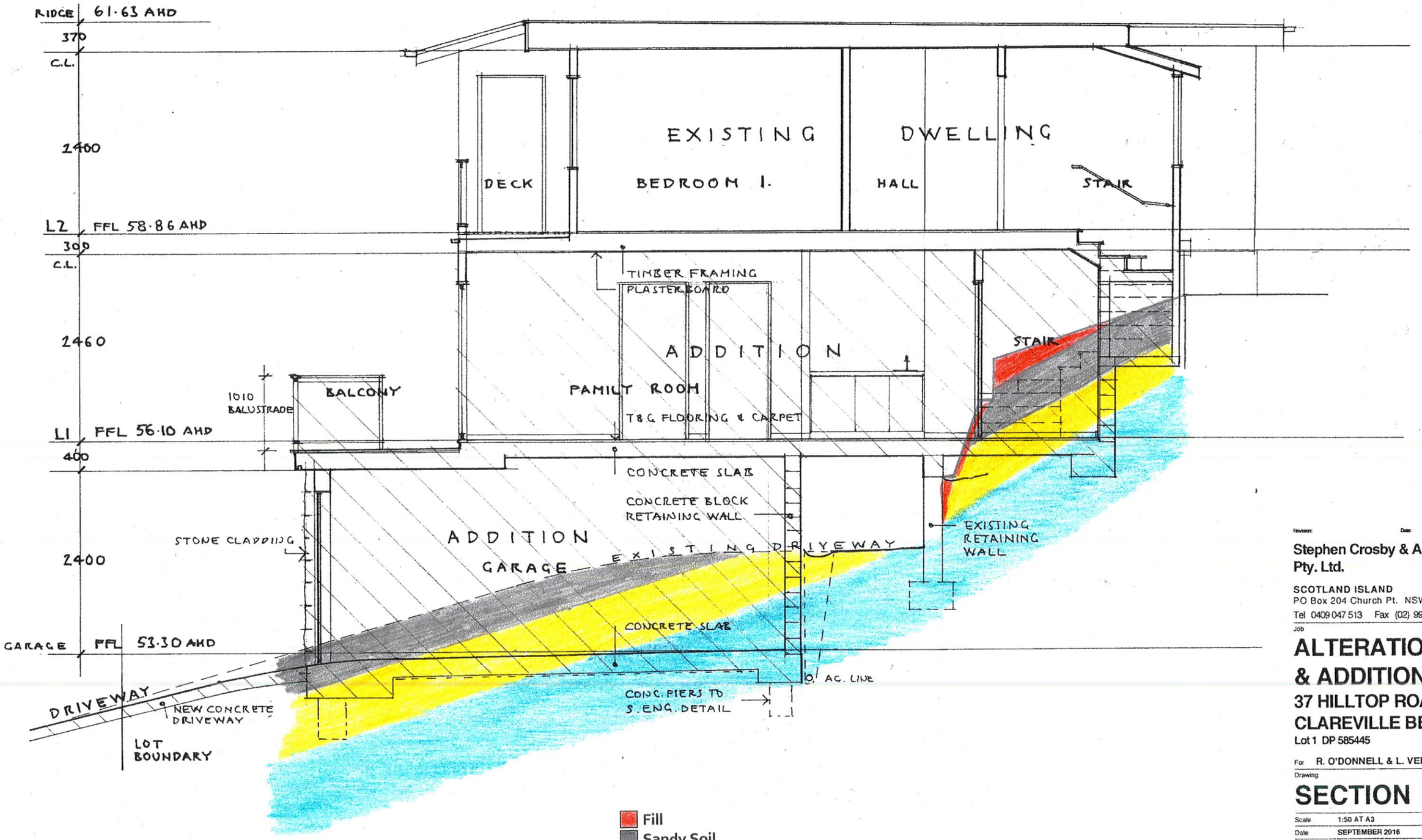
SITE PLAN & LONG SECTION

Scale	1:200 AT A3
Date	SEPTEMBER 2016
Drawn	S.C.

Drawing Number

2136 - **DA 01**

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



Fill
Sandy Soil
Sandy Clay – Firm to Stiff
Narrabeen Group Rocks – Very Low Strength Rock - after being cut up by excavation equipment can resemble a stiff to hard clay.

Revision: Date:

Stephen Crosby & Assoc. Pty. Ltd.

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Job

ALTERATIONS & ADDITIONS

37 HILLTOP ROAD
CLAREVILLE BEACH
Lot 1 DP 585445

For R. O'DONNELL & L. VERNON

Drawing

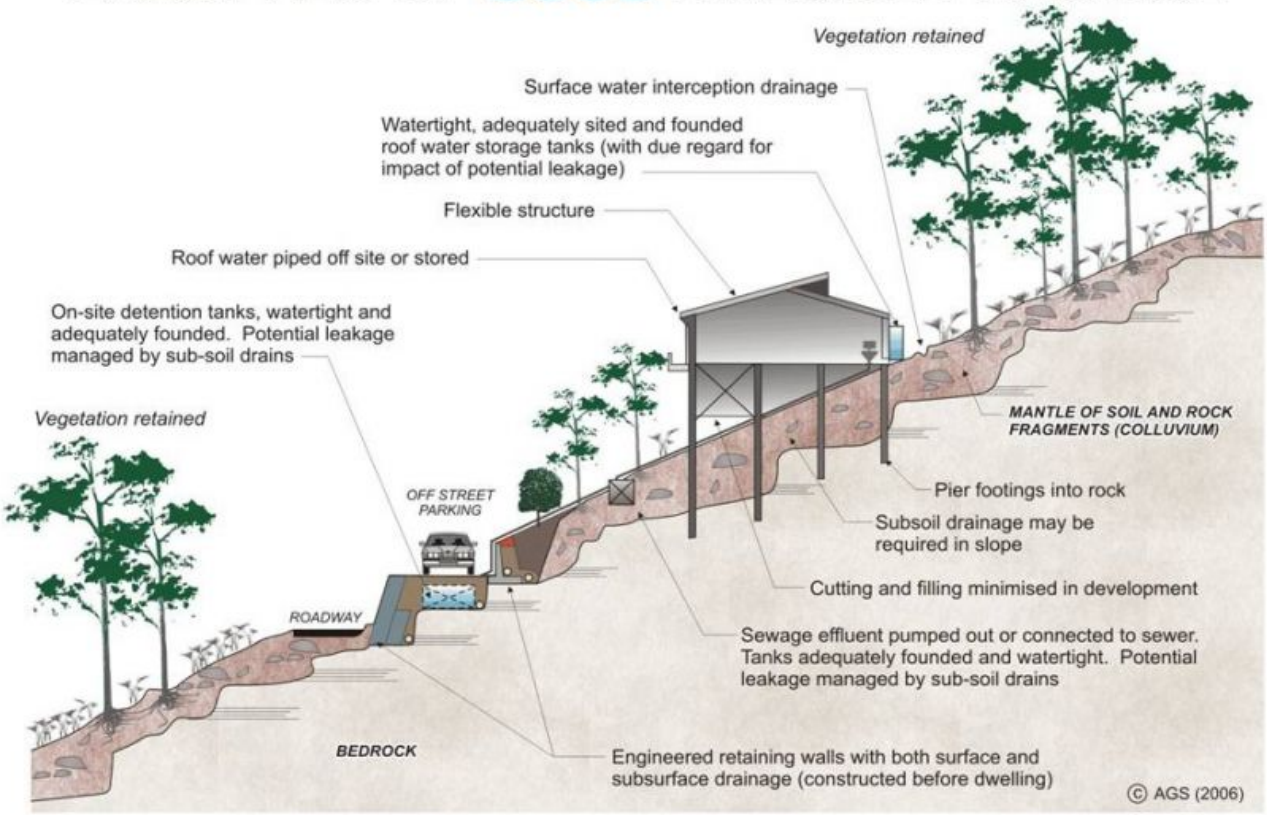
SECTION

Scale	1:50 AT A3
Date	SEPTEMBER 2016
Drawn	S.C.

Drawing Number

2136 - DA 04

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE