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

Development Application for _____
Name of Applicant

Address of site **6 BUSHRANGERS HILL, NEWPORT**

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

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

on this the 27/6/16 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 **6 BUSHRANGERS HILL, NEWPORT**

Report Date: 24/6/16

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 **6 BUSHRANGERS HILL, 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: Geotechnical Report **6 BUSHRANGERS HILL, NEWPORT**

Report Date: 24/6/16

Author : BEN WHITE

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

Please mark appropriate box

☒ Comprehensive site mapping conducted 23/6/16 (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 See Report
  ☐ Yes Date conducted .....
☒ Geotechnical model developed and reported as an inferred subsurface type-section
☒ Geotechnical hazards identified
  ☒ Above the site
  ☒ On the site
  ☐ Below the site
  ☐ Beside the site
☒ Geotechnical hazards described and reported
☒ Risk assessment conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
  ☒ Consequence analysis
  ☒ Frequency analysis
☒ Risk calculation
☒ Risk assessment for property conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
☒ Risk assessment for loss of life conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
☒ Assessed risks have been compared to "Acceptable Risk Management" criteria as defined in the Geotechnical Risk Management Policy for Pittwater - 2009
☒ Opinion has been provided that the design can achieve the "Acceptable Risk Management" criteria provided that the specified conditions are achieved.
☒ Design Life Adopted:
  ☒ 100 years
  ☐ Other ..... specify
☒ Geotechnical Conditions to be applied to all four phases as described in the Geotechnical Risk Management Policy for Pittwater – 2009 have been specified
☒ Additional action to remove risk where reasonable and practical have been identified and included in the report.
☐ Risk Assessment within Bushfire Asset Protection Zone

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

Signature 

Name Ben White

Chartered Professional Status MScGEOLAusIMM CP GEOL

Membership No. 222757

Company **White Geotechnical Group Pty Ltd**

GEOTECHNICAL INVESTIGATION:

Secondary Dwelling at **6 Bushrangers Hill, Newport.**

1. Proposed Development

1.1 Construct a secondary dwelling off Bungan Head Road at the upper third of the property.

1.2 Details of the proposed development are shown on 9 drawings prepared by Noah Stutchbury numbered DA110, DA210, DA220, DA230, DA310, DA320, DA330, DA340, and DA410, dated 25 May, 2016.

2. Site Description

2.1 The site was inspected on the 23rd June, 2016.

2.2 This residential property is on the high side of Bushrangers Hill and has a N aspect. The block is located on the moderate to steeply graded upper reaches of a hillslope. From the road frontage the slope rises at an average angle of ~12°, then steepens to ~21° at the upper third of the site before reaching Bungan Head Road at the upper boundary. The slope below the property continues at moderate angles. The slope above the property continues at steep angles.

2.3 At the Bushrangers Hill road frontage two concrete driveways runs up the slope to a concrete parking area and rendered brick garage. A large sloping lawn that has been terraced encompasses the entire W half of the site (Photo 1). The fills are supported by stable rendered concrete block and stacked boulder retaining walls. A large cut has been made into the slope for a level lawn and concrete-paved area which is supported by a ~2.7m high concrete block retaining wall (Photo 2). The wall displays minor hairline cracking but no signs of movement. The lawn beside to the E and above the cut extends to a chain-link fence lining the upper third of the site.

The E driveway is flanked on both sides by low terraces supported by low retaining walls (Photo 3). The W flank terraces are supported by two low timber retaining walls. The lower wall is ~0.7m high and tilting at angles of ~7°. The wall will eventually need replacing but is not considered a threat to life or property. The upper wall is up to ~1.0m high and considered stable (Photo 4). The E flank terraces are supported by 2 mortared sandstone block walls ~0.6m high. The walls display cracking through the blocks and the upper wall has settled away from the concrete of the

driveway by ~40mm (Photos 5 & 6). This settlement most likely occurred soon after the construction of the walls and is currently considered stable. The cut for the garage and driveway is supported by a ~1.8m high concrete retaining wall that displays a minor crack from the top of the wall to the base but no signs of deflection were observed (Photo 7). A pool area extending off the downhill side of the house displayed no signs of movement (Photo 8). A cut has been made in the slope to provide a level platform for the house. The part three storey rendered brick house is in good condition (Photo 9). The external supporting brick walls show no signs of movement that could be related to slope instability. The supporting brick piers and steel posts stand vertical (Photo 10). A concrete and lawn area extends off the uphill side of the house. A soldier pile timber retaining wall ~1.2m high lines the boundary on the uphill side of the house (Photo 11). The wall appears to have been remediated in the past but currently appears stable.

The upper third of the property is steeply graded and covered in native and exotic vegetation. The slope is terraced with five stable keystone retaining walls reaching a maximum height of ~1.2m and three low rough stack rock walls (Photo 12). The two lower rough stack rock walls are considered stable. The upper wall is crumbling but will be demolished as part of the proposed works. The fill batter for Bungan Head Road merges into the natural slope and is considered stable.

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

The location of the proposed development is a steep, narrow corridor with many services running beneath the surface including gas, water, and electricity. The locations of these services are unknown and the risk of striking them during ground testing was considered to be too high.

Our staff have conducted work on the property previously and White Geotechnical Group has conducted many ground tests in the vicinity of the subject property including the adjoining neighbour immediately to the W at 18 Bungan Head Road. In this instance we have used the results from previous work to interpret the subsurface conditions in the location of the proposed development. As the ground materials are relatively uniform in the area we consider this sufficient for the proposed development.

5. Geological Interpretation

It is interpreted from work carried out previously on the property by our staff and ground testing in the vicinity of the subject property that the slope materials are colluvial at the near surface and residual at depth. They consist of a sandy topsoil over sandy clays and clays. The sandy clays and clays merge into the weathered zone of the under lying rocks at an average depth of ~1.5m below the current surface. The weathered zone of the underlying rock is interpreted as extremely low strength shale. 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. A sandstone band was observed on the neighbouring property. The band may extend across to the subject property but it appears to be relatively narrow.

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 bases of the proposed excavations.

7. Surface Water

No evidence of surface flows were observed on the property during the inspection. It is expected that sheet wash will move onto the site from above the property during heavy down pours. Bungan Head Road will not intercept the sheet wash from above as the road edges are not guttered.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above, beside or below the property. The steeply graded slope that rises across the property and continues above is a potential hazard (**Hazard One**). The excavations for the proposed secondary dwelling are potential hazards until the retaining walls are in place (**Hazard Two**).

Risk analysis on NEXT PAGE

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The steeply graded slope that rises across the property and continues above failing and impacting on the existing house or the proposed works.	The proposed excavations for the secondary dwelling collapsing onto the work site before retaining walls are in place.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (20%)	'Minor' (9%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Moderate' (5×10^{-5})
RISK TO LIFE	1.24×10^{-6}/annum	8.7×10^{-6}/annum
COMMENTS	This level of risk is '**ACCEPTABLE'**.	This level of risk to life and property is '**TOLERABLE**'. To move the 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 street below. All stormwater or drainage runoff from the proposed development is to be piped to the street drainage system through any tanks that may be required by the regulating authorities.

11. Excavations.

Three excavations to a maximum depth of ~1.4m will be required to install the proposed secondary dwelling. The cuts are expected to be through a sandy soil over a firm to stiff clay. It is envisaged the excavations through soil and clay can be carried out with a bucket and excavator and rock hammers will

not be required. A relatively narrow medium strength sandstone band may be encountered during one of the excavations. Excavations through sandstone will require grinding or rock sawing and breaking.

12. Vibrations.

Possible vibrations generated during excavations through sandy soil, sandy clays and weathered shale will be below the threshold limit for building damage. However, a sandstone band may be encountered in one of the excavations.

If excavations through medium strength sandstone is required, it is to be carried out to minimise the potential to cause vibration damage to any nearby structures. The proposed excavations will be set back ~1.0m from the E common boundary and will be ~2.5m from the W common boundary. 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 5mm/sec at the common 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 5mm/sec at the supporting brick walls of the house and garage and common 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 house and garage.

13. Excavation Support Requirements

The proposed excavations will be ~1.0m from the E common boundary. The excavation for the lower ground floor bedroom will reach a maximum depth of ~1.2m, the excavation behind the laundry room will reach a maximum depth of ~1.3m, and the excavation underneath the carport structure will reach a maximum depth of ~1.4m.

The soil portions of the proposed excavations are to be battered temporarily at 1.0 Vertical to 1.7 Horizontal (30°) until the retaining walls are in place. Cut batters through firm to stiff clay 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 cut batters through 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 or is to 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.

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

All retaining structures are to have sufficient back wall drainage and be backfilled immediately behind the structure 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 structures likely hydrostatic pressures are to be accounted for in the retaining structure design.

15. Site Classification

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

16. Foundations

Piers supported on the underlying extremely low strength shale are suitable footings for the proposed secondary dwelling. Required pier depths to encounter this material are expected to be ~1.5m below the current surface. It should be noted that this material is a soft rock that a rock auger will cut through so the builders should not be looking for refusal to end the footings. A maximum allowable pressure of 600kPa can be assumed for footings supported on extremely low strength shale.

As the bearing capacity of clay and shale 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.

17. Inspections

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

- 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

Photo 9

Photo 10

Photo 11

Photo 12

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.

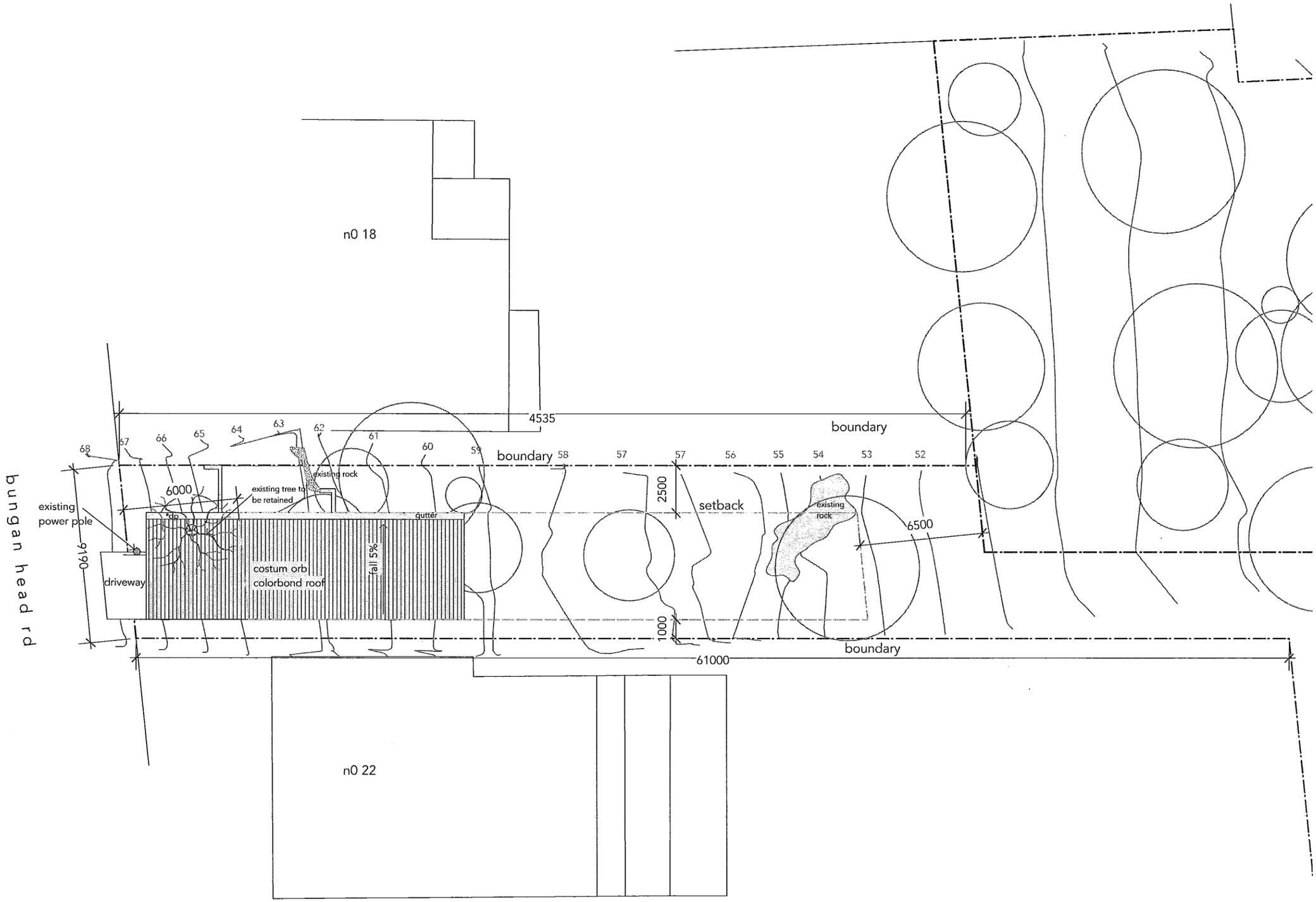
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



site & roof plan

PLOT DATE 25 May, 2016
FILE NAME BH plan.vwx

DRAWING ISSUE

1	Revision 1	Date 1

NOTES

Project
Bushrangers hill
Proprietor
Harry Crawford
Project Address
6 Bushrangers hill rd
Newporth NSW 2106

Design

Noah Stutchbury

11 Surfside Ave
Avalon NSW 2107

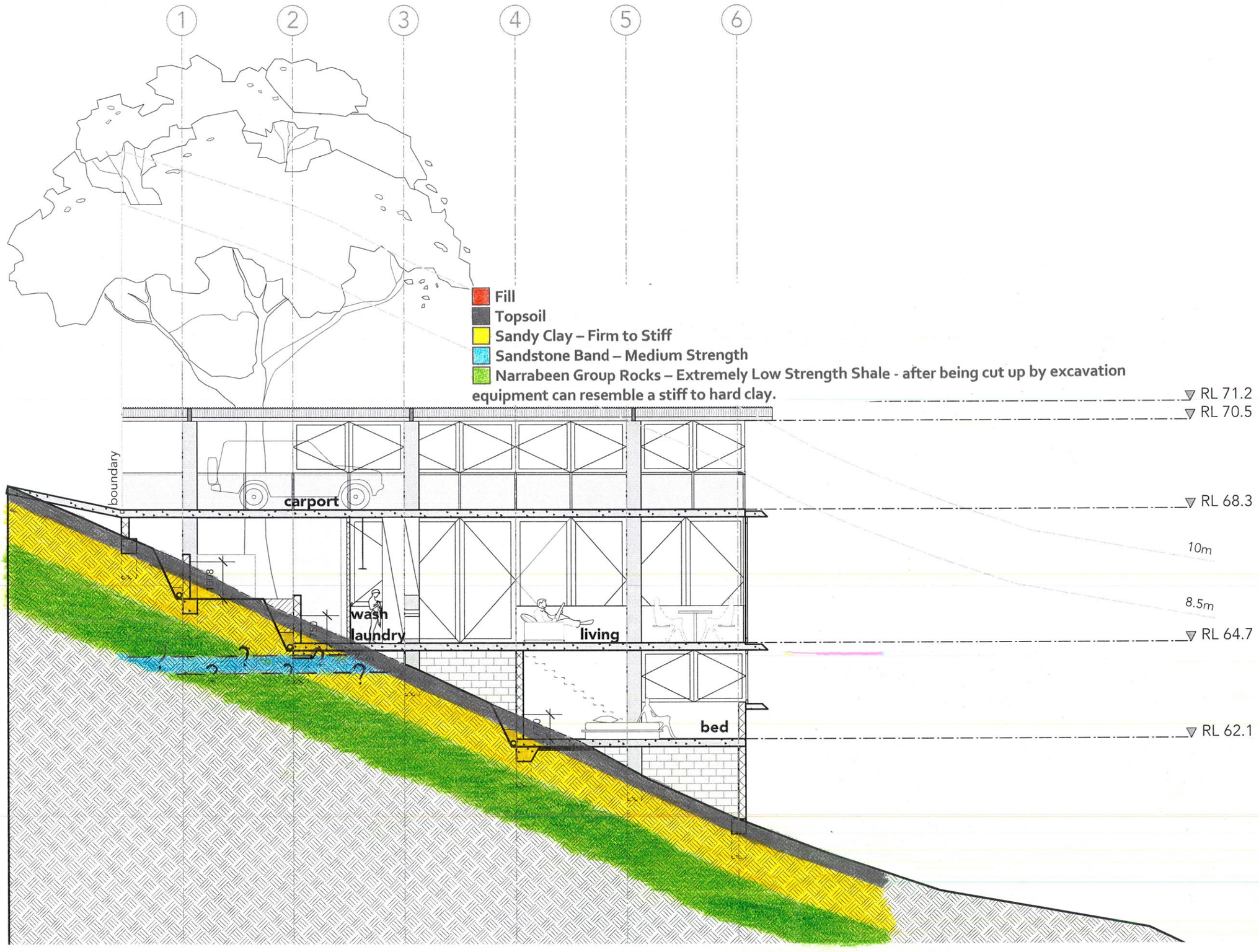
Scale **1:400** @ A3

Drawing Name
site

Issue
1

Drawing Number
DA 110

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



section a

PLOT DATE	25 May, 2016
FILE NAME	BH elevation.vwx
DRAWING ISSUE	
1 Revision 1	Date 1

NOTES

Project
Bushrangers hill
Proprietor
Harry Crawford
Project Address
6 Bushrangers hill rd
Newporth NSW 2106

Design

Noah Stutchbury

11 Surfside Ave
Avalon NSW 2107

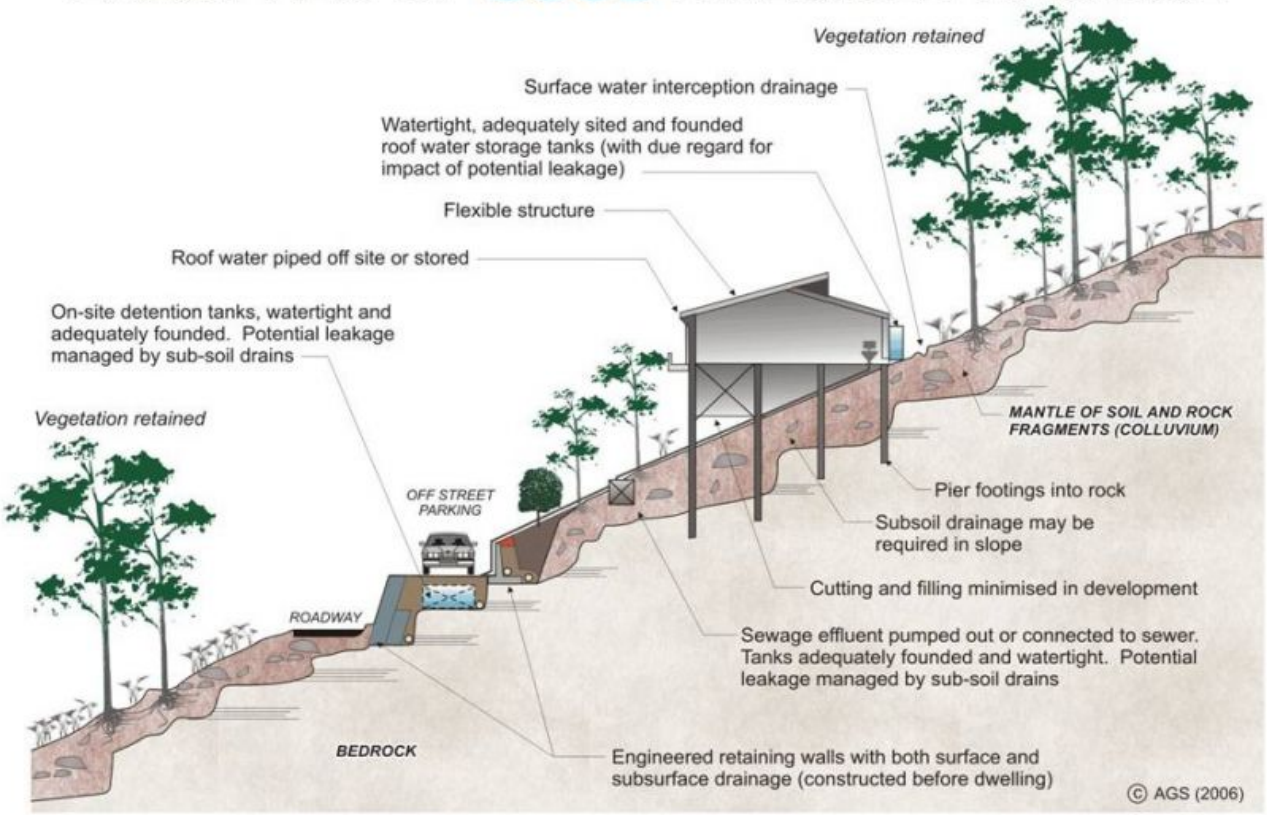
Scale **1:100** @ A3

Drawing Name
section A

Issue **1**

Drawing Number **DA 410**

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE