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

Development Application for _____
Name of Applicant

Address of site 45 Marine Parade, 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 2/5/19 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 **45 Marine Parade, Avalon**

Report Date: 2/5/19

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 45 Marine Parade, 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 **45 Marine Parade, Avalon**

Report Date: 2/5/19

Author: BEN WHITE

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

Please mark appropriate box

☒ Comprehensive site mapping conducted **29/4/19**
(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 **30/4/19**

☒ 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 Garage and Alterations and Additions at **45 Marine Parade, Avalon**

1. Proposed Development

1.1 Construct a new garage and driveway on the downhill side of the property by excavating to a maximum depth of ~3.5m into the slope.

1.2 Construct a courtyard on the NE side of the house by excavating to a maximum depth of ~1.3m into the slope.

1.3 Extend the house to the NE and NW.

1.4 Extend the existing studio upslope and construct decks on the uphill and downhill sides of the building.

1.5 Details of the proposed development are shown on 7 drawings prepared by Gartner Trovato Architects, Project number 1833, drawings numbered A.01 to 07, Revision A, dated 2nd May, 2019.

2. Site Description

2.1 The site was inspected on the 29th April, 2019.

2.2 This residential property is on the high side of the road and has a NW aspect. It is located on the moderate to steeply graded upper reaches of a hillslope. From the road frontage to the uphill side of the house the slope rises at an average angle of ~13° and continues at ~26° to the uphill boundary. The slope above eases to a seacliff. The slope below the property continues at moderate angles.

2.3 At the road frontage, a concrete driveway runs up the slope to a garage on the downhill side of the property (Photos 1 & 2). The masonry garage at the house frontage will be demolished as part of the proposed works. To the NE of the driveway

a moderately sloping stable bank rises from the road to a low dry stack rock retaining wall reaching a maximum height of ~0.4m (Photo 3). The retaining wall supports a garden bed above. From the wall a level lawn extends to another stable bank that rises ~2.5m at steep angles to the house and a lawn area to the NE (Photo 4). The part two storey timber framed and clad house is supported on brick walls and brick and dimensioned sandstone block piers (Photo 5). No significant signs of cracking or movement were observed in the supporting brick walls and the supporting brick and dimensioned sandstone block piers stand vertical. An excavation to a maximum height of ~1.8m has been made to level an area for the house. The excavation is supported by a stable mortared stack rock retaining wall (Photo 6). An excavation to a maximum depth of ~1.0m has been made on the uphill side of the property to level an area for a part two-storey studio. The cut is supported by a stable stack rock retaining wall. Medium Strength Sandstone outcrops on the slope that rises from the uphill side of the house to the uphill boundary and is also scattered with detached joint blocks (Photos 8 & 9). The joint blocks have been in place over a geological time scale and are currently seated in stable positions. No significant signs of movement were observed on the property. No geotechnical hazards that could impact on the subject property were observed on the neighbouring properties as seen from the subject property and the road.

3. Geology

The Sydney 1:100 000 Geological sheet indicates the site is underlain by the Newport Formation of the Narrabeen Group. The observed outcropping sandstone encompassing the steep slope above the house is an unusually thick band of sandstone that extends through the otherwise shale-dominated profile (Photo 10).

4. Subsurface Investigation

One Hand auger hole (AH) was put down to identify the soil materials. Nine Dynamic Cone Penetrometer (DCP) tests were put down to determine the relative density of the overlying

soil and the depth to weathered rock. 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. DCP3 likely refused on an obstruction in the profile. This is not expected to be an issue for the rest of the testing on the site and the results are as follows:

AUGER HOLE 1 (~RL36.3) **–** AH1 (Photo 11)

Depth (m)	**Material Encountered**
0.0 to 0.2	**TOPSOIL**, sandy soil, orangey brown, loose, rock fragments, roots, fine to medium grained, dry.
0.2 to 0.4	**SANDY SOIL**, brown, loose, roots, rock fragments, fine to medium grained, dry.
0.4 to 0.5	**VOID**
0.5 to 0.6	**SANDY SOILS**, brown, loose, roots, rock fragments, fine to medium grained, dry.
0.6 to 1.2	**CLAY**, orange with red mottling, firm to stiff, fine to medium grained, fine grained, dry.

End of hole @ 1.2m in firm to stiff clay. No watertable encountered.

SEE OVER THE PAGE FOR DCP TEST RESULTS

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** (~RL33.0)	**DCP 2** (~RL33.2)	**DCP 3** (~RL36.3)	**DCP 4** (~RL36.3)	**DCP 5** (~RL36.3)
0.0 to 0.3	8	6	4	9	5
0.3 to 0.6	4	10	12	8	9
0.6 to 0.9	4	12	#	20	11
0.9 to 1.2	18	11		18	14
1.2 to 1.5	#	13		34	10
1.5 to 1.8		8		#	21
1.8 to 2.1		#			16
2.1 to 2.4					#
	Refusal on Rock @ 1.2m	Refusal on Rock @ 1.8m	Refusal on Rock @ 0.4m	Refusal on Rock @ 1.5m	Refusal on Rock @ 1.9m

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

DCP Notes:

DCP1 – Refusal on rock @ 3.6m, DCP bouncing off rock surface, white impact dust on dry tip, sandy orange clay in sleeve above tip.

DCP2 – Refusal on rock @ 0.3m, DCP bouncing off rock surface, white impact dust on dry tip, white and pink shale above tip.

DCP3 – Refusal on rock @ 0.6m, DCP bouncing off rock surface, orange rock fragments on dry tip.

DCP4 – Refusal on rock @ 0.3m, DCP bouncing off rock surface, yellow rock fragments and white impact dust on dry tip.

DCP5 – Refusal on rock @ 0.3m, DCP bouncing off rock surface, red rock fragments on dry tip.

SEE OVER THE PAGE FOR CONTINUED DCP TEST RESULTS

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 6** (~RL30.5)	**DCP 7** (~RL39.0)	**DCP 8** (~RL40.4)	**DCP 9** (~RL40.8)
0.0 to 0.3	12	10	8	Rock Exposed @ Surface
0.3 to 0.6	13	7	14	
0.6 to 0.9	14	4	#	
0.9 to 1.2	33	6		
1.2 to 1.5	#	10		
1.5 to 1.8		39		
1.8 to 2.1		#		
2.1 to 2.4				
	Refusal on Rock @ 1.2m	End of Test @ 1.8m	Refusal on Rock @ 0.4m	Rock Exposed @ Surface

DCP Notes:
DCP6 – Refusal on rock of test @ 3.6m, DCP bouncing off rock surface, clean dry tip.
DCP7 – End of test @ 0.3m, DCP still very slowly going down, orange clay on dry tip.
DCP8 – Refusal on rock @ 0.6m, DCP bouncing off rock surface, orange impact dust on dry tip.
DCP9 – Rock exposed @ surface.

5. Geological Observations/Interpretation

Sandstone bedrock outcrops at the sea cliff face to the E of the property and is visible outcropping down the slope to the house (Photos 8, 9 & 10). This is an unusually thick sandstone bed within the Narrabeen Group of rocks. The rock is overlain by natural sandy soils and clay. In the test locations, rock was encountered at depths of between ~0.4 to ~1.9m due to the variable nature of the rock. As the majority of the tests bounced on refusal we expect the band of sandstone outcropping above the house to continue down the slope beneath the testing. This underlying rock is interpreted to be of Low to Medium Strength. 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

Normal sheet wash will move onto the site from the slope above during heavy down pours. Due to the steep slope above the house this will move at a relatively high velocity.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed below, or beside the property. The steep slope that rises across the uphill side of the property and continues above is a potential hazard (**Hazard One**). The vibrations produced during the proposed excavation are a potential hazard (**Hazard Two**). The excavation for the proposed garage and courtyard undercutting the NE boundary is a potential hazard (**Hazard Three**). The proposed courtyard excavation is a potential hazard until retaining walls are in place (**Hazard Four**). A loose boulder, wedge, or similar geological defect toppling onto the work site during the excavation process for the proposed new garage is a potential hazard (**Hazard Five**).

SEE OVE THE PAGE FOR HAZARD RISK ANALYSIS SUMMARY

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two	Hazard Three
TYPE	The steep slope that rises above the house and continues above failing onto the house and proposed works (Photos 8 & 9).	The vibrations produced during the proposed excavation impacting on the subject and neighbouring house to the NE.	The proposed garage and courtyard excavations undercutting The NE common boundary.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (10%)	'Medium' (15%)	'Medium' (20%)
RISK TO PROPERTY	'Low' (2×10^{-6})	'Moderate' (2×10^{-4})	'Moderate' (2×10^{-4})
RISK TO LIFE	1.4×10^{-7}/annum	6.6×10^{-7}/annum	1.6×10^{-5}/annum
COMMENTS	This level of risk to life and property is 'ACCEPTABLE'	This level of risk to property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels the recommendations in **Sections 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 OVER THE PAGE FOR CONTINUED HAZARD RISK ANALYSIS

HAZARDS	Hazard Four	Hazard Five
TYPE	The proposed excavation for the courtyard collapsing onto the worksite before retraining walls are in place.	A loose boulder, wedge, or similar geological defect failing onto the work site during the excavation process for the proposed new garage.
LIKELIHOOD	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (20%)	'Medium' (20%)
RISK TO PROPERTY	'Moderate' (2×10^{-4})	'Moderate' (2×10^{-4})
RISK TO LIFE	3.5×10^{-5}/annum	4.7×10^{-4}/annum
COMMENTS	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.	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

The fall is to Marine Parade below. 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

An excavation to a maximum depth of ~3.5m is required to construct the proposed garage and driveway. Another excavation to a maximum depth of ~1.3m is required for the proposed courtyard. The excavations are expected to be through a sandy soil over clays with weathered

rock expected at an average depth of ~1.5m. Low to Medium Strength Rock is expected at an average depth of ~1.7m below the current ground surface. It is envisaged that excavations through sandy soil, clay, and weathered rock can be carried out with a bucket and excavations through Medium Strength Rock will require grinding or rock sawing and breaking.

12. Vibrations

Possible vibrations generated during excavations through sandy soil, clay and weathered rock will be below the threshold limit for building damage.

Excavations through Medium Strength Rock should be carried out to minimise the potential to cause vibration damage to the subject house and NE neighbouring house. The excavation will be ~3.0m from the subject house and ~3.5m from the NE neighbouring house. 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 near the supporting walls of the subject house 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 property boundaries using this method provided the saw cuts are kept well below the rock to be broken.

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

13. Excavation Support Requirements

On steep sites such as this one, to help maintain excavation stability, it is critical upslope runoff be diverted from the proposed excavation with temporary or permanent drainage

measures. Temporary measures may be trenches and sandbag mounds and permanent measures could be a wide diameter dish drain or similar. These are to be installed before any excavation work commences.

Accounting for backwall drainage the proposed garage excavation will be located ~1.0m from the NE common boundary. In this instance, the zone of influence is the area above a theoretical 30° line through soil and a 45° line through clay and weathered rock, from the top of Medium Strength rock towards the surrounding structures and boundaries.

The uphill corners of the garage excavation are beneficial in that they help to brace the cut face. This will add additional support to the excavation on the uphill side where it is deepest. The top 1.0m of soil and clay of the excavation face are to be battered temporarily at 1.0 Vertical: 1.0 Horizontal (45°) until permanent retaining walls are in place. The remaining portion of the cut face is expected to be mostly through rock and will stand unsupported for a short period of time until retaining walls are in place, provided they are prevented from becoming saturated.

During the excavation process, the geotechnical consultant is to inspect the cut in 1.5m intervals as it is lowered to ensure the ground materials are as expected and no wedges or other geological defects are present that could require additional support.

The excavation for the courtyard will stand unsupported for a short period of time before the retaining wall is in place provided the excavation is prevented from becoming saturated.

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 wall is to be organised so on completion of the excavation the wall can be constructed as soon as possible. No excavations are to commence if heavy or prolonged rainfall is forecast.

All 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 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
Sandy Soil	20	0.40	0.55
Residual Clays	20	0.35	0.45
Extremely Low Strength Shale	22	0.30	0.40
Rock up to Medium Strength	22	0.20	0.25

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 do not account for any surcharge loads, assume the surface above the wall is near level, and 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

The bedrock underlying the area of the proposed development is interpreted to be a tick bed of sandstone, however, sandstone beds in the shale profile are typically fractured and jointed. Thus footings are to be designed conservatively for Very Low Strength Rock.

Rock of Very Low Strength or better is expected to be exposed across the uphill portion of the garage excavation. A concrete slab supported directly off the exposed Rock is a suitable footing for the proposed garage. Where it is not exposed shallow piers will be required to maintain a uniform bearing material. A maximum allowable bearing pressure of 600kPa can be assumed for footings on Very Low Strength Rock.

The extension to the studio and uphill deck can be supported on the underlying Very Low Strength Rock. This bearing material is expected at a maximum depth of ~0.4m below the current ground surface. Where rock is exposed over the footprint of the proposed deck, it is a suitable bearing material. Pads embedded at least ~0.4m into the underlying firm to stiff clays is a suitable bearing material for the proposed deck on the downhill side of the studio. A maximum allowable bearing pressure of 200kPa can be assumed for footings on firm to stiff clays.

Given the age of the house it is expected to be supported on the underlying natural clay. The proposed addition to the house can be supported on pads or strip footings embedded into the underlying natural clays. Footing depth is expected to be a minimum of ~0.4m below the current ground surface.

Ideally, footings should be founded on the same footing material across each structure. Where the footing material changes across the structure, construction joints or similar are to be installed to prevent differential settlement where the structure cannot tolerate such movement.

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.

16. Inspections

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

- During the excavation process for the garage, the geotechnical consultant is to inspect the cut face in 1.5m intervals as it is lowered 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 professional 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

Photo 9

Photo 10

Photo 11: AH1 – Downhole is top to bottom

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.

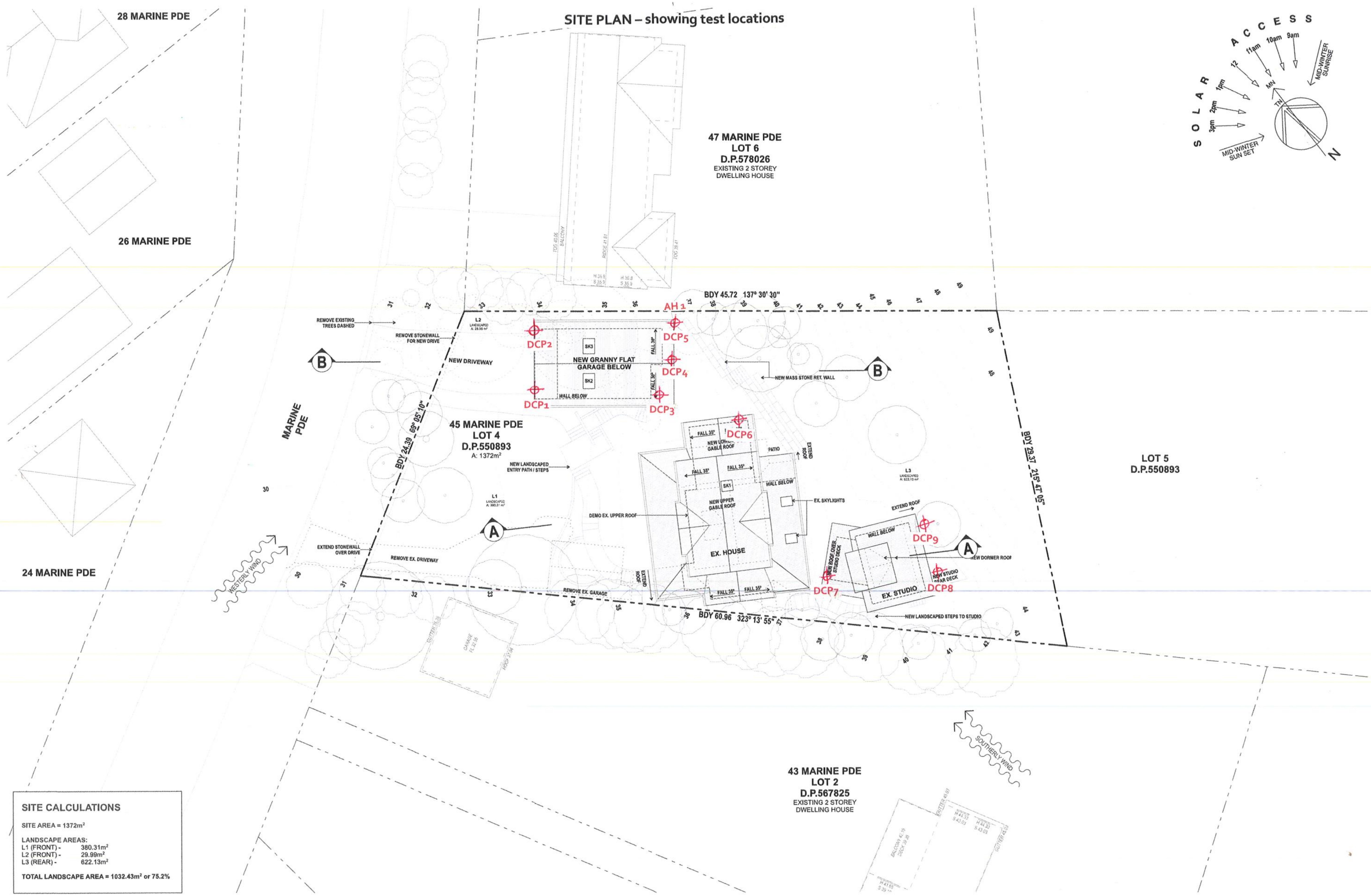
- If this report is used by other professionals during the design or construction process, any questions should be directed to White Geotechnical Group as only we understand the full methodology behind the report's conclusions.

- 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
28 MARINE PDE
26 MARINE PDE
24 MARINE PDE
MARINE PDE
47 MARINE PDE
LOT 6
D.P.578026
EXISTING 2 STOREY
DWELLING HOUSE
45 MARINE PDE
LOT 4
D.P.550893
A: 1372m²
LOT 5
D.P.550893
43 MARINE PDE
LOT 2
D.P.567825
EXISTING 2 STOREY
DWELLING HOUSE
BDY 45.72 137° 30' 30"
BDY 24.39 69° 05' 10"
BDY 29.37 215° 47' 05"
BDY 60.96 323° 13' 55"
AH 1
DCP1
DCP2
DCP3
DCP4
DCP5
DCP6
DCP7
DCP8
DCP9
NEW GRANNY FLAT
GARAGE BELOW
NEW DRIVEWAY
REMOVE EXISTING TREES DASHED
REMOVE STONEWALL FOR NEW DRIVE
NEW MASS STONE RET. WALL
NEW LANDSCAPED ENTRY PATH / STEPS
DEMO EX. UPPER ROOF
NEW UPPER GABLE ROOF
EX. HOUSE
EX. SKYLIGHTS
EXTEND ROOF
NEW DORMER ROOF
EX. STUDIO
NEW LANDSCAPED STEPS TO STUDIO
EXTEND STONEWALL OVER DRIVE
REMOVE EX. DRIVEWAY
REMOVE EX. GARAGE
WESTERLY WIND
SOUTHERLY WIND
SOLAR ACCESS
9am
10am
11am
12
1pm
2pm
3pm
MID-WINTER SUNRISE
MID-WINTER SUN SET
MN
TN
N
SITE CALCULATIONS
SITE AREA = 1372m²
LANDSCAPE AREAS:
L1 (FRONT) - 380.31m²
L2 (FRONT) - 29.99m²
L3 (REAR) - 622.13m²
TOTAL LANDSCAPE AREA = 1032.43m² or 75.2%

GARTNERTROVATO ARCHITECTS

DATE	REV	DESCRIPTION
30/5/18	A	DA ISSUE

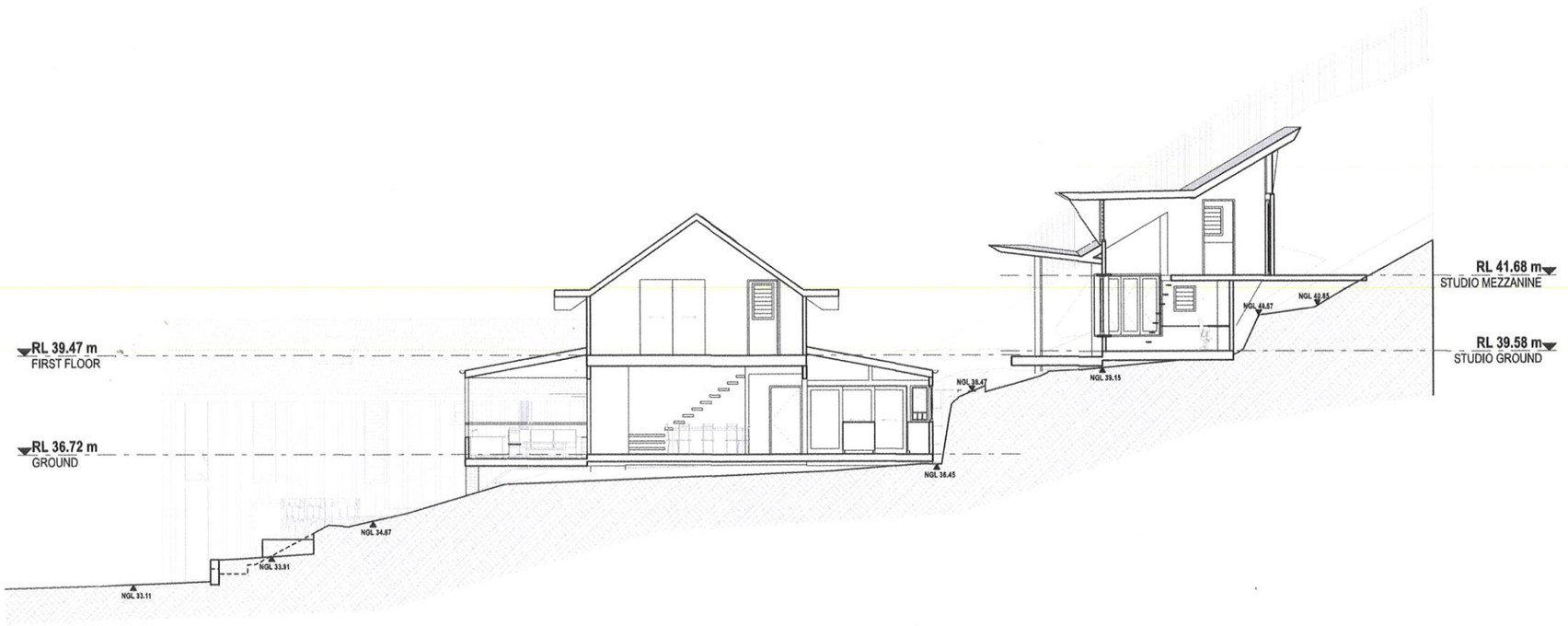
ALTERATIONS & ADDITIONS, NEW GARAGE + GRANNY FLAT
45 MARINE PDE AVALON BEACH NSW 2107
LOT 4, DP 550893
FOR MR AND MRS SCOTT

SITE PLAN / SITE ANALYSIS

SCALE	DRAWN BY	PLOT DATE
1:200 @ A2	SG/AB	17/4/19

PROJECT NO.	DRAWING NO.	REVISION
1833	CDC.01	A

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



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17/4/19	A	DA ISSUE

PROJECT
ALTERATIONS & ADDITIONS, NEW GARAGE + GRANNY FLAT
45 MARINE PDE AVALON BEACH NSW 2107
LOT 4, DP 550893

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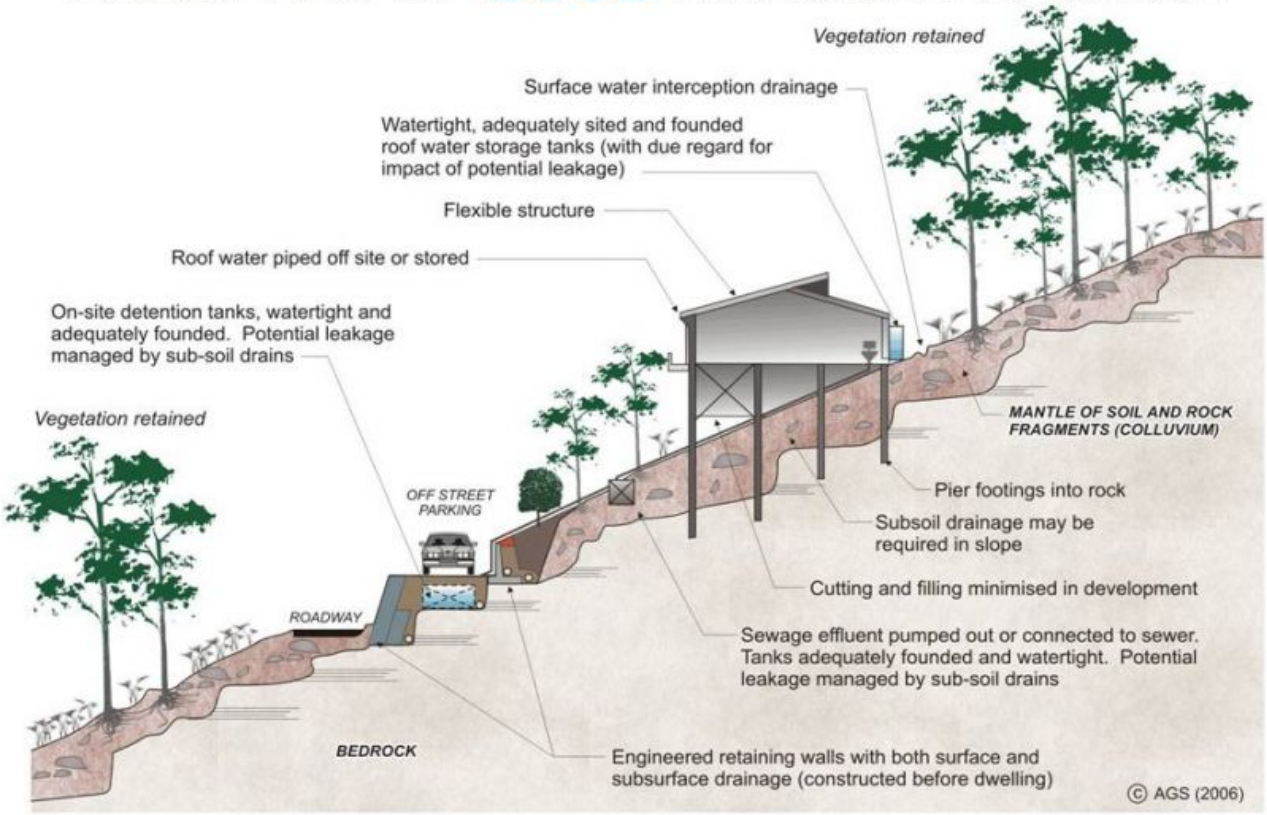
DRAWING TITLE
SECTIONS

SCALE	DRAWN BY	PLOT DATE
1:100 @ A2	SG/AB	17/4/19

PROJECT NO.	DRAWING NO.	REVISION
1833	CDC.07	A

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE