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

Development Application for _____
Name of Applicant

Address of site 168 Whale Beach Road, Whale Beach

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 15/2/21 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 **168 Whale Beach Road, Whale Beach**

Report Date: 10/2/21

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 168 Whale Beach Road, Whale Beach

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 **168 Whale Beach Road, Whale Beach**

Report Date: 10/2/21

Author: BEN WHITE

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

Please mark appropriate box

☒ Comprehensive site mapping conducted **9/2/21**
(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 **9/2/21**

☒ 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 House & Pool at **168 Whale Beach Road, Whale Beach**

1. Proposed Development

1.1 Construct a new part four-storey house on the vacant lot by excavating to a maximum depth of ~6.8m.

1.2 Install a new pool on the uphill side of the property by excavating to a maximum depth of ~1.1m.

1.3 Details of the proposed development are shown on 22 drawings prepared by Watershed Design, Job number 200731, drawings numbered DA02 to DA23, Issue C, dated 12/2/21.

2. Site Description

2.1 The site was inspected on the 9th February, 2021.

2.2 This vacant residential property is on the high side of the road and encompasses the NE and SW flanks of a SE to NW-trending ridgeline. The slope rises steeply from the road frontage at angles of ~21° to the crest of the ridge. The crest of the ridge is relatively level for ~20m before falling steeply at angles of ~28° to the W common boundary. The slopes below the property fall at gradually easing angles to the waterfronts.

2.3 At the road frontage, a concrete Right of Carriageway (ROW) runs up the slope to a parking area on the downhill side of the vacant property (Photos 1 & 2). A steep, densely vegetated slope rises from the parking area to the crest of the slope (Photo 3). Some sandstone boulders were observed to be embedded in the slope in stable positions (Photo 4). Additionally, outcrops of sandstone bedrock were observed

through the thick vegetation near and on the crest of the slope (Photos 5 & 6). These outcrops continued over the ridge where a similar steep and densely vegetated slope falls to the W common boundary. We were unable to assess this portion of the slope during the site visit due to the very thick vegetation.

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. A band of Medium Strength Sandstone outcrops at the crest of the ridge and slightly down the flanks and extends through the otherwise shale-dominated profile.

4. Subsurface Investigation

Six DCP (Dynamic Cone Penetrometer) tests were put down to determine the relative density of the overlying soil and the depth to bedrock. The locations of the tests are shown on the site plan attached. 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. However, excavation and foundation budgets should always allow for the possibility that the interpreted ground conditions in this report vary from those encountered during excavations. See the appended “Important information about your report” for a more comprehensive explanation. The results are as follows:

DCP RESULTS ON NEXT PAGE

DCP TEST RESULTS – Dynamic Cone Penetrometer						
Equipment: 9kg hammer, 510mm drop, conical tip.				Standard: AS1289.6.3.2 - 1997		
Depth(m) Blows/0.3m	**DCP 1** (~RL49.0)	**DCP 2** (~RL51.7)	**DCP 3** (~RL54.4)	**DCP 4** (~RL56.7)	**DCP 5** (~RL58.2)	**DCP 6** (~RL57.6)
0.0 to 0.3	6	8	9	Rock Exposed at Surface	Rock Exposed at Surface	14
0.3 to 0.6	12	9	#			16
0.6 to 0.9	18	14				21
0.9 to 1.2	30	17				15
1.2 to 1.5	#	30				#
1.5 to 1.8		#				
	End of Test @ 1.1m	End of Test @ 1.5m	Refusal on Rock @ 0.2m			Refusal on Rock @ 1.1m

#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 @ 1.1m, DCP still very slowly going down, clean dry tip, orange and maroon clay in collar above tip.
DCP2 – End of test @ 1.5m, DCP still very slowly going down, grey and maroon shale on dry tip.
DCP3 – Refusal on rock @ 0.2m, DCP bouncing off rock surface, white sandstone on dry tip.
DCP4 – Rock exposed at surface.
DCP5 – Rock exposed at surface.
DCP6 – Refusal on rock @ 1.1m, DCP bouncing off rock surface, white impact dust on dry tip.

5. Geological Observations/Interpretation

Medium Strength Sandstone outcrops on the crest of the ridge and slightly down each flank (Photos 5 & 6). The outcropping sandstone is interpreted to be a band of sandstone through the otherwise shale-dominated profile. Where sandstone was not exposed at the crest of the ridge, it was encountered at a maximum depth of ~1.1m below the current surface.

The typical weathered rock of the Narrabeen Group underlies the natural profile of the slopes below the sandstone band. The weathered rock is overlain by a thin silty topsoil over firm to

stiff clays. In the test locations, weathered rock was encountered at an average depth of ~1.2m below the current surface. The weathered rock was interpreted to be Extremely Low Strength Shale that generally becomes progressively stronger with depth. 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 excavations.

7. Surface Water

No evidence of surface flows were observed on the property during the inspection. As the property encompasses the crest of the hill, any surface flows will be generated on the property and will flow away from the property.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above or beside the property. The steeply graded slopes that rise to the crest of the ridge and fall over the crest of the ridge are a potential hazard (**Hazard One**). The proposed excavations are a potential hazard until retaining walls are installed (**Hazard Two**).

SEE THE RISK ANAYSIS SUMMARY OVER THE PAGE

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The steep slopes that rise to the crest of the ridge and fall over the crest of the ridge failing and impacting on the proposed works.	The proposed excavations collapsing onto the work site and impacting the neighbouring properties before retaining walls are in place.
LIKELIHOOD	'Unlikely' (10^{-4})	'Likely' (10^{-2})
CONSEQUENCES TO PROPERTY	'Medium' (12%)	'Medium' (30%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'High' (2×10^{-3})
RISK TO LIFE	9.1×10^{-7}/annum	8.3×10^{-4}/annum
COMMENTS	This level of risk is 'ACCEPTABLE' provided the recommendations in **Section 16** are carried out.	This level of risk to 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 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

An excavation to a maximum depth of ~6.8m is required to construct the proposed house. This excavation is expected to be taken through Medium Strength Sandstone at the near-

surface before encountering Extremely Low Strength Shale that becomes progressively stronger with depth.

Another excavation to a maximum depth of ~1.1m is required to install the proposed pool. This excavation is expected to be taken entirely through Medium Strength Sandstone where it is exposed at the surface, and through a shallow soil over a firm to very stiff clay with Medium Strength Sandstone expected at a maximum depth of ~1.0m below the current surface where it is not exposed. Excavations through sandy soil, clay, and rock up to Low Strength Rock can be carried out with an excavator and bucket. Excavations through Medium Strength Rock or better will require grinding or rock sawing and breaking.

12. Vibrations

The proposed excavation is set back sufficiently from any surrounding neighbouring structures so that vibrations from the excavation will not exceed tolerable limits for building or infrastructure damage.

13. Excavation Support Requirements

Bulk Excavation for Proposed House

It is recommended, before the structural design commences for the project, exploration core drilling is to be carried out on the site to confirm to the rock quality and strength. This is to be arranged and supervised by the geotechnical consultant and should consist of a minimum of two cored bore holes taken to a depth of not less than 10m each. The following ground support advice can be considered preliminary and will be reviewed on recovery of the drill core. It may change as a result of the assessment of the drill core.

The excavation for the proposed house will reach a maximum depth of ~6.8m and, allowing for back-wall drainage, will be set back ~1.5m from the N common boundary, and ~2.8m from the S common boundary. However, the adjacent neighbouring properties to the N and S are also vacant and so no structures will be within the zone of influence of the proposed

excavation. Thus, only the N and S common boundaries will be within the zone of influence of the proposed excavation.

To ensure the integrity of the neighbouring properties into the future and due to the depth of the proposed excavation and the steep slope, ground support will need to be installed along all sides of the excavation with the support installed before, or as the excavation commences with a staged retaining wall. A Spaced Pile retaining wall is one of the suitable methods of support. Pier spacing is typically ~2.0m but can vary between 1.6 to 2.4m depending on the design. The piers can be supported by embedment or propping installed as the excavation is lowered. To drill the pier holes for the wall, a pilling rig that can excavate through Medium Strength Rock will be required. As the excavation is lowered in 1.5m lifts, infill sprayed concrete panels or similar are added between the piers to form the wall. Drainage is installed behind the panels. The walls are to be tied into the concrete floor and ceiling slabs after which any temporary support can be released.

The geotechnical consultant is to inspect the drilling process of the entire first pile and the ground materials at the base of all pier holes/excavations for ground support purposes. Additionally, inspections are to be carried out at 1.5m intervals as the excavation is lowered.

Bulk Excavation for Proposed Pool

The excavation for the proposed pool will reach a maximum depth of ~1.1m and will be set back ~1.6m from the N common boundary. Thus, no structures or boundaries will be within the zone of influence of the excavation.

The cut batters are expected to stand at near-vertical angles for short periods of time until the pool structure is installed provided the cut batters are kept from becoming saturated. If the cut batters through soil and clay remain unsupported for more than a few days, they are to be supported with typical pool shoring, such as sacrificial sheet iron, until the pool structure is in place.

Unsupported 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. The materials and labour to construct the pool structure are to be organised so on completion of the excavation it 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 following the current Environmental Protection Agency (EPA) waste classification guidelines.

14. Retaining Structures

Where wall height allows, cantilever or singly-propped retaining walls can be designed for a triangular pressure distribution of lateral pressures using the parameters shown in Table 1. Braced walls can be designed for a rectangular distribution.

Table 1 – Likely Earth Pressures for Retaining Walls

Unit	Earth Pressure Coefficients			
	Unit weight (kN/m³)	**'Active' K_a**	**'At Rest' K_0**	**Passive**
Sandy Soil and Residual Clays	20	0.40	0.55	N/A
Rock Up to Low Strength Rock - Jointed	24	0.25	0.35	K_p = 2.5
Medium Strength Rock	24	0.00	0.10	2.0MPa "Ultimate"

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

It is to be noted that the earth pressures in Table 1 assume a level surface above the wall, do not account for any surcharge loads and assume retaining walls are fully drained. Surcharge

loads to be accounted for also include temporary loads that may act on the wall during the building process from machinery, trucks, and storage of materials. It should be noted that passive pressure is an ultimate value and should have an appropriate safety factor applied. No passive resistance should be assumed for the top 0.4m to account for any disturbance from the excavation. Soil/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

A raft or thickened edge concrete slab and piers supported on the underlying Extremely Low Strength Rock are suitable footings for the proposed house. This ground material is expected to be exposed across the base of the proposed excavation, and at an average depth of ~1.2m below the current surface where the footprint of the house is not over the proposed excavation. A maximum allowable bearing pressure of 600kPa can be assumed for Extremely Low Strength Rock.

The proposed pool is expected to be partially seated in Medium Strength Sandstone. Where sandstone is not exposed at the base of the excavation, the pool is to be supported on shallow piers taken to the underlying Medium Strength Sandstone.

As the area around the pool will periodically become saturated with pool use, to prevent excessive settlement it is recommended any paving be laid on a concrete slab supported on Medium Strength Sandstone.

A maximum allowable bearing pressure of 800kPa can be assumed for footings on Medium Strength Sandstone.

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.

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

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

16. Site Maintenance/Remedial Works

Where slopes approach or exceed 30° (such as on the SW flank of the ridge), it is prudent for the owners to occasionally inspect the slope (say annually or after heavy rainfall events, whichever occurs first). Should any of the following be observed: movement or cracking in retaining walls, cracking in any structures, cracking or movement in the slope surface, tilting or movement in established trees, leaking pipes, or newly observed flowing water, or changes in the erosional process or drainage regime, then a geotechnical consultant should be engaged to re-assess the slope. We can carry out these inspections upon request. The risk assessment in **Section 8** is subject to this site maintenance being carried out.

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.

- The geotechnical professional is to inspect the drilling process of the entire first pile of the retaining wall and the ground materials at the base of all the piers before any concrete is placed.

- During the excavation process, the geotechnical consultant is to inspect the cuts in 1.5m intervals as they are lowered, while the machine/excavation equipment is on site.

- 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

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.

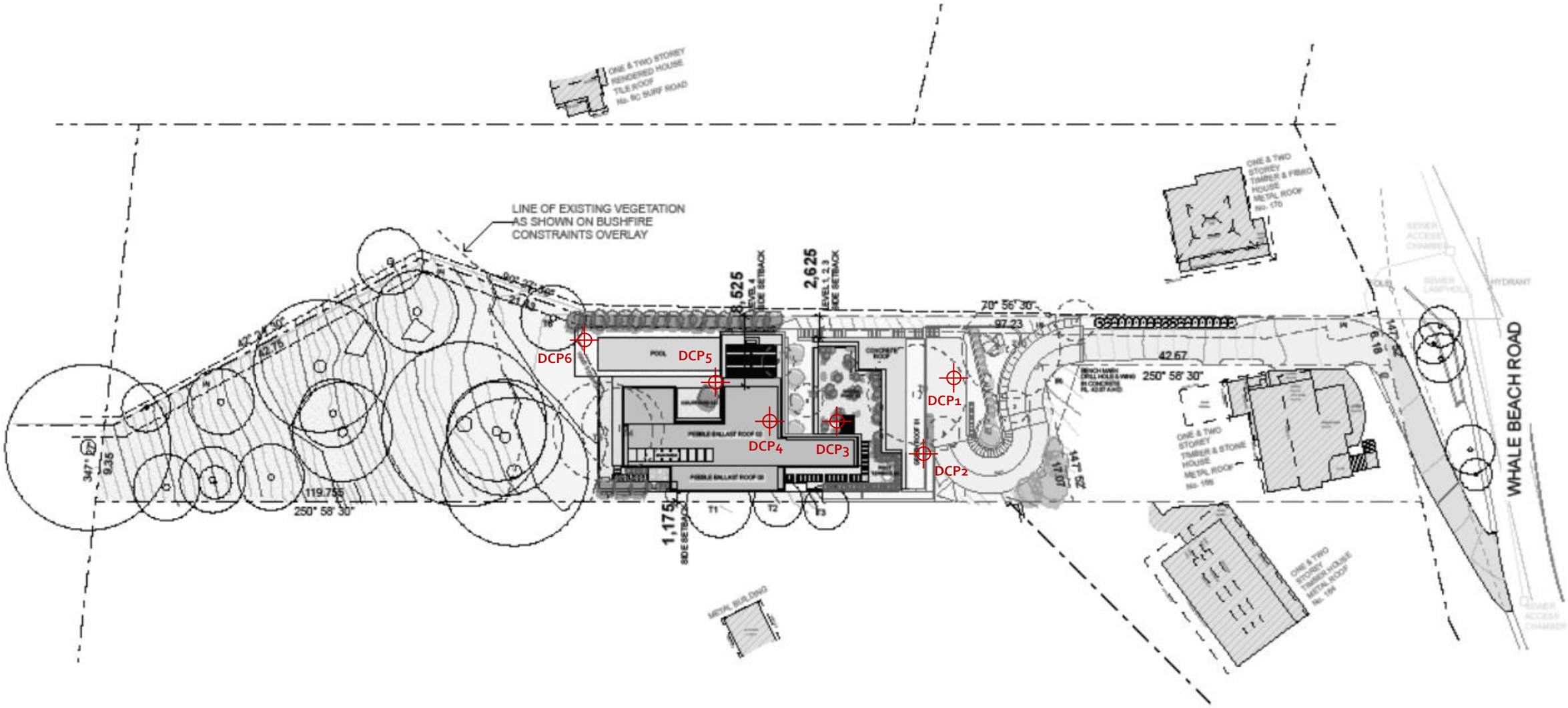
LANDSCAPE AREA

01 EXISTING SITE AREA	2,825.00
02 PROPOSED LANDSCAPE	1,735.67

FLOOR SPACE RATIO

01 EXISTING SITE AREA	2,825.00
04 INTERNAL FLOOR AREA	547.63

SITE PLAN – showing test locations



NOTES:

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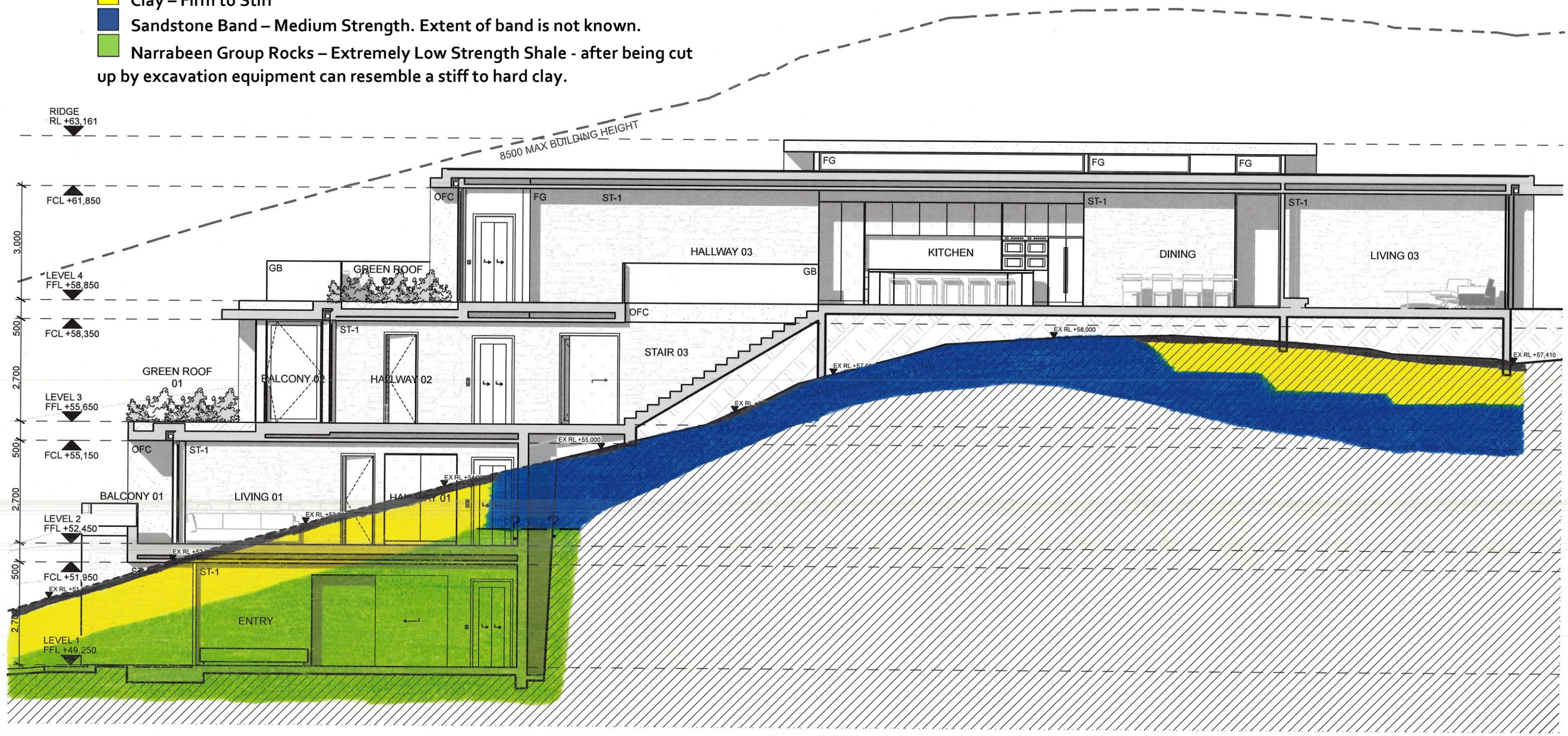
Issue ID	Issue Name	Issue Date
A	Issue to Consultants	10/11/20
B	Issue to for Pre DA	12/11/20
C	Issue to Consultants	12/2/21

WATERSHED DESIGN
architecture interiors landscapes
REGISTERED ARCHITECT: MARK KORGUL REGISTRATION NUMBER: 6221
PHONE: 9977 1076 FAX: 02 9976 0625 EMAIL: INFO@WATERSHEDDESIGN.COM.AU
ADDRESS: LEVEL 1, 167 PITTWATER ROAD MANLY NSW 2095 AUSTRALIA

CLIENT:	MARCUS & LIDIA AYRES	ADDRESS:	168 WHALE BEACH ROAD WHALE BEACH NSW 2107	JOB NO:	200731	DRAWING NO:	DA04
PROJECT:	AYRES HOUSE	DRAWING:	SITE & ROOF PLAN	DRAWN:	MC	ISSUE:	C
				CHECKED:	MK		
				SCALE:	1:500, 1:1		

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials

Topsoil
Clay – Firm to Stiff
Sandstone Band – Medium Strength. Extent of band is not known.
Narrabeen Group Rocks – Extremely Low Strength Shale - after being cut up by excavation equipment can resemble a stiff to hard clay.



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Issue ID	Issue Name	Issue Date
A	Issue to Consultants	10/11/20
C	Issue to Consultants	12/2/21

WATERSHED DESIGN architecture interiors landscapes

REGISTERED ARCHITECT: MARK KORGUL REGISTRATION NUMBER: 6221
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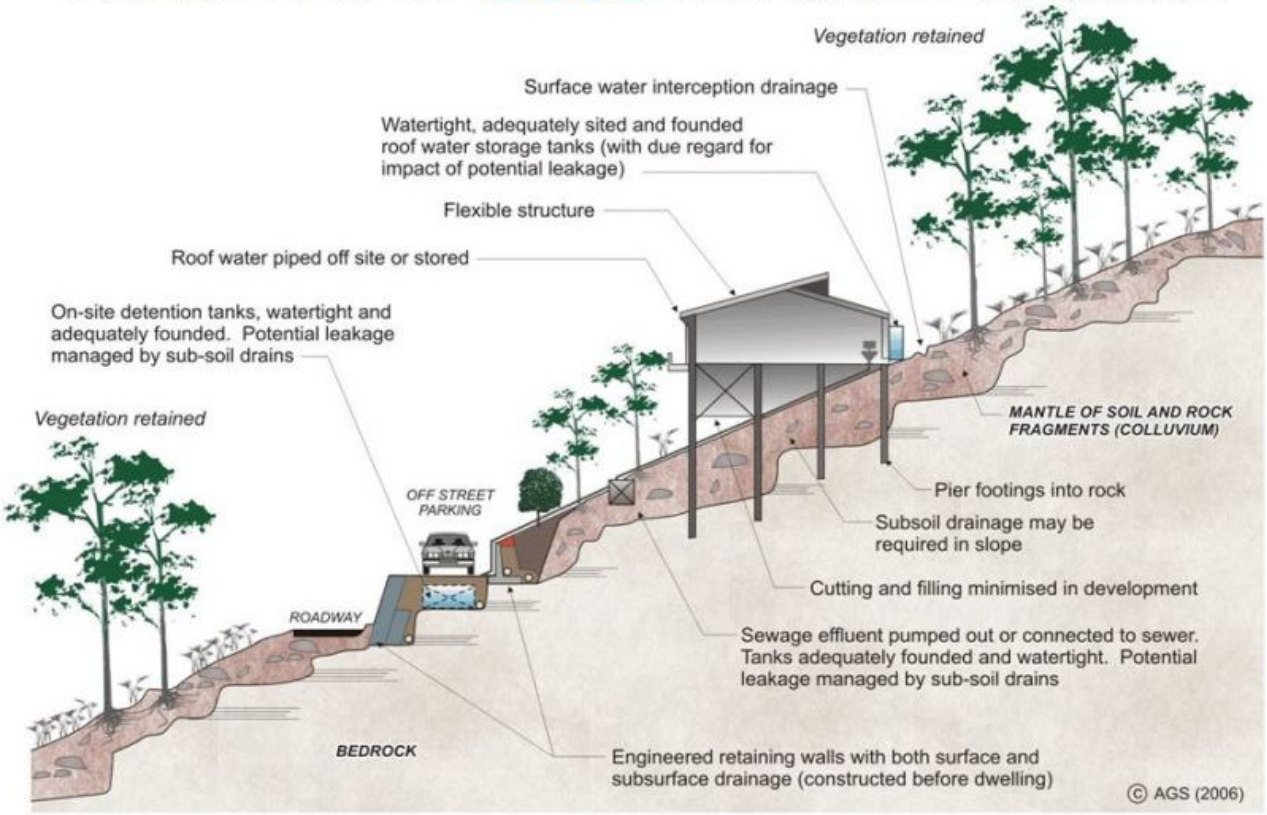
CLIENT:	MARCUS & LIDIA AYRES	ADDRESS:	168 WHALE BEACH ROAD WHALE BEACH NSW 2107	JOB NO:	200731	DRAWING NO:	DA10
PROJECT:	AYRES HOUSE	DRAWING:	**SECTION AA**	DRAWN:	MC	ISSUE:	C
				CHECKED:	MK		
				SCALE:	1:100		

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE