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

Development Application for _____
Name of Applicant

Address of site 9 Eungai Place, North Narrabeen

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 23/12/19 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 **9 Eungai Place, North Narrabeen**

Report Date: 23/12/19

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 9 Eungai Place, North Narrabeen

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 **9 Eungai Place, North Narrabeen**

Report Date: 23/12/19

Author: BEN WHITE

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

Please mark appropriate box

☒ Comprehensive site mapping conducted **17/12/19**
(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 **17/12/19**

☒ 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:

Alterations and Additions at **9 Eungai Pl, North Narrabeen.**

1. Proposed Development

1.1 Construct a garage at the NE side of the house by excavating to a maximum depth of ~0.8m.

1.2 Construct new decks on the uphill and downhill sides of the house.

1.3 Extend the ground floor at the N side of the house.

1.4 Internal modifications to the house.

1.5 Details of the proposed development are shown on 15 drawings prepared by JJ drafting, drawings numbered DA.01 to DA.15, dated August 2019.

2. Site Description

2.1 The site was inspected on the 17th of December, 2019.

2.2 This residential property is on the high side of the road and has a W aspect. It is located on the moderate to steeply graded lower reaches of a hillslope. From the road frontage to the uphill side of the house, the slope rises at angle of ~14° before increasing in grade to a steep angle of ~28° at the uphill boundary. The slope below the property decreases in grade and the slope above continues at steep angles.

2.3 From the road frontage the existing concrete driveway runs up the slope to the house (photo 1). The driveway will be re-routed as part of the development so as to access the proposed garage. The part two storey brick house is supported on brick walls, brick piers and steel posts (photos 2 to 6). The supporting walls, piers and posts appear to be in good condition and show no significant signs of movement. Uphill of the house a sandstone boulder wall up to ~3m high lines the slope to the N and a

sandstone block wall supports the slope to the S (photos 7 & 8). The boulder wall is battered at an angle of ~40° to ~45°. The wall components are suitably placed and well sized. The sandstone block wall is battered back at ~6° from vertical and appears to be well made. An old ~1.3m mortared stack rock retaining wall supports forms a terrace along the S boundary and in the neighbouring S property (photo 9). At the W boundary loose sandstone boulders are scattered on the slope and are considered to be in stable conditions (photo 10).

3. Geology

The Sydney 1:100 000 Geological sheet indicates the site is underlain by Hawkesbury Sandstone. It is described as a medium to coarse grained quartz sandstone with very minor shale and laminite lenses.

4. Subsurface Investigation

One auger hole was put down to identify the soil materials. Five 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. It should be noted that floating boulders are expected through the profile in this location. The results are as follows:

AUGER HOLE 1 (~RL15.7) **–** AH1 (photo 11)

Depth (m)	**Material Encountered**
0.0 to 0.8	**CLAYEY SAND**, brown and grey, fine to medium grained, loose, dry.
0.8 to 1.1	**CLAY**, brown and orange, firm to stiff, moist.

End of hole @ 1.1m in firm to stiff clay. No watertable encountered.

Depth(m) Blows/0.3m	DCP 1 (~RL12.5)	DCP 2 (~RL13.7)	DCP 3 (~RL15.7)	DCP 4 (~RL15.2)	DCP 5 (~RL14.0)
0.0 to 0.3	12	4	16	4	20
0.3 to 0.6	14	#	7	7	#
0.6 to 0.9	29		6	#	
0.9 to 1.2	39		8		
1.2 to 1.5	#		14		
1.5 to 1.8			8		
1.8 to 2.1			#		
	End of Test @ 1.2m	Refusal @ 0.5m	Refusal @ 1.9m	Refusal @ 0.8m	Refusal @ 0.4m

#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, nothing on dry tip.
DCP2 – Refusal @ 0.5m, DCP bouncing, nothing on muddy tip.
DCP3 – Refusal @ 1.9m, DCP bouncing, nothing on moist tip.
DCP4 – Refusal @ 0.8m, DCP bouncing, nothing on moist tip.
DCP5 – Refusal @ 0.4m, DCP bouncing, nothing on muddy tip.

5. Geological Observations/Interpretation

The surface features of the block are controlled by the underlying sandstone bedrock that steps down the property forming sub-horizontal benches between the steps. Where the grade is steeper, the steps are larger and the benches narrower. Where the slope eases, the opposite is true. The rock is overlain by clayey sand (colluvium – geologically old) and insitu clays that fill the bench step formation. In the test locations, the depth to rock ranged between 0.4 to 1.9m below the current surface of the proposed works. It should be noted that floating boulders are expected through the profile so foundation depths may be variable and this should be accounted for in the budget and building plan. The sandstone underlying the property is estimated to be medium strength or better. 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 clay and rock and through the cracks in the rock.

Due to the slope and elevation of the block, the water table in the location is expected to be many metres below the base of the proposed excavation.

7. Surface Water

No evidence of surface flows were observed on the property during the inspection. It is expected that normal sheet wash will move onto the site from above the property during heavy down pours.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed below or beside the property. The moderate to steep slope that falls across the property and continues above is a potential hazard (**Hazard One**). The vibrations from the proposed excavation are a potential hazard (**Hazard Two**). The proposed excavation collapsing onto the worksite during the excavation process is a potential hazard (**Hazard Three**).

RISK ANALYSIS SUMMARY IS ON THE NEXT PAGE

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two	Hazard Three
TYPE	The moderate to steep slope that falls across the property and continues above failing and impacting on the property.	The vibrations produced during the proposed excavation impacting on the surrounding structures.	The proposed excavation collapsing onto the worksite during the excavation process.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (20%)	'Medium' (15%)	'Medium' (15%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Moderate' (2×10^{-4})	'Moderate' (2×10^{-4})
RISK TO LIFE	8.3×10^{-7}/annum	8.3×10^{-7}/annum	8.3×10^{-7}/annum
COMMENTS	This level of risk is 'ACCEPTABLE'.	This level of risk to property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels the recommendations in **Sections 11 & 12** are to be followed.	This level of risk to life and property is 'ACCEPTABLE', provided the recommendations in **Section 13** are 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 Eungai Place. Stormwater from the proposed developments 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 ~0.8m is required to construct the proposed new garage and house additions. On the uphill side the excavation is interpreted to be through clayey sand and clay from between ~0.4m to ~0.5m deep over Medium Strength Sandstone. It is envisaged that excavations through clayey sand and clay can be carried out with a machine and bucket and excavations through rock will require grinding or rock sawing and breaking.

12. Vibrations

Possible vibrations generated during excavations through clayey sand and clays will be below the threshold limit for building damage.

Excavations through Medium Strength Rock or better should be carried out to minimise the potential to cause vibration damage to the subject house and neighbouring property to the N. Allowing for back wall drainage the excavation will come ~0.8m from the downhill side of the existing house and ~1.7m from the N 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 5mm/sec at 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 5mm/sec at the subject 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 subject house and neighbouring properties.

13. Excavation Support Requirements

An excavation to a maximum depth of ~0.8m is required to construct the proposed new garage and house additions. The proposed excavation will come to 0.8m of the downhill supporting wall of the existing house. Rock is expected at a depth of 0.5m so the house foundations are considered to be outside the zone of influence of the excavation.

The clayey sand portion of the proposed excavation is to be battered temporarily at 1.0 Vertical to 2.0 Horizontal (30°) until the retaining walls are in place. Excavations through clay will stand unsupported for a short period of time until the retaining walls are in place, provided they are kept from becoming saturated. Medium Strength Sandstone or better will stand at vertical angles unsupported subject to approval by the geotechnical consultant.

Upslope runoff is to be diverted from the cut faces by sandbag mounds or other diversion works. All unsupported cut batters are to be covered to prevent access of water in wet weather and loss of moisture in dry weather. 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. If the retaining walls are not constructed within a few days of the excavation being completed temporary shoring will be required.

During the excavation process, 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 additional support is not required.

All excavation spoil is to be removed from site or is to be supported by engineered retaining walls.

14. Retaining Structures

For cantilever or singly propped retaining structures 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 Structures

Unit	Earth Pressure Coefficients		
	Unit weight (kN/m^3)	'Active' K_a	'At Rest' K_0
Clayey Sand	20	0.40	0.55
Residual Clay	20	0.35	0.45
Medium Strength Sandstone	24	0.00	0.01

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 structure, do not account for any surcharge loads and assume retaining structures are fully drained.

Rock strength and relevant earth pressure coefficients are to be confirmed on site by the geotechnical consultant.

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 the full hydrostatic pressures are to be accounted for in the retaining structure design.

15. Foundations

The proposed garage, decks and house additions can be supported on spread footings or shallow piers taken into the firm to stiff clays of the natural profile where some movement in accordance with a 'Class S' site can be tolerated. The clay is interpreted to be at a maximum depth of ~0.8m below the surface. A maximum allowable bearing pressure of 200kPa can be assumed for footings on firm to stiff clay.

The proposed deck at the uphill side of the house may also be supported on pad footings taken to the underlying Clayey Sand at a minimum depth of 0.4m from the downhill side of the footing. A maximum allowable bearing pressure of 100kPa can be assumed for footings on Clayey Sand.

For better quality footings or where little movement can be tolerated piers can be taken to Medium Strength Sandstone. This ground material is expected at a maximum depth of ~1.9m below the current surface. A maximum allowable bearing pressure of 1.2MPa can be assumed for footings on Medium Strength Sandstone.

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

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

16. 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 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 consultant 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

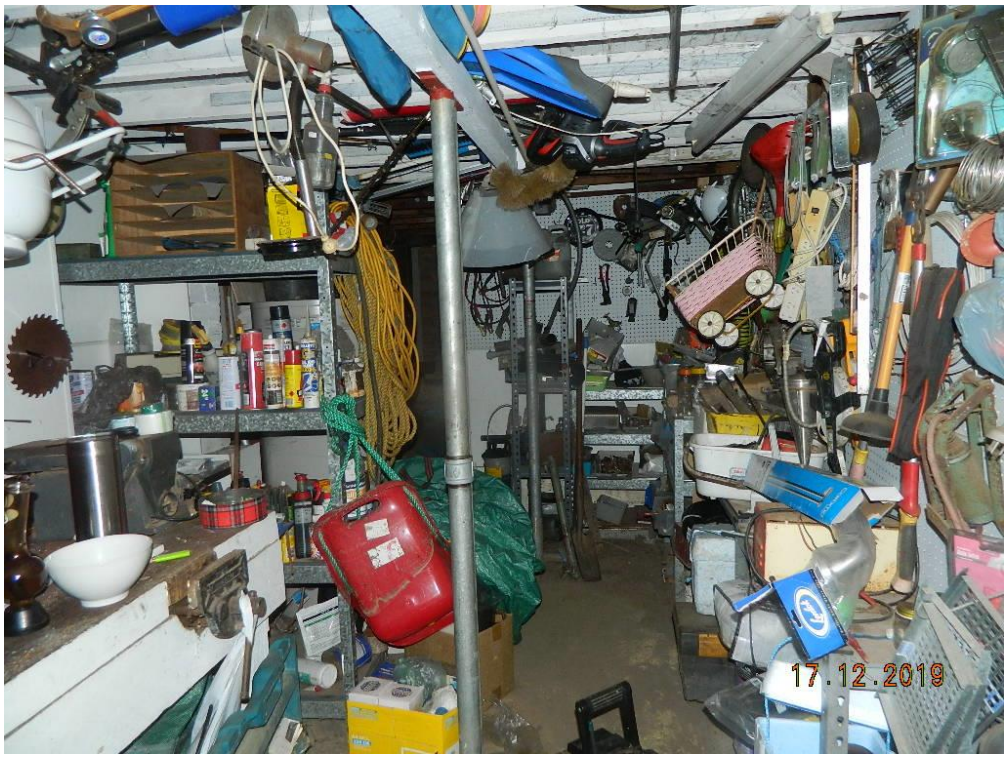


Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11: AH1 – Downhole is from 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.

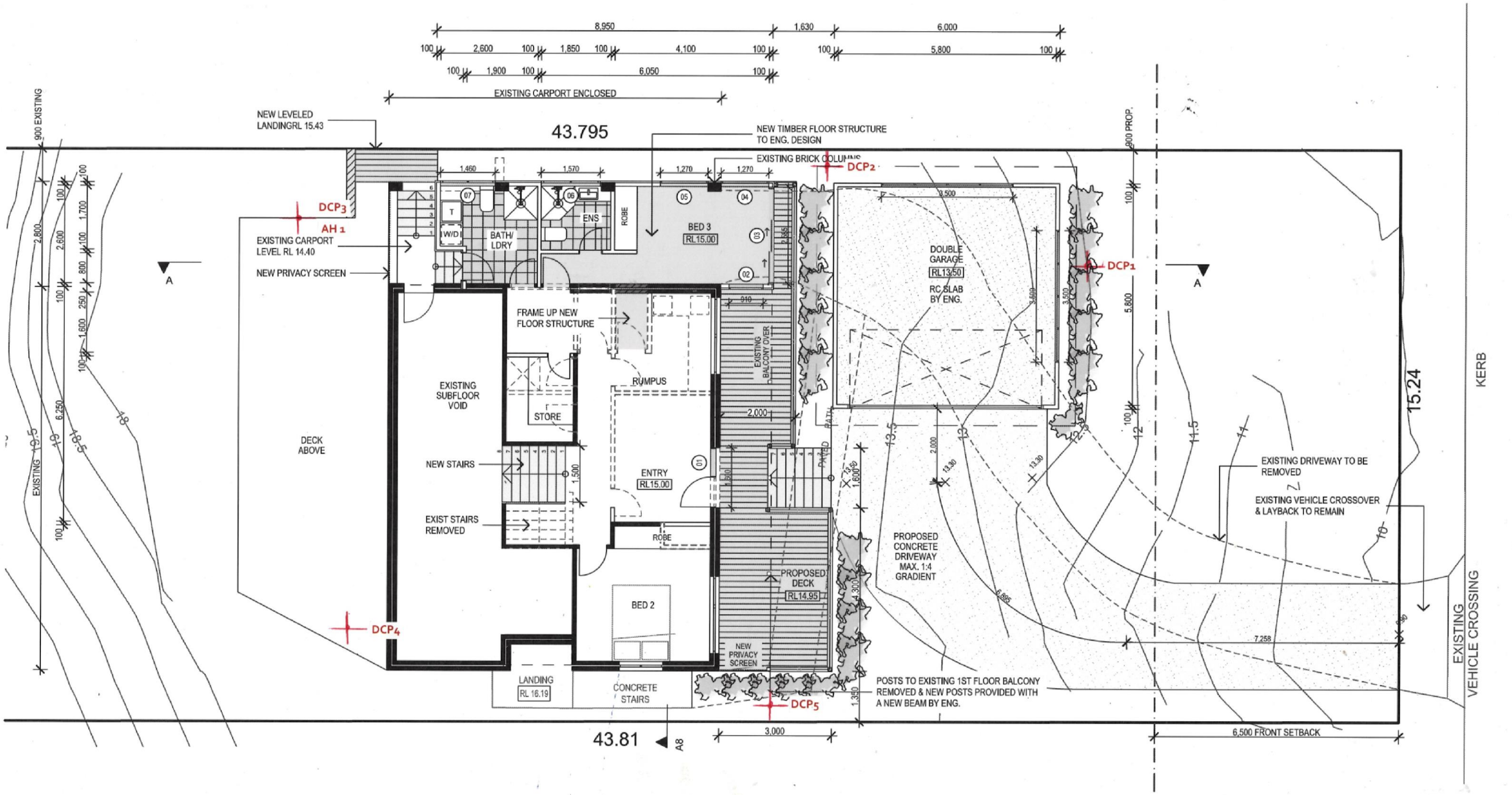
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



GARAGE & LOWER GROUND FLOOR PLAN
1:100

TRUE NORTH:

NOTES:
- All structures including stormwater & drainage to engineer's details.
- Do not obtain dimensions by scaling drawings.
- All dimensions are to be checked on site prior to starting work.
- These drawings are to be read in conjunction with all other consultant's drawings and specifications.
- All workmanship & materials shall be in accordance with the requirements of current editions including amendments of the relevant SAA Codes of Practice, the Building Code of Australia and local council requirements.
- New materials are to be used throughout unless otherwise noted.
- Concrete footings, slab, structural beams or any other structural members are to be designed by a practicing engineer.

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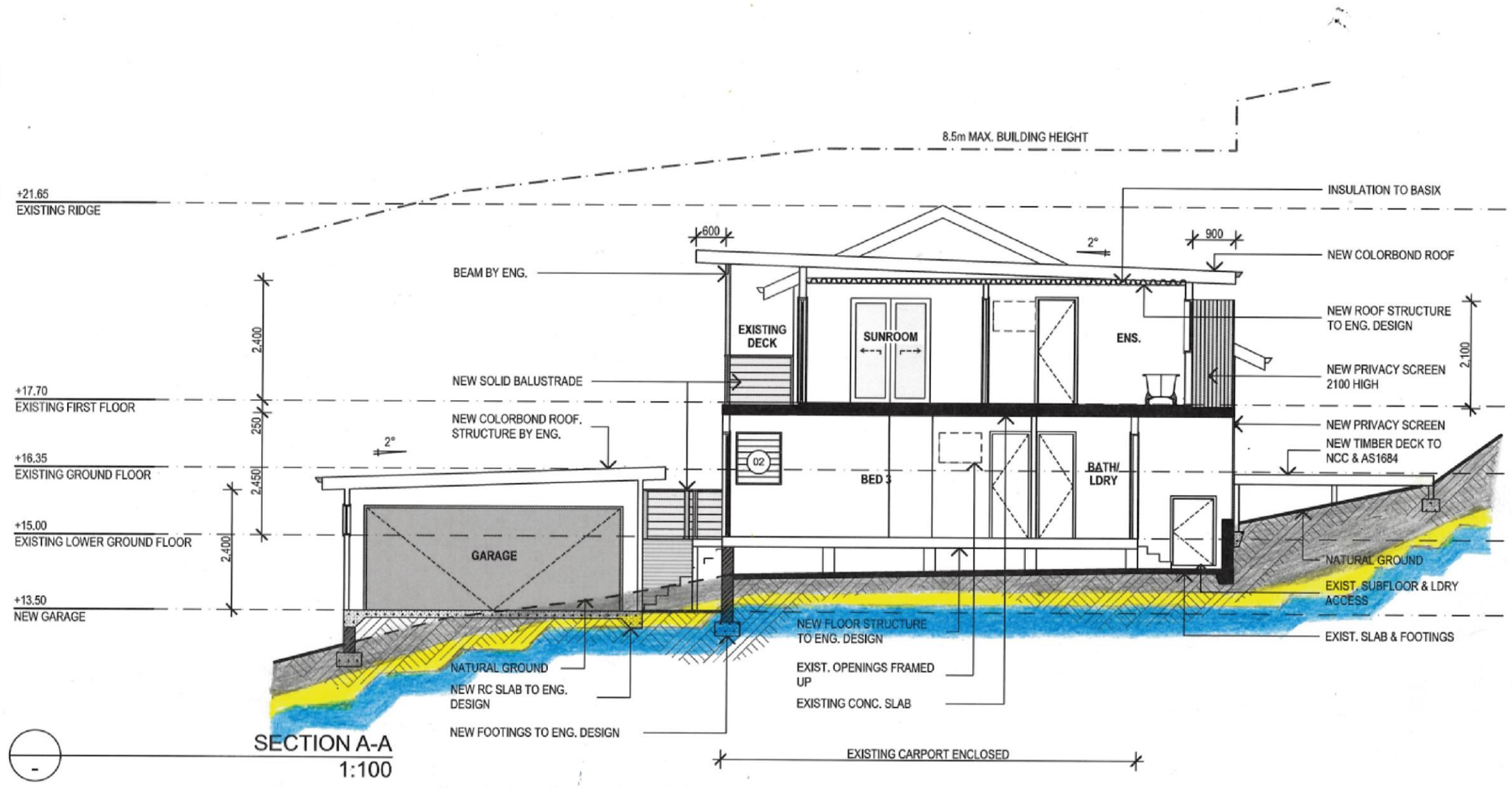
REV:	DATE:	DESCRIPTION:

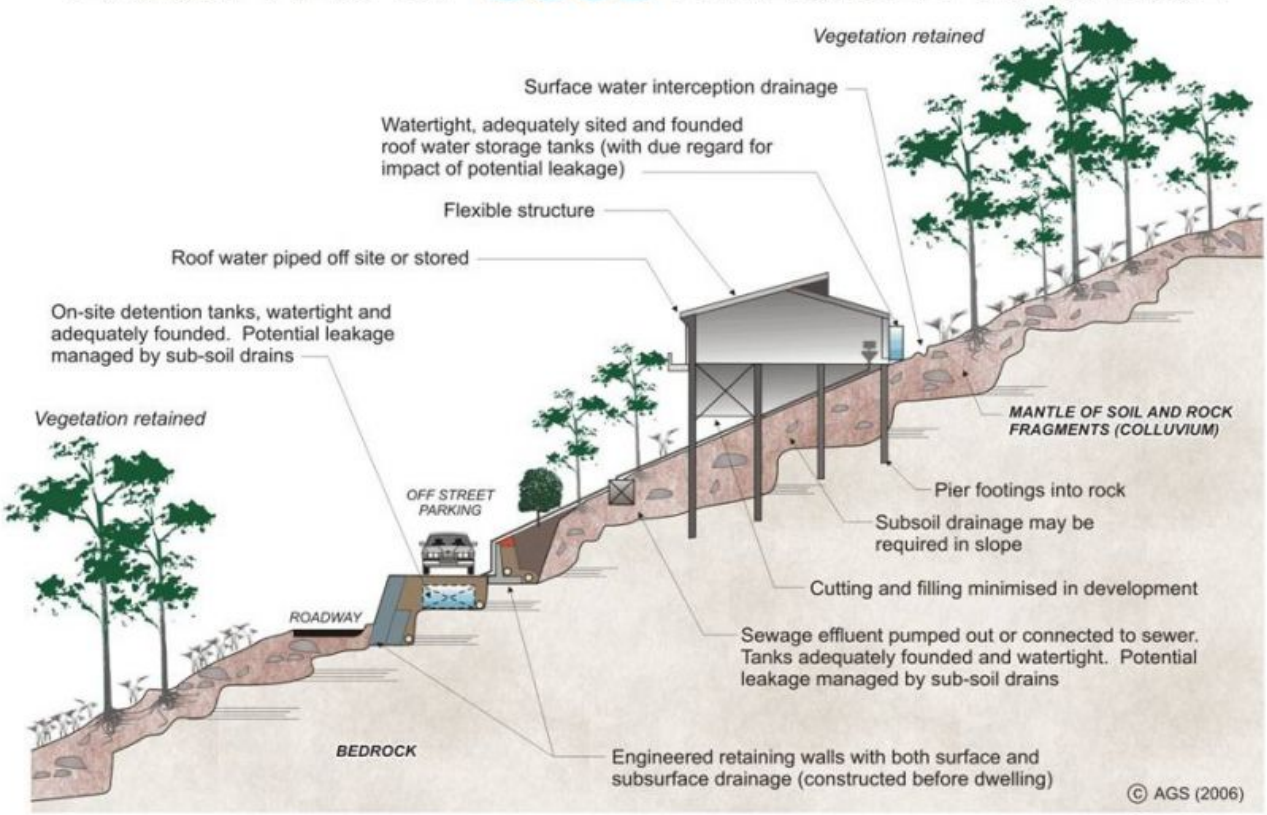
PROJECT DETAILS: PROPOSED ALTERATIONS AND ADDITIONS 9 EUNGAI PLACE NORTH NARRABEEN	DATE: AUG/19	DRAWN BY: AHB	SCALE: 1:100 @ A3
DRAWING TITLE: GARAGE & LOWER GROUND FLOOR PLAN	JOB No: 721/19	CHECKED BY: JJ	DRAWING No: **DA.03**

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



- Clayey Sand
- Clay – Firm to Stiff
- Hawkesbury Sandstone – Medium Strength

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE