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

Development Application for _____
Name of Applicant

Address of site 31 Marine Parade, Avalon 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 9/6/21 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 **31 Marine Parade, Avalon Beach**
Report Date: 9/6/21

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 31 Marine Parade, Avalon 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 **31 Marine Parade, Avalon Beach**

Report Date: 9/6/21

Author: BEN WHITE

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

Please mark appropriate box

☒ Comprehensive site mapping conducted **26/5/21**
(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 **26/5/21**

☒ 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 and Garage at **31 Marine Parade, Avalon Beach**

1. Proposed Development

1.1 Demolish the existing house and construct a new house by excavating to a maximum depth of ~2.0m.

1.2 Construct a new garage on the uphill side of the property by excavating to a maximum depth of ~1.0m.

1.3 Minor landscaping works on the downhill side of the property.

1.4 Details of the proposed development are shown on 7 drawings prepared by Rama Architects, drawings numbered DA-000, DA-001, DA-100, DA-101, DA-300, DA-301, DA-400 dated 24/5/21.

2. Site Description

2.1 The site was inspected on the 26th May 2021, and previously on the 3rd November, 2020.

2.2 This waterfront residential property is near level with the road and encompasses the crest and gentle to steeply graded slope that falls to the waterfront. The ground surface is near level from the road frontage to the downhill side of the house before the slope falls from the downhill side of the house at an angle of ~8° and increases in grade markedly before dropping away at near vertical angles at the coastal bluff.

2.3 At the road frontage, a concrete driveway runs to a brick garage beside the house (Photos 1 & 2). Between the road frontage and the house is a near level lawn. The single storey brick, rendered brick and fibro house will be demolished as part of the proposed works. A gentle to moderately graded lawn and garden area extends off

the downhill side of the house (Photo 7). A stable brick retaining wall up to ~2.0m high along the W common boundary supports a cut on the W neighbouring property (Photo 8). The steep coastal bluff that falls to the waterfront is densely vegetated (Photos 9 & 10). A cliff face consisting of various sedimentary layers including laminate, shale and sandstone marks the beachfront. The cliff face shows some evidence of recent rock falls but these are limited in extent by the structure of the rock and are considered part of the normal ongoing weathering process.

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

One Auger Hole (AH) was put down to identify the soil materials. Eleven 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 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 this site. But due to the possibility that the actual ground conditions vary from our interpretation there should be allowances in the excavation and foundation budget to account for this. We refer to the appended "Important Information about Your Report" to further clarify. The results are as follows:

GROUND TEST RESULTS ON THE NEXT PAGE

AUGER HOLE 1 (~RL22.4) **–** AH1 (Photo 11)

Depth (m)	**Material Encountered**
0 to 0.4	**FILL**, sandy soil and clay, dark brown and orange brown, fine to medium grained, damp.
0.4 to 0.6	**SANDY SOIL**, dark brown/grey, fine to medium grained, damp.
0.6 to 0.8	**CLAY**, light brown/orange, firm, moist.

End of hole @ 0.8m in firm clay. No watertable encountered.

DCP TEST RESULTS – Dynamic Cone Penetrometer

Equipment: 9kg hammer, 510mm drop, conical tip. Standard: AS1289.6.3.2 - 1997

Depth (m) Blows/0.3m	**DCP 1** (~RL24.1)	**DCP 2** (~RL25.1)	**DCP 3** (~RL24.0)	**DCP 4** (~RL23.1)	**DCP 5** (~RL22.4)	**DCP 6** (~RL21.9)
0.0 to 0.3	3	4	11	2F	3	3
0.3 to 0.6	7	9	16	3	5	5
0.6 to 0.9	15	10	20	7	5	11
0.9 to 1.2	18	22	25	15	13	24
1.2 to 1.5	38	30	10	38	40	30
1.5 to 1.8	#	#	#	#	#	#
	End of Test @ 1.5m	End of Test @ 1.3m	Refusal @ 1.3m	End of Test @ 1.5m	End of Test @ 1.5m	End of Test @ 1.4m

DCP RESULTS CONTINUE ON THE NEXT PAGE

Depth (m) Blows/0.3m	DCP 7 (~RL22.5)	DCP 8 (~RL21.1)	DCP 9 (~RL19.8)	DCP 10 (~RL18.6)	DCP 11 (~RL18.4)
0.0 to 0.3	6	8	2	10	10
0.3 to 0.6	13	14	#	9	5
0.6 to 0.9	13	#		#	#
0.9 to 1.2	27				
1.2 to 1.5	25				
1.5 to 1.8	#				
	Refusal on rock @ 1.4m	Refusal on rock @ 0.6m	Refusal on rock @ 0.2m	Refusal on rock @ 0.6m	Refusal on rock @ 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 @ 1.5m, DCP still very slowly going down, brown sandy soil on moist tip.

DCP2 – End of test @ 1.3m, DCP still very slowly going down, orange clay on damp tip.

DCP3 – Refusal on rock @ 1.3m, DCP bouncing off rock surface, red orange shale fragments on moist tip.

DCP4 – End of test @ 1.5m, DCP still very slowly going down, brown sandy soil on muddy tip.

DCP5 – End of test @ 1.5m, DCP still very slowly going down, orange red shale fragments on damp tip.

DCP6 – End of test @ 1.4m, DCP still very slowly going down, white impact dust on dry tip.

DCP7 – Refusal on rock @ 1.4m, DCP bouncing off rock surface, red and white rock fragments on dry tip.

DCP8 – Refusal on rock @ 0.6m, DCP bouncing off rock surface, clean dry tip, red and white rock fragments on cone.

DCP9 – Refusal on rock @ 0.2m, DCP bouncing off rock surface, red and white rock fragments on dry tip.

DCP10 – Refusal on rock @ 0.6m, DCP bouncing off rock surface, red and white rock fragments on dry tip.

DCP11 – Refusal on rock @ 0.4m, DCP bouncing off rock surface, red and white rock fragments on dry tip, red sandy clay on collar.

5. Geological Observations/Interpretation

The slope materials are colluvial at the near surface and residual at depth. In the test locations, the ground materials consist of fill and sandy soil over clays. Filling has been placed on the downhill side of the house. On the uphill side of the house the clays merge into the weathered zone of the underlying rocks at depths of between 1.3 to 1.5m below the current surface. The rock underlying the property is conservatively estimated to be Very Low to Medium Strength Rock. 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 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 works.

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 gentle to steep slope that falls across the property and continues above is a potential hazard (**Hazard One**). The vibrations produced during the proposed excavation impacting on the neighbouring properties is a potential hazard (**Hazard Two**). The proposed excavations are a potential hazard until retaining walls are in place (**Hazard Three**). The additional surcharge loads from the proposed house & garage structures are a potential hazard to the existing brick retaining wall along the W common boundary (Photo 8) (**Hazard Four**). Note: The coastal engineering

report attached (by Horton Coastal Engineering) specifies an erosion/weathering rate of 5 to 12mm/year for the sea cliff near the downhill boundary of the property. This is an acceptably low risk and will have no impact on the proposed development.

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The gentle 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 neighbouring properties.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (12%)	'Medium' (15%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Moderate' (2×10^{-4})
RISK TO LIFE	8.3×10^{-7}/annum	5.3×10^{-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 **Section 12** are to be followed.

RISK ANALYSIS CONTINUES ON THE NEXT PAGE

HAZARDS	Hazard Three	Hazard Four
TYPE	The excavations (up to a maximum depth of 2.7m) collapsing onto the work site before retaining structures are in place.	The additional surcharge loads from the house structure transferring onto the existing brick retaining wall causing damage and instability (Photo 8).
LIKELIHOOD	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (15%)	'Medium' (35%)
RISK TO PROPERTY	'Moderate' (2×10^{-4})	'Moderate' (2×10^{-4})
RISK TO LIFE	8.3×10^{-6}/annum	5.6×10^{-5}/annum
COMMENTS	UNACCEPTABLE' level of risk to life and property. To move risk to 'ACCEPTABLE' levels, the recommendations in **Section 13 and 14** are to be followed.	This level of risk to life and property is 'UNACCEPTABLE'. To move the risk to 'ACCEPTABLE' levels the recommendations in **Section 15** 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 waterfront. All stormwater from the proposed development is to be piped to the waterfront through any tanks that may be required by the regulating authorities.

11. Excavations

An excavation to a maximum depth of ~1.0m will be required to construct the proposed garage. The excavation is expected to be through shallow fill and sandy soil over firm to stiff clays, with Very Low to Medium Strength Rock expected near the base of the excavation.

An excavation to a maximum depth of ~2.0m will be required to construct the proposed house. The excavation is expected to be through sandy soil over firm to stiff clays, with Very Low to Medium Strength Rock expected at shallow depths.

Excavations through fill, soil and rock up to Low Strength can be carried out with an excavator and bucket. 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 rock up to Low Strength will be below the threshold limit for building damage. Medium Strength Rock is expected to be encountered during the excavations for the proposed house.

Excavations through Medium Strength Rock should be carried out to minimise the potential to cause vibration damage to the neighbouring houses to the E and W. Accounting for back wall drainage, the E common boundary will be as close as ~2.0m and the W common boundary will be as close as 0.5m from the proposed excavation. The E neighbouring proposed construction will come as close to ~4.0m and the W neighbouring house will come as close as ~1.1m to the proposed excavation.

Dilapidation reporting carried out on the W neighbouring property is recommended prior to the excavation works commencing.

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 property boundaries. Vibration monitoring will be required to verify this is achieved. The Vibration monitoring equipment must include a light/alarm so the operator knows if vibration limits have been exceeded. It also must log and record vibrations throughout the excavation works.

In rock up to Low Strength we expect a machine up to 20 tonnes with a bucket only will be capable to remove the material. Vibrations from this type of equipment are expected to be below the threshold limit outlined.

In Medium Strength Rock or better techniques to minimise vibration transmission will be required. These include:

- Rock sawing the excavation perimeter to at least 1.0m deep prior to any rock breaking with hammers, keeping the saw cuts below the rock to be broken throughout the excavation process.
- Limiting rock hammer size.
- Rock hammering in short bursts so vibrations do not amplify.
- Rock breaking with the hammer angled away from the nearby sensitive structures.
- Creating additional saw breaks in the rock where vibration limits are exceeded.

13. Excavation Support Requirements

An excavation to a maximum depth of ~1.0m will be required to construct the garage. The cut tapers down to a maximum depth of ~0.5m along the W side of the excavation. Allowing for backwall-drainage, the excavation will come as close as ~0.6m to the W common boundary.

Another excavation to a maximum depth of ~2.0m will be required to construct the proposed house assuming a ramp batter is left for the proposed boundary steps. The cut tapers down to a maximum depth of ~1.1m along the W side of the excavation. Allowing for backwall-drainage, the excavation for the house will come close to flush with both the W & E common boundaries, as close as ~2.0m to the E neighbouring proposed construction, and as close as ~0.5m to the W neighbouring house.

The base of the W common boundary wall and W neighbouring house are cut into the slope and have already been lowered past the base of the proposed excavation so only the E boundary will fall within the zone of influence of the excavations. In this instance, the zone of influence is the area above a theoretical 45° line through clay and Very Low Strength Rock

towards the surrounding structures and boundaries. This line reduces to 30° through the fill and soil.

Where the E common boundary falls within the zone of influence of the excavation, the cut faces will require shoring so the cut face is not left unsupported. One suitable form of shoring is to install a soldier post wall whereby the holes for the soldier posts are drilled and the posts installed before any excavation commences. The gaps between the posts are excavated out one at a time before the supporting whalers are installed to form the wall. The support is to be designed by the structural engineer. The temporary support is to remain in place until the retaining walls are built. See site plan attached for extent of minimum required shoring.

As there is an existing brick retaining wall along the W common boundary supporting the cut for the neighbouring property, the excavation along the W common boundary will not require any temporary shoring and will stand unsupported provided care is taken during the excavation so as to not damage the existing wall.

The remaining cut batters through fill, soil, clay and Very Low to Medium Strength Rock 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. 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.

Upon completion of the excavation, it is recommended all unsupported cut faces for the house excavation be supported with retaining walls to prevent any potential future movement of joint blocks in the cut face that can occur over time, when unfavourable jointing is obscured behind the excavation face. Additionally, retaining walls will help control seepage and to prevent minor erosion and sediment movement. Excavation spoil may be used for landscaping on site.

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.

All excavation spoil is to be removed from site following the current Environmental Protection Agency (EPA) waste classification guidelines.

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**	**Passive**
Fill and Soil	20	0.40	0.55	N/A
Residual Clays	20	0.35	0.45	N/A
Rock up to Low Strength Rock	22	0.25	0.38	K_p = 2.5
Medium Strength Rock	24	0.00	0.01	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. 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. 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 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 walls the full hydrostatic pressures are to be accounted for in the retaining structure design.

15. Foundations

The proposed driveway can be supported off the natural surface after any organic matter has been stripped. A maximum allowable bearing pressure of 100kPa can be assumed for soil of the natural surface. Where the driveway is cut into the slope, the driveway can be supported off the exposed clay or Very Low Strength Rock or better. A maximum allowable bearing pressure of 200kPa can be assumed for footings on clay and 600kPa for footings on Very Low Strength Rock or better. Where the foundation material across the driveway structure changes, expansion joints are to be installed to separate the different foundation materials and to accommodate minor differential movement.

The proposed garage can be supported on a raft slab on the underlying Very Low Strength Rock or better. This ground material is expected to be exposed across the base of the excavation on the uphill side. On the downhill side where the Very Low Strength Rock or better drops away with the slope, piers taken to the rock will be required to maintain a uniform bearing pressure across the structure.

A concrete slab and shallow piers supported directly off Very Low to Medium Strength Rock are suitable footings for the proposed house construction. This ground material is expected to be exposed across the downhill side of the excavation. Where the bedrock falls below the base of the excavation, the construction can be supported off shallow piers taken to the Very Low Strength Rock or better where necessary.

A ~2.0m high brick retaining wall along the W common boundary supports a cut on the W neighbouring property (Photo 8). The W edge of the house is to be supported on piers embedded into to Very Low Strength Rock or better and taken to below the base of the retaining wall. Provided the footings are taken to and embedded into this ground material at the required depths no surcharge loads from the proposed structure will be transferred onto the existing retaining wall.

A maximum allowable bearing pressure of 600kPa can be assumed for footings on Very Low to Medium Strength Rock.

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

If a rapid turnaround from footing excavation to the concrete pour is not possible a sealing layer of concrete may be added to the footing surface after it has been cleaned.

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 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. Geotechnical Review

The structural plans are to be checked and certified by the geotechnical engineer as being in accordance with the geotechnical recommendations. On completion a Form 2B will be issued. This form is required for the Construction Certificate to proceed.

17. Inspections

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

- 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, that additional support is not required, 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 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.

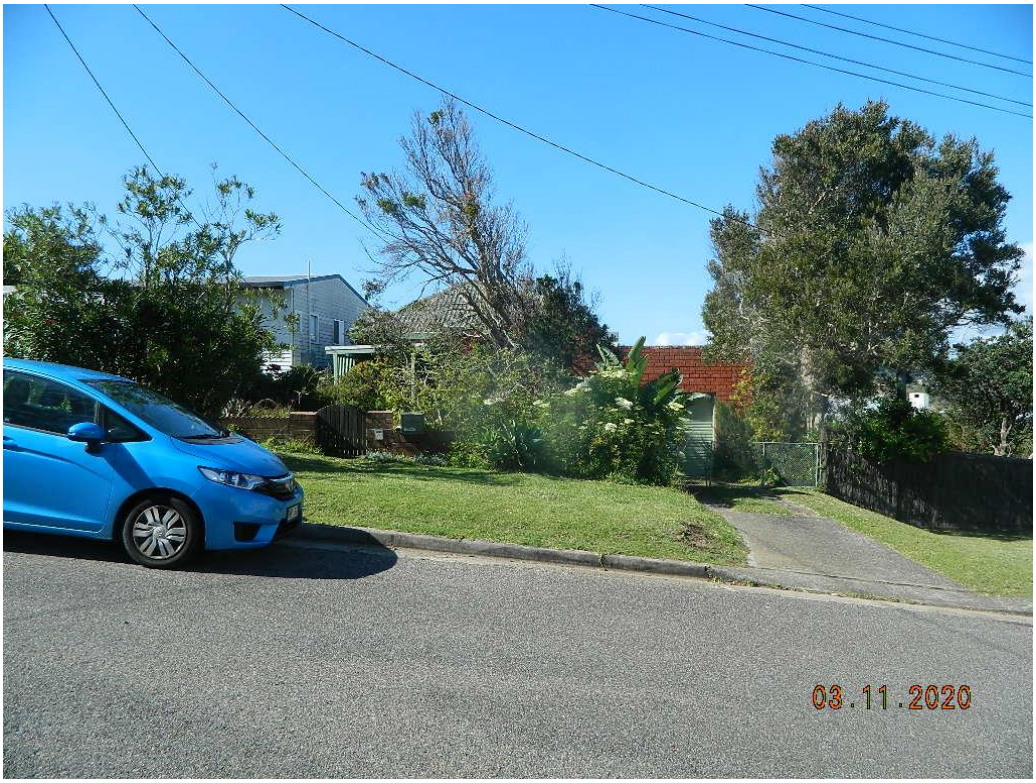


Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

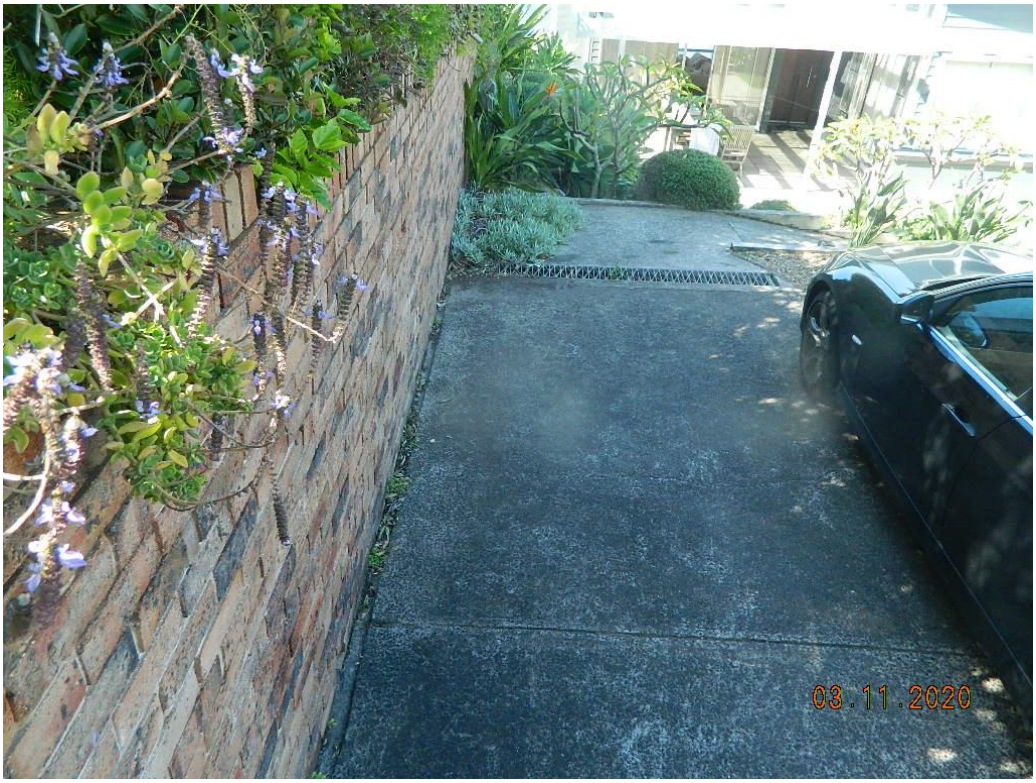


Photo 8

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.

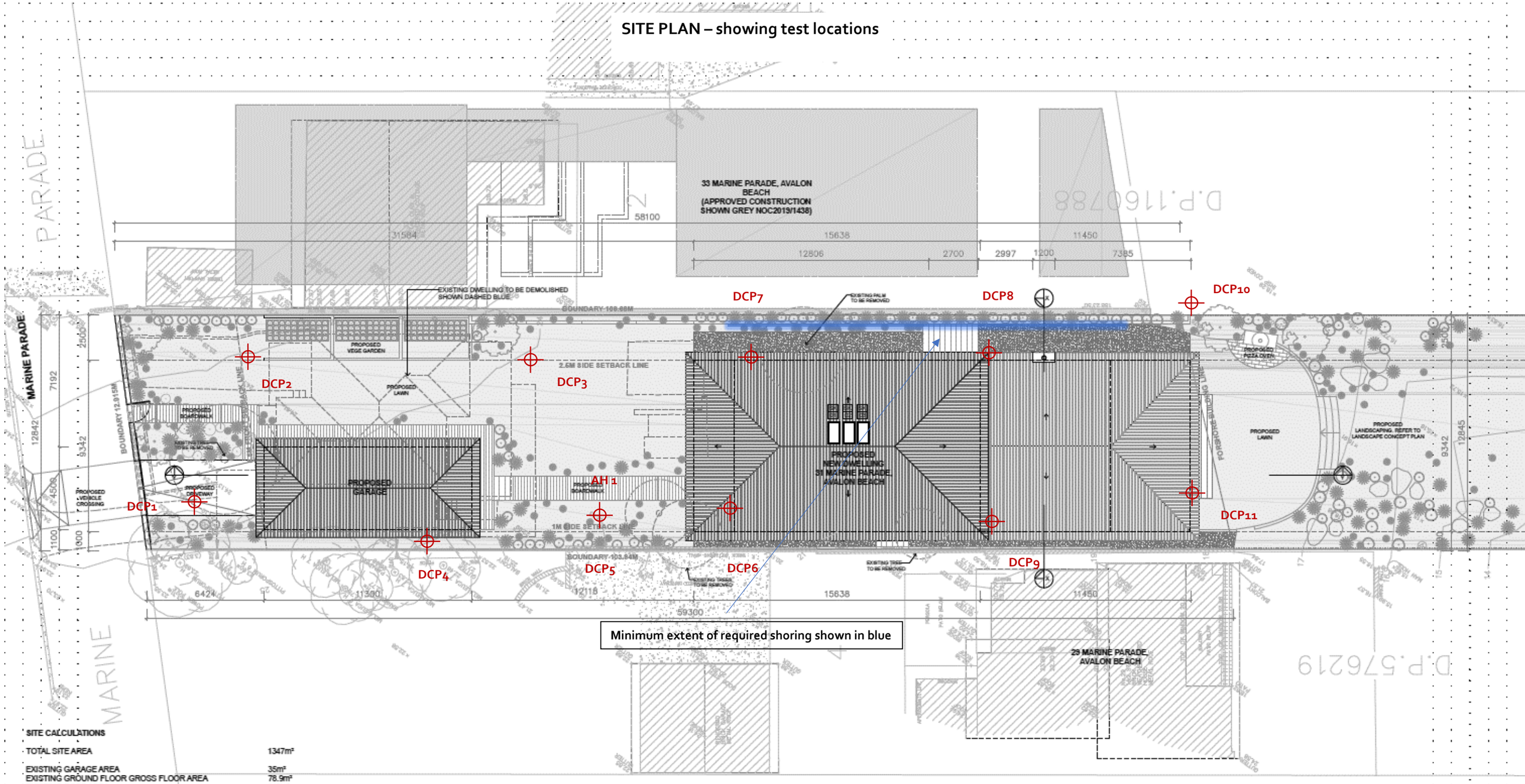
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



SITE CALCULATIONS

TOTAL SITE AREA	1347m²
EXISTING GARAGE AREA	35m²
EXISTING GROUND FLOOR GROSS FLOOR AREA	78.9m²
EXISTING ROOF AREA	142m²
EXISTING TOTAL GROSS FLOOR AREA (EX GARAGE)	78.9m²
PROPOSED GARAGE AREA	46.2m²
PROPOSED LOWER GROUND FLOOR GROSS FLOOR AREA	89.3m²
PROPOSED GROUND FLOOR GROSS FLOOR AREA	115.3m²
PROPOSED ROOF AREA	352.6m²
PROPOSED TOTAL GROSS FLOOR AREA (EX GARAGE)	204.6m²
PROPOSED LANDSCAPED AREA	959.94m² (71.3%)

NORTH

LEGEND:

7.03 DENOTES EXISTING SPOT LEVEL

RL 7.10 DENOTES PROPOSED LEVEL

NOTE: THESE DRAWINGS ARE NOT FOR CONSTRUCTION. FOR DA APPROVAL ONLY.
NOTE: DO NOT SCALE OFF THIS DRAWING
NOTE: ALL WORKS TO BE IN ACCORDANCE WITH THE NCC
NOTE: ALL WORKS TO BE IN ACCORDANCE WITH THE RELEVANT AUSTRALIAN STANDARDS.
NOTE: ALL WORKS TO BE IN ACCORDANCE WITH THE BASIX REQUIREMENTS
NOTE: ALL WORKS TO BE IN ACCORDANCE WITH CONSULTANTS REQUIREMENTS

KEY:

- DENOTES PROPOSED WALLS
- DENOTES OUTLINE OF EXISTING TO BE DEMOLISHED
- DENOTES AREA OF PROPOSED LANDSCAPING
- DENOTES AREA OF PROPOSED DEMOLITION

PROJECT: PROPOSED NEW RESIDENTIAL DWELLING

CLIENT: SHAUN TIMBRELL & SARAH PARKER

LOCATION: 31 MARINE PARADE, NORTH AVALON, NSW

PROJECT STAGE: DEVELOPMENT APPLICATION

DRAWING TITLE: SITE PLAN

SCALE: 1:200 @ A3

DATE OF ISSUE: 24.05.2021

DRAWING NO. DA-001

REVISION: B

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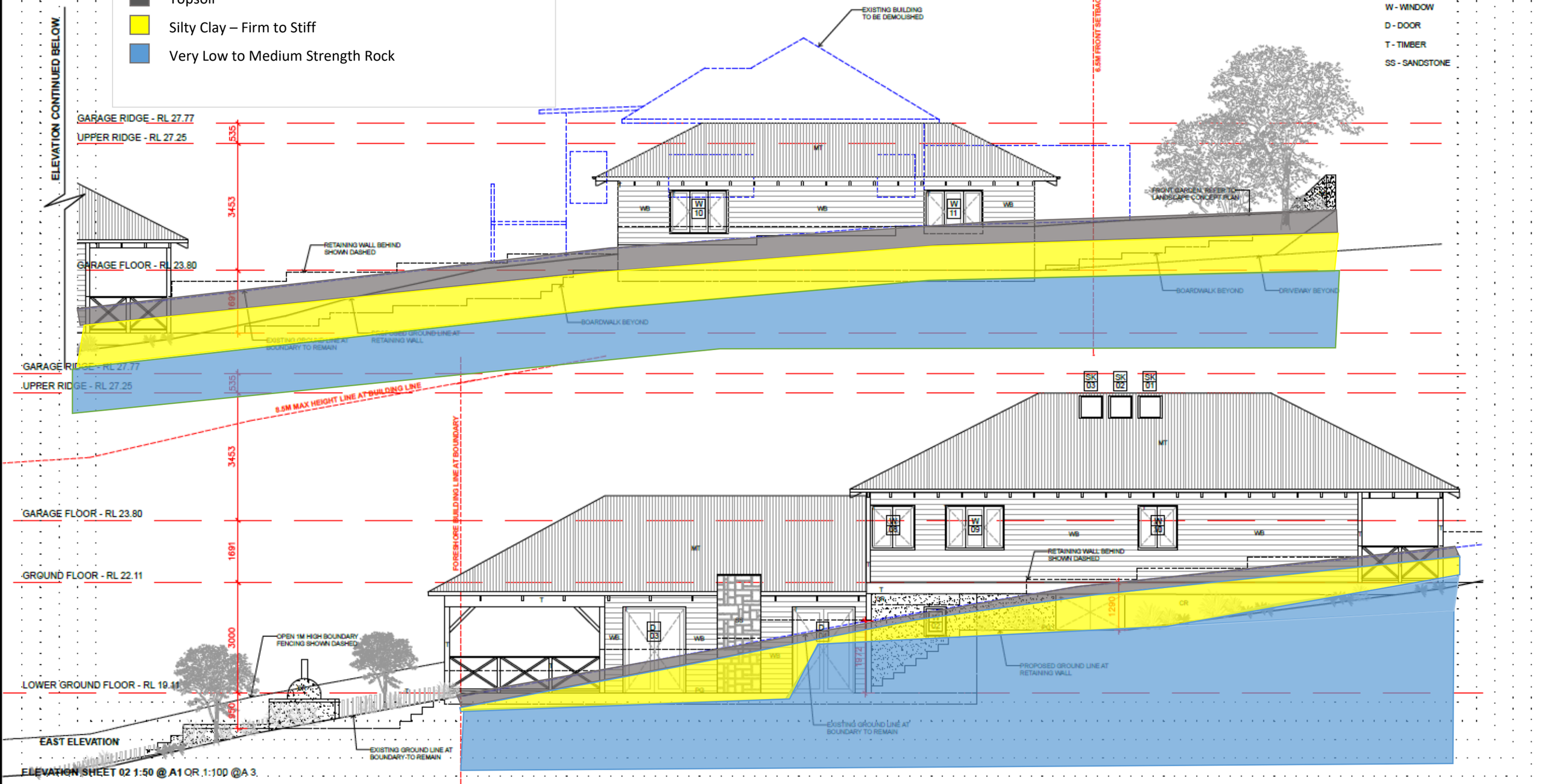
TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials

Expected Ground Materials

- Fill
- Topsoil
- Silty Clay – Firm to Stiff
- Very Low to Medium Strength Rock

SCHEDULE OF FINISHES:

MT - METAL ROOFING
CR - CEMENT RENDER
PG - PERMEABLE GRAVEL
WB - WEATHER BOARD
W - WINDOW
D - DOOR
T - TIMBER
SS - SANDSTONE



EAST ELEVATION

ELEVATION SHEET 02 1:50 @ A1 OR 1:100 @A 3.

LEGEND:

7.03 DENOTES EXISTING SPOT LEVEL

RL 7.10 DENOTES PROPOSED LEVEL

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DEVELOPMENT APPLICATION

DRAWING TITLE:
ELEVATION SHEET 02

SCALE:
1:100 @ A3

DATE OF ISSUE:
24.05.2021

DRAWING NO.
DA-301

REVISION:
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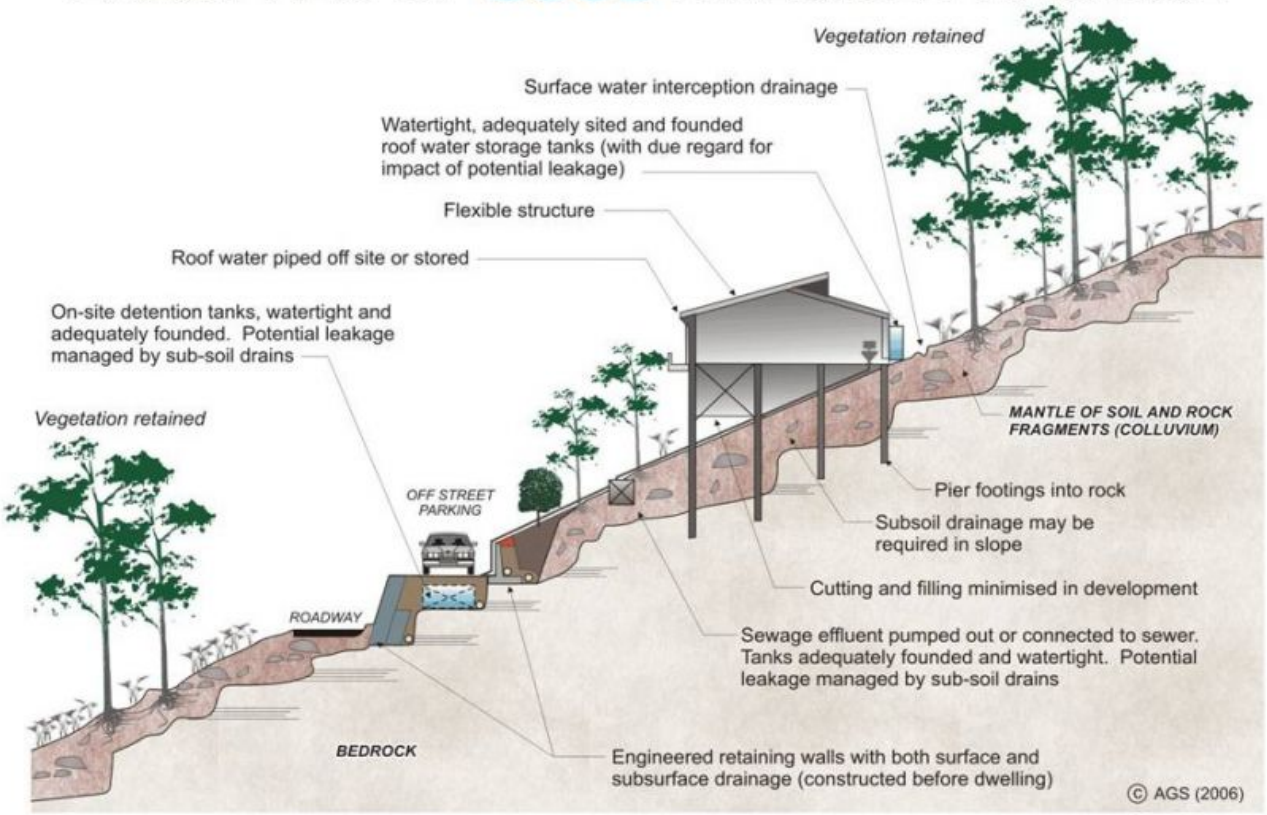
EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE