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

Development Application for _____
Name of Applicant

Address of site 122 Riverview Road, Avalon (AKA 55 Trappers Way)

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 19/11/21 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 **122 Riverview Road, Avalon (AKA 55 Trappers Way)**
Report Date: 19/11/21

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 122 Riverview Road, Avalon (AKA 55 Trappers Way)

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 **122 Riverview Road, Avalon (AKA 55 Trappers Way)**

Report Date: 19/11/21

Author: BEN WHITE

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

Please mark appropriate box

☒ Comprehensive site mapping conducted **6/5/21**
(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 **6/5/21**

☒ 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 at **122 Riverview Road, Avalon (AKA 55 Trappers Way)**

1. Proposed Development

1.1 The property is in the process of being subdivided into two lots as per the previously approved DA.

1.2 Construct a new house on the vacant lot by excavating to a maximum depth of ~4.3m into the slope.

1.3 Details of the proposed house are shown on 15 drawings prepared by Interlock, drawings numbered A000, A050 to A052, A070, A100, A102, A200, A201, A300, and A301, with two drawings numbered A002 and with two drawings numbered A101, all drawings dated 18/11/21.

2. Site Description

2.1 The site was inspected on the 5th and 6th May, 2021, and previously on the 6th September, 2017, and 26th April, 2016.

2.2 This newly subdivided lot will be on the uphill side of Riverview Road. Trappers Way cuts through the uphill side of the lot. The entire block encompasses the crest of a NW trending ridge line and runs down the upper W flank of the ridge. The sloping majority of the block reaches grades of ~20°. The slope below the property continues at similar angles.

2.3 The vacant lot rises from the road frontage to Riverview Road to the downhill side of Trappers Way (Photo 1). The lot continues above Trappers Way to the upper common boundary (Photo 2). The slope between Riverview Road and Trappers Way has been slightly levelled (Photo 3). The cut and fill batters for the levelled area are battered to stable angles. The fill for Trappers Way is also battered to stable angles

(Photo 4). The steep slope that rises above Trappers Way to the upper common boundary appears stable (Photo 2).

3. Geology

The Sydney 1:100 000 Geological sheet indicates the contact of the Hawkesbury Sandstone and the Newport Formation of the Narrabeen Group cuts the property. It is interpreted from ground tests that the proposed works are underlain by the Narrabeen Group of Rocks. The Narrabeen Group is described as interbedded laminite, shale and quartz to lithic quartz sandstone.

4. Subsurface Investigation

Two Core Holes (CH) were drilled across the property to determine the depth and strength of the rock. The drill used was a hand portable rig running an NMLC core barrel. Five Dynamic Cone Penetrometer (DCP) 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 expected to have occurred with DCP4. 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:

GROUND TEST RESULTS ON NEXT PAGE

CORE HOLE 1 (~RL46.5) **–** CH1 (Photo 5)

Depth (m)	Material Encountered

Start of Core Hole at 0.8m:

1.1 to 2.4	**EXTREMELY LOW STRENGTH SHALE**, orange and mottled maroon, dry, fine grained.
2.4 to 2.7	**EXTREMELY LOW TO VERY LOW STRENGTH SHALE**, orange and mottled maroon, dry, fine grained.
2.7 to 4.75	**EXTREMELY LOW STRENGTH SHALE**, grey and mottled orange and maroon, dry, fine grained.
4.75 to 5.2	**EXTREMELY LOW TO VERY LOW STRENGTH SHALE**, grey and mottled orange and maroon, dry, fine grained.
5.2 to 6.1	**EXTREMELY LOW STRENGTH SHALE**, grey, dry, fine grained.

End of hole @ 6.1m in Extremely Low Strength Shale. No water table encountered.

CORE HOLE 2 (~RL47.0) **–** CH2 (Photo 6)

Depth (m)	Material Encountered

Start of Core Hole at 1.3m:

1.3 to 1.5	**CORE LOSS**.
1.5 to 1.65	**GRAVEL**, most likely fill or due to drilling process.
1.65 to 1.9	**EXTREMELY LOW STRENGTH SHALE**, orange and mottled grey and maroon, dry, fine grained.

End of hole @ 1.9m in Extremely Low Strength Shale. No water table encountered.

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	**DCP1** (~RL43.5)	**DCP2** (~RL44.9)	**DCP3** (~RL45.5)	**DCP4** (~RL48.5)	**DCP5** (~RL42.2)
0.0 to 0.3	28	10	16	7	3F
0.3 to 0.6	32	15	21	13	13
0.6 to 0.9	#	40	35	#	35
0.9 to 1.2		#	#		#
	End of Test @ 0.6m	End of Test @ 0.9m	End of Test @ 0.9m	Refusal @ 0.5m	End of Test @ 0.9m

#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 @ 0.6m, DCP still very slowly going down, brown shale fragments on dry tip, test taken at the base of a cut batter.

DCP2 – End of test @ 0.9m, DCP still very slowly going down, clean dry tip.

DCP3 – End of test @ 0.9m, DCP still very slowly going down, maroon shale fragments on dry tip.

DCP4 – Refusal @ 0.5m, DCP bouncing off rock surface, white impact dust on dry tip, test taken beside exposed sandstone boulders.

DCP5 – End of test @ 0.9m, DCP still very slowly going down, brown shale fragments on dry tip.

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 a thin sandy topsoil over firm to stiff sandy clays and clays. The sandy clays and clays merge into the underlying weathered rock at an average depth of ~0.8m below the current surface. The weathered zone is interpreted to be Extremely Low to Very Low Strength Shale. DCP4 likely refused on a buried sandstone boulder as there were exposed sandstone boulders beside the test. See Type Section attached for a diagrammatical representation of the expected ground materials.

6. Groundwater

Normal ground water seepage is expected to move over the buried surface of the rock and through the cracks.

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

7. Surface Water

No evidence of significant surface flows were observed on the property during the inspection. Normal sheet wash from the slope above will be intercepted by the drainage system for Trappers Way.

8. Geotechnical Hazards and Risk Analysis

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

RISK ANALYSIS SUMMARY ON THE NEXT PAGE

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The steep slope that falls across the property and continues below failing and impacting on the existing house and proposed works.	The proposed excavations collapsing onto the work site before the retaining structures are in place.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (15%)	'Medium' (35%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Moderate' (2×10^{-4})
RISK TO LIFE	5.5×10^{-7}/annum	6.0×10^{-4}/annum
COMMENTS	This level of risk is 'ACCEPTABLE'.	This level of risk to life and property is 'TOLERABLE'. 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 ~4.3m is required to construct the proposed lower ground floor of the house. Another excavation to a maximum depth of ~1.0m is required to construct the proposed deck on the uphill side of the house. It is expected the excavations

will be through a thin sandy soil over a firm to stiff clay. Extremely Low to Very Low Strength Shale is expected to be encountered at an average depth of ~0.8m below the current surface.

It is envisaged the excavations through soil, clay, and Extremely Low to Very Low Strength Shale can be carried out with a bucket and excavator and rock hammers will not be required.

12. Vibrations

No excessive vibrations will be generated by excavation through soil, clay, or Extremely Low to Very Low Strength Shale.

13. Excavation Support Requirements

As this job is considered technically complex and due to the depth of the excavations, we recommend it be carried out by builders and contractors who are well experienced in similar work and can provide a proven history of completed work. We recommend a pre-construction meeting between the structural engineer, the builder, and the geotechnical consultant to discuss and confirm the excavation plan and to ensure suitable excavation equipment will be on site.

On steep sites such as this one, to help maintain excavation stability, it is critical upslope runoff be diverted from the proposed excavations with temporary or permanent drainage measures. Temporary measures may be trenches and sandbag mounds and permanent measures could be a wide diameter dish drain or similar. These are to be installed before any excavation work commences.

No structures or boundaries will be within the zone of influence of any proposed excavation.

Due to the depth of the excavation for the lower ground floor, where the excavation exceeds a depth of 2.0m, we recommend heavy ground support be installed prior to the commencement of the excavation to ensure the safety of any workers below the cut. See the attached lower ground floor plan for the minimum extent of the required shoring. For ease of design and construction it may be easier to shore the entire excavation perimeter.

Spaced Pile Retaining Walls are 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 embedment and temporary bracing installed as the excavations are lowered. As the excavations are lowered in 1.5m lifts, infill sprayed concrete panels or similar are added between the piers to form the walls. Drainage is installed behind the panels.

Sandstone floaters were observed to be outcropping nearby and DCP4 likely refused on a buried sandstone boulder. To drill the pier holes for the walls, a small pilling rig that can excavate through Medium Strength Rock will be required. The walls are to be tied into the concrete floor and ceiling slabs of the house 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.

Where the excavation depths are less than 2.0m, the soil portions of the excavations are to be battered at 1.0 Vertical to 1.7 Horizontal (30°) and cut batters through clay and Extremely Low to Very Low Strength Shale or better are expected to stand unsupported at near-vertical angles for short periods of time until retaining walls are installed, provided they are kept from becoming saturated.

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 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 pressure 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
Soil and Residual Clays	20	0.40	0.55	N/A
Extremely Low to Very Low Strength Rock	24	0.25	0.35	Kp 2.5 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 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

Raft slabs supported on the underlying Extremely Low to Very Low Strength Shale are suitable footings for the proposed house. This ground material is expected to be exposed across the majority of the base of the proposed excavations. Where the slope drops away on the downhill side and where the footprint of the house does not fall over the footprints of the excavations, piers will be required to maintain a uniform bearing pressure. The piers are to be embedded at least 0.6m into the underlying Extremely Low to Very Low Strength Shale. The required pier depth is expected to be ~1.4m below the current surface.

A maximum allowable pressure of 600kPa can be assumed for Extremely Low to Very Low Strength Shale. It should be noted that this material is a soft rock and a rock auger will cut through it so the builders should not be looking for refusal to end the footings.

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

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

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

16. Inspections

The client and builder are to familiarise themselves with the following required inspections as well as council geotechnical policy. We cannot provide certification for the regulating

authorities or the owner if the following inspections have not been carried out during the construction process.

- The geotechnical consultant is to inspect the ground materials while the first pier for the ground support is being dug to assess the ground strength and to ensure it is in line with our expectations.

- All finished pier holes for piled wall/excavations for ground support are to be inspected and measured before concrete is placed.

- All footings are to be inspected and approved by the geotechnical consultant while the excavation equipment and contractors are 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: CH1

Photo 6: CH2

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.

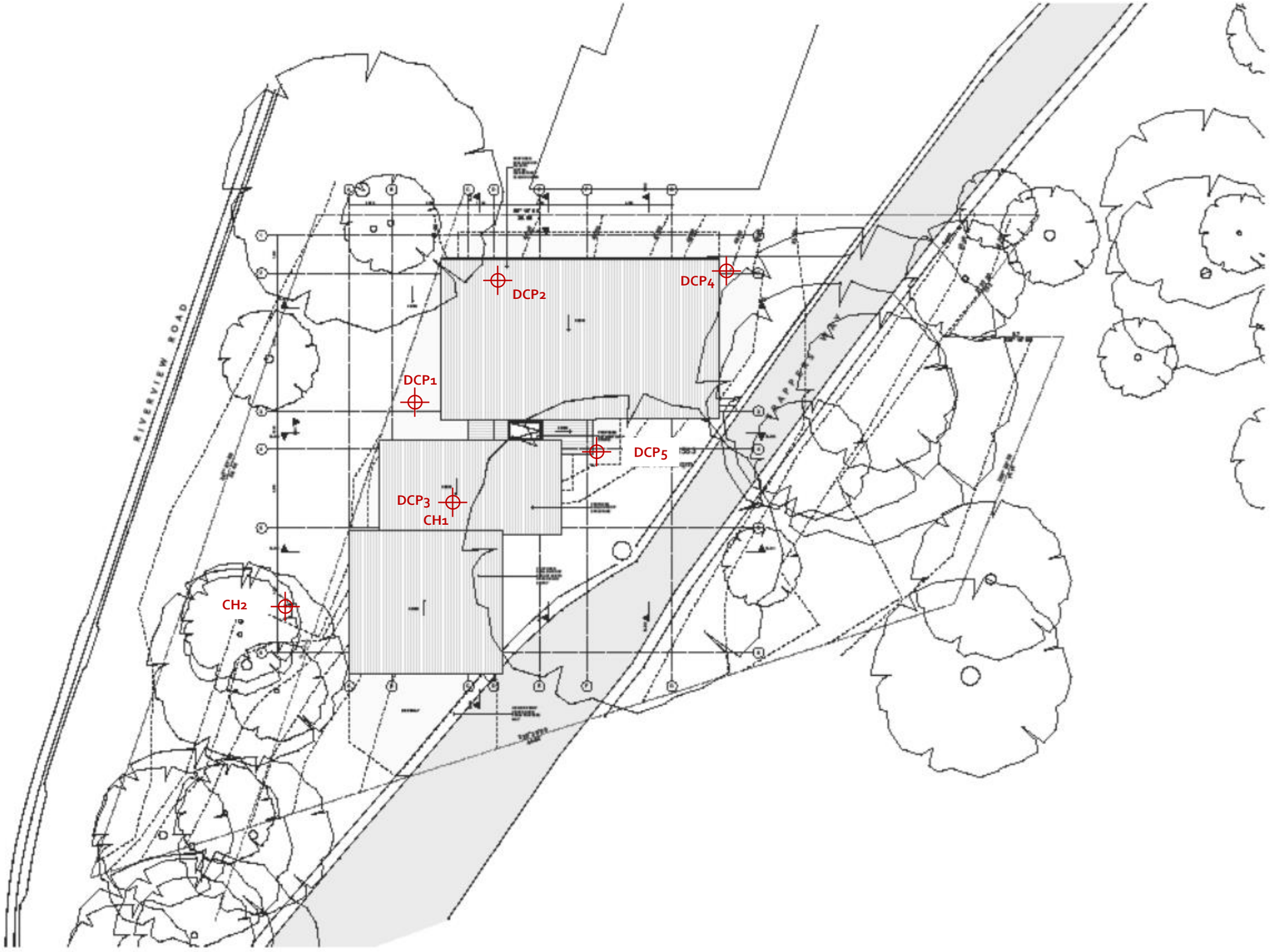
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



NOT FOR CONSTRUCTION

01 Proposed - Ridge
1:100 @ A3

FOR DA COORDINATION | FOR COMMENT 18/11/21

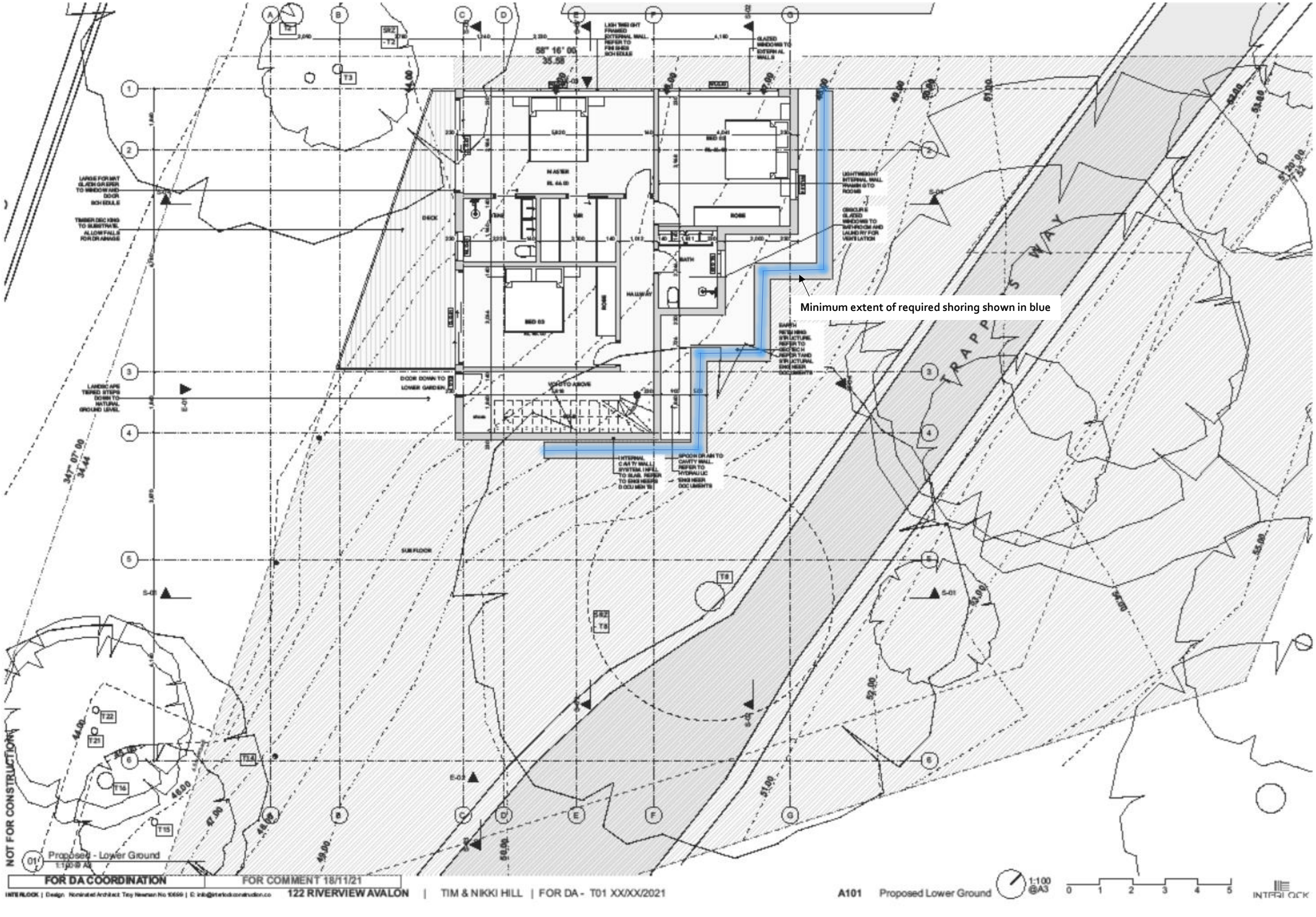
INTERLOCK | Design Nominated Architect Trey Newman No 10699 | E: info@interlockconstruction.co 122 RIVERVIEW AVALON | TIM & NIKKI HILL | FOR DA - T01 XX/XX/2021

A002 Site Plan / Analysis

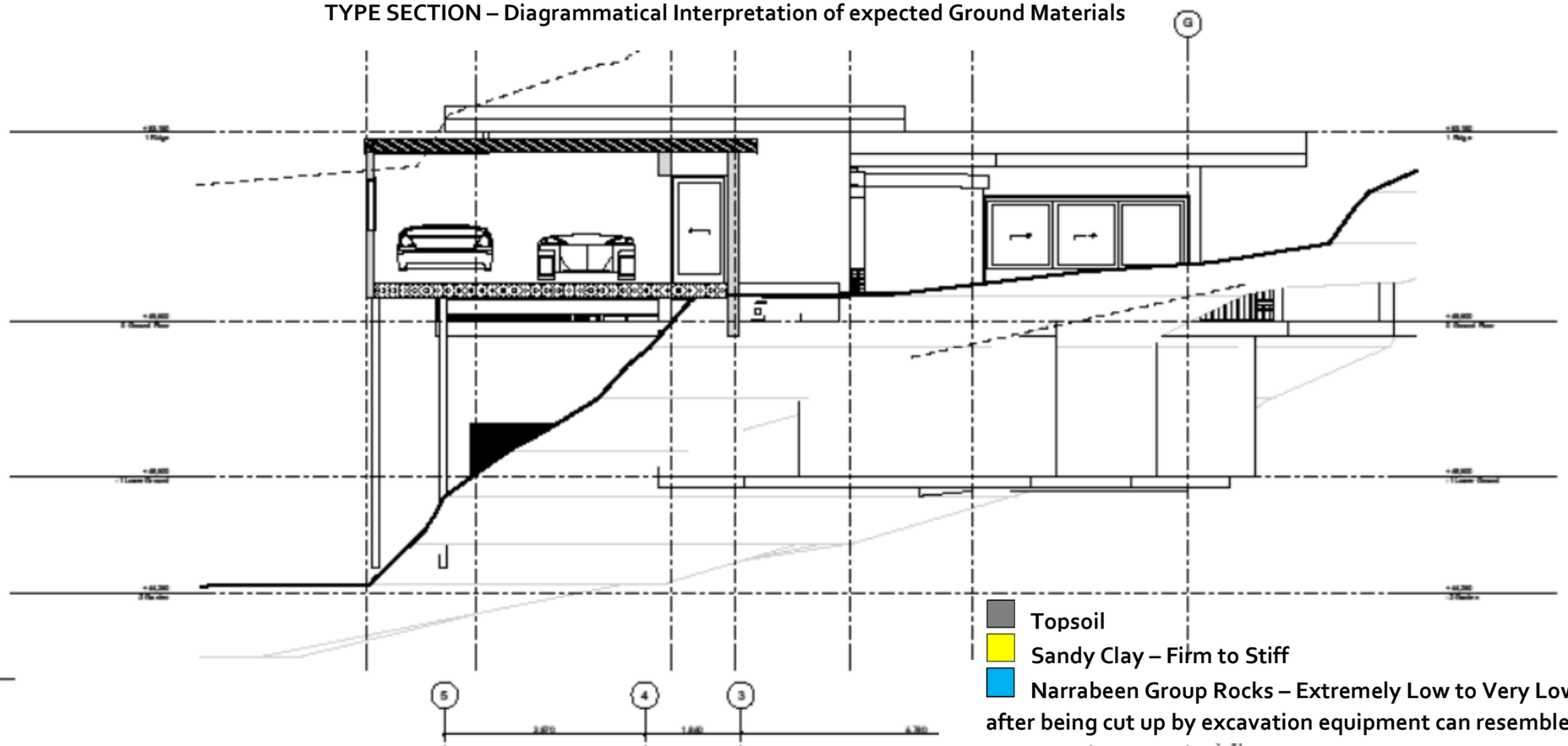
1:200 @A3 0 2 4 6 8 10

INTERLOCK

LOWER GROUND FLOOR PLAN – showing minimum required extent of shoring

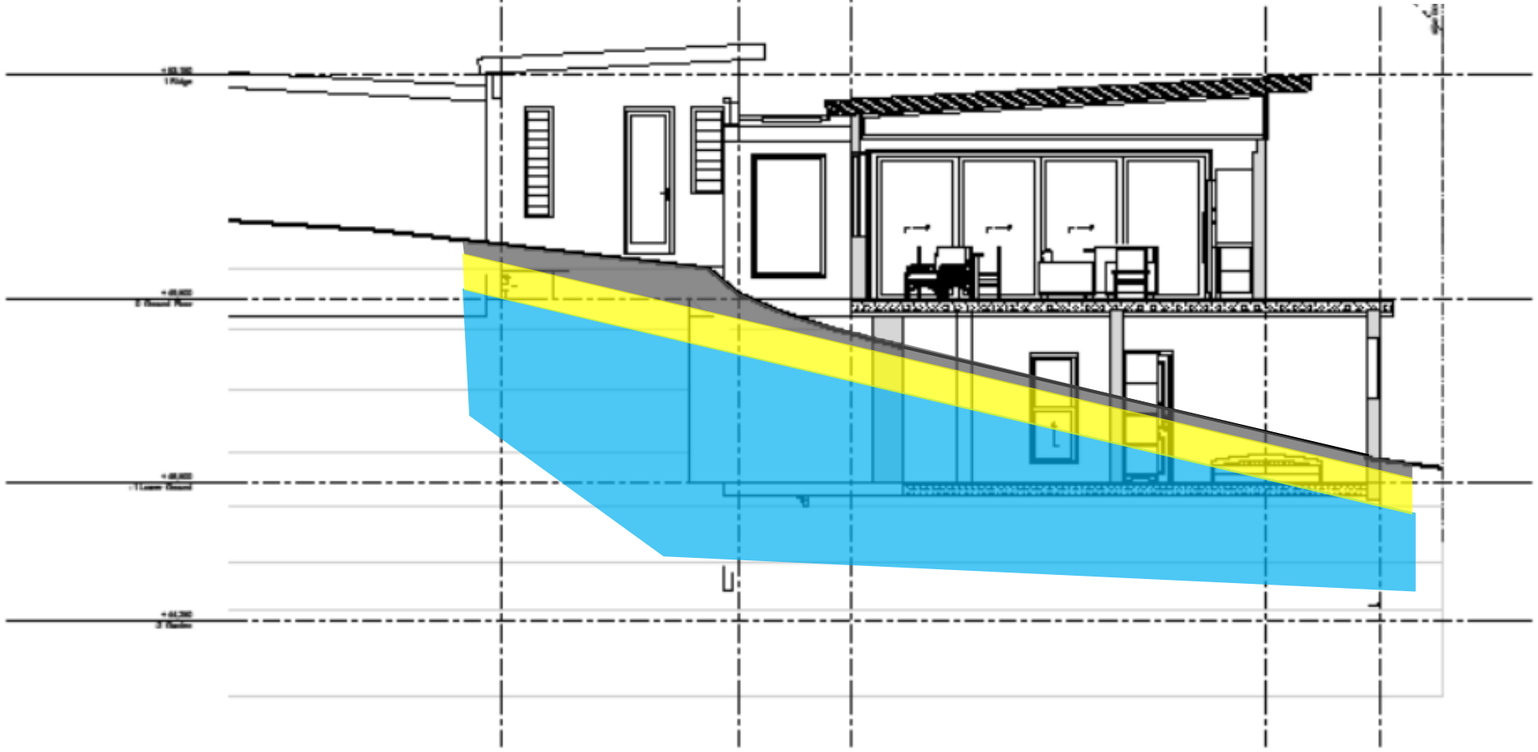


TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



01 Proposed - Section 01
1:100 @ A3

Topsoil
Sandy Clay – Firm to Stiff
Narrabeen Group Rocks – Extremely Low to Very Low Strength Shale - after being cut up by excavation equipment can resemble a stiff to hard clay.



02 Proposed - Section 02
1:100 @ A3

Site Boundary
Proposed Structure
New Works

NOT FOR CONSTRUCTION

FOR DA COORDINATION	FOR COMMENT 18/11/21

INTERLOCK | Design Nominated Architect: Trey Newman No.10699 | E: info@interlockconstruction.co

122 RIVERVIEW AVALON | TIM & NIKKI HILL | FOR DA - T01 XX/XX/2021

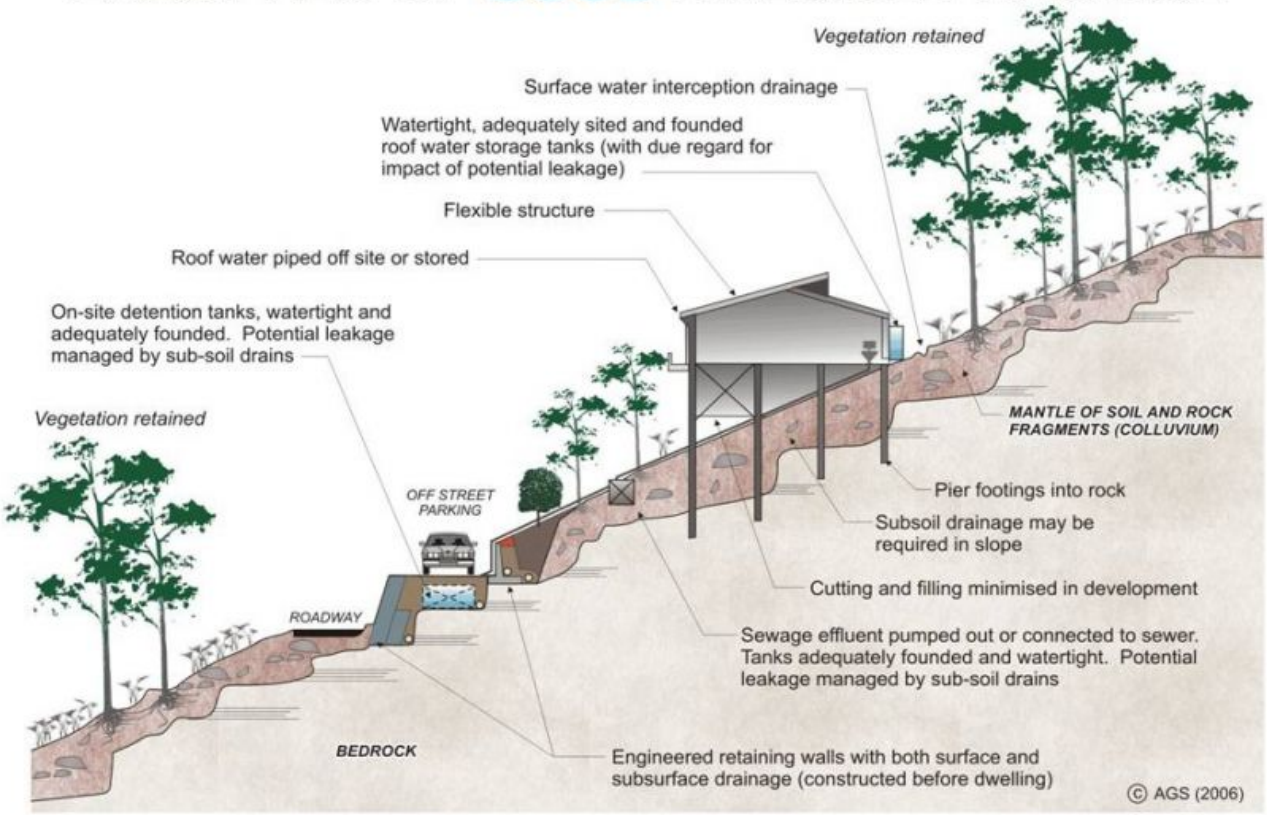
A300 Proposed Sections

1:100 @A3

0 1 2 3 4 5

INTERLOCK

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE