GEOTECHNICAL INVESTIGATION:

Additions and Alterations at **17 Jamieson Parade, Collaroy**

1. Proposed Development

1.1 Demolish the existing house and construct a new dwelling by excavating to a maximum depth of ~2.5m.

1.2 Install a pool on the downhill side of the property by excavating to a maximum depth of ~1.0m.

1.3 Various other internal alterations and additions.

1.4 Details of the proposed development are shown on 13 drawings prepared by Brianna Emily Design, drawings numbered DA-BS-00 and DA-BS-02 to DA-BS-13, dated 29th April 2021.

2. Site Description

2.1 The site was inspected on the 5th May, 2021.

2.2 This residential property is on the low side of the road and has a NE aspect. The block runs directly to the E so the slope is a crossfall. The block is located on the gently graded lower reaches of a hillslope. The slope falls across the property at angles averaging <5°.

2.3 At the road frontage, a concrete driveway runs to a timber clad garage on the S side of the house (Photo 1). Between the road frontage and the house is a gently sloping lawn area. The single-storey timber framed and clad house will be demolished as part of the proposed works (Photo 2). Another gently sloping lawn extends off the downhill side of the house to a shed and an outbuilding (Photo 3). Both are to be demolished as part of the proposed works. A garden encompasses the E and N perimeters of the lawn (Photo 4).

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. Six 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 not expected to be an issue for the testing on this site. However, excavation and foundation budgets should always allow for the possibility that the interpreted ground conditions in this report vary from those encountered during excavations. See the appended "Important information about your report" for a more comprehensive explanation. The results are as follows:

GROUND TEST RESULTS ON THE NEXT PAGE

AUGER HOLE 1 (~RL20.6) **–** AH1 (Photo 7)

Depth (m)	**Material Encountered**
0.0 to 0.1	**TOPSOIL**, sandy soil, dark brown, loose, dry, fine to coarse grained, with fine trace of organic matter.
0.1 to 0.8	**SAND**, grey, loose to medium dense, damp, fine to medium grained.
0.8 to 1.1	**SILTY SAND**, yellow and grey, medium dense, damp, fine to medium grained.
1.1 to 1.5	**CLAYEY SAND**, yellow and grey, medium dense, very wet, fine to medium grained. Seepage noted at 1.35m.
1.5 to 1.8	**CLAYEY SAND**, mottled grey, orange, and red, medium dense, damp, fine to medium grained.
1.8 to 1.9	**SANDY CLAY**, mottled grey, orange, and red, very stiff to hard, damp, and fine grained

End of Test @ 1.9m in clay. Seepage due to groundwater encountered at 1.35m.

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** (~RL18.6)	**DCP 2** (~RL18.8)	**DCP 3** (~RL20.0)	**DCP 4** (~RL19.7)	**DCP 5** (~RL20.3)	**DCP 6** (~RL20.6)
0.0 to 0.3	5	2	5	4	2	5
0.3 to 0.6	9	8	36	7	8	7
0.6 to 0.9	23	34	#	41	20	16
0.9 to 1.2	13	#		8	11	13
1.2 to 1.5	9			21	12	10
1.5 to 1.8	20			22	14	32
1.8 to 2.1	35			39	31	37
2.1 to 2.4	#			#	55	#
2.4 to 2.7					#	
	End of Test @ 2.1m	Refusal @ 0.8m	Refusal @ 0.6m	End of Test @ 2.1m	End of Test @ 2.4m	End of Test @ 2.1m

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

DCP Notes:

DCP1 – End of test @ 2.1m, DCP still very slowly going down, brown mud streaking down DCP, muddy grey sand on wet tip.
DCP2 – Refusal @ 0.8m, DCP bouncing, white sand on wet tip.
DCP3 – Refusal @ 0.6m, DCP bouncing, white sand on wet tip.
DCP4 – End of test @ 2.1m, DCP still very slowly going down, white sand on wet tip.
DCP5 – End of test @ 2.4m, DCP still very slowly going down, brown muddy sand on wet tip.
DCP6 – End of test @ 2.1m, DCP still very slowly going down, brown muddy sand on wet tip.

5. Geological Observations /Interpretation

A layer of sandy sediment overlies the natural residual clays. In the test locations, the ground materials consist of 0.8m of sand over residual medium dense clayey sands and firm to stiff sandy clay. The sandy clays merge into the underlying weathered rock at an average depth of ~1.8m below the current ground surface. The weathered zone is interpreted to be Extremely Low Strength Shale. See Type Section attached for a diagrammatical representation of the expected ground materials.

6. Groundwater

Ground water seepage was encountered during testing. This is likely due to the heavy rains that occurred on the days prior to the inspection.

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 street drainage system for Jamieson Parade above.

8. Geotechnical Hazards and Risk Analysis

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

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The gentle slope that falls across the property and continues above failing and impacting on the proposed works.	The excavations (To a maximum depth of ~2.5m) collapsing onto the work site before retaining walls are in place.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'low' (5%)	'Medium' (25%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Moderate' (2×10^{-4})
RISK TO LIFE	5.5×10^{-7}/annum	5.9×10^{-5}/annum
COMMENTS	This level of risk is 'ACCEPTABLE'.	'UNACCEPTABLE' level of risk to life and property. 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 construction of the new dwelling will introduce over 50m^2 of additional roof area. It is recommended that a drainage easement be obtained from the downhill neighbouring property and all stormwater or drainage runoff from the proposed development be piped to the street below. If this option is not feasible, a spreader/dispersion trench is suitable as a last resort, provided flows are kept close to natural runoff for the site with the use of onsite detention. All stormwater is to be piped through any tanks that may be required by the regulating authorities.

11. Excavations

An excavation to a maximum depth of ~2.5m is required to construct the proposed garage basement. Another excavation to a maximum depth of ~1.0m is required to install the proposed pool. The excavations are expected to be through sandy soil over a silty sand and firm to stiff sandy clay, with Extremely Low Strength rock expected at depths of between 1.5 to 1.8m.

Excavations through soil, sand, clay and Extremely Low Strength Shale can be carried out with an excavator and bucket.

12. Vibrations

No excessive vibrations will be generated by excavation through fill, soil, clay, or Extremely Low Strength Shale. Any vibrations generated by a domestic machine and bucket up to 16 ton will be below the threshold limit for infrastructure or building damage.

13. Excavation Support Requirements

Bulk Excavation for Proposed Garage Level of the house

The excavation for the proposed garage level of the house will reach a maximum depth of ~2.5m and, accounting for back wall drainage, will be located ~0.5m from the S common boundary, ~1.3m from the N common boundary, ~1.5m from the S neighbouring house, and ~3.3m from the N neighbouring house. Thus, the S and N boundaries, and the S neighbouring

house will lie within the zone of influence of the proposed garage excavation. In this instance, the zone of influence is the area above a theoretical 30° line through soil and sand, and a 45° line through clay and weathered rock from the base of the excavation towards the surrounding structures and boundaries.

The N common boundary fence is to be braced prior to the excavation commencing.

Due to the depth of the sandy soil and the proximity of the excavation to the brick wall along the S common boundary, ideally the excavation is to be permanently supported along the both sides before any excavations commence with secant or contiguous piers. Secant piles are the preferred option but if contiguous piles are used, the gaps between the piles are to be grouted closed as the excavation is lowered so no sand/sediment moves through the wall. The piers can be supported by embedment, propping, temporary, or permanent rock anchors (depending on the location of the excavation) installed as the excavation is lowered. A mini piling rig or similar capable of drilling through Medium Strength Rock will be required for the job. It is to be noted that a standard domestic excavator is not able to drill through Medium Strength Rock. We recommend the excavation contractor assess the drill core to ensure the equipment is capable of reaching the required depths. The walls are to be tied into the concrete floor and ceiling slabs of the house after which any temporary support can be released. See site plan for location and extent of the required shoring shown in blue.

For ease of design and construction, piers may be installed around the entire perimeter of the excavation.

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

If piles are not installed along the entire perimeter of the excavation, then, where room permits, the remaining sides of the excavation through sandy soil and clayey sand portions of the excavation are to be temporarily battered at 1.0 Vertical: 1.7 Horizontal (30°) until

permanent retaining walls are in place. Sandy clay and weathered shale are to be battered temporarily at 1.0 Vertical: 1.0 Horizontal (45°) until permanent retaining walls are in place.

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

Bulk Excavation for Pool

The excavation for the pool will reach a maximum depth of ~1.0m. The N side of the pool excavation will be as close as ~1.3m from the N common boundary. Thus, the N common boundary will fall within the zone of influence.

The N common boundary fence is to be braced prior to the excavation commencing

We recommend the N side of the excavation be temporarily supported with typical pool shoring such as sacrificial form ply, until the pool structure is in place. The remaining sides of the cut will stand at near-vertical angles for short periods of time until the pool structure is installed provided the cut batters are kept from becoming saturated. If the cut batters through soil and clay remain unsupported for more than a few days, they are also to be supported with typical pool shoring until the pool structure is in place. See site plan for location and extent of the required shoring shown in blue.

The Following Applies to All Excavations

Unsupported cut batters through soil, clay, and Extremely Low Strength Shale 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. Upslope runoff is to be diverted from the cut faces by sandbag mounds or other diversion works. The materials and labour to construct the retaining 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 Structures

For cantilever or singly-propped retaining structures, 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 Structures

Unit	Earth Pressure Coefficients			
	Unit weight (kN/m^3)	'Active' K_a	'At Rest' K_0	Passive Pressure 'Ultimate'
Soil and Residual Clays	20	0.40	0.55	N/A
Loose Sands	20	0.45	0.55	$K_p = 3.0$
Medium Dense Sands	20	N/A	N/A	$K_p = 4.0$
Extremely Low Strength Shale	22	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 structure, do not account for any surcharge loads, e.g., from the neighbouring house to the S, and assume retaining structures 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 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 likely hydrostatic pressures are to be accounted for in the structural design.

15. Foundations

Spread footings supported directly off the Extremely Low Strength Rock is a suitable foundation for the proposed house and garage. This ground material is expected to be exposed across the entire base of the garage excavation. Where the footprint of the house is not over the garage, piers are to be taken down to the Extremely Low Strength Rock where necessary.

A maximum allowable bearing pressure of 600kPa can be assumed for footings on Extremely Low Strength Rock or better.

The proposed pool is expected to be seated in Medium Dense Sand. This is a suitable foundation material.

A maximum allowable bearing pressure of 100kPa can be assumed for footings supported on the medium dense sands of the natural profile.

As the area around the pool will become saturated during pool use, it is recommended any paving around the pool be supported on a raft slab also taken to the underlying Medium Dense Sand with piers as necessary. This will reduce the risk of settlement around the pool that can result from ongoing saturation of the soil.

The base of the pool/footing excavations in sand should be compacted as the excavation will loosen the upper sands. This can be carried out with a hand-held plate compactor. Water may be used to assist in compaction in sand but footing materials should be kept damp but not

saturated. As a guide to the level of compaction required a density index of >85% is to be achieved.

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.

14. 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 owners or the regulating authorities 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 is still onsite and before steel reinforcing is placed or concrete is poured.

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Photo 1

Photo 2

Photo 3

Photo 4

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.

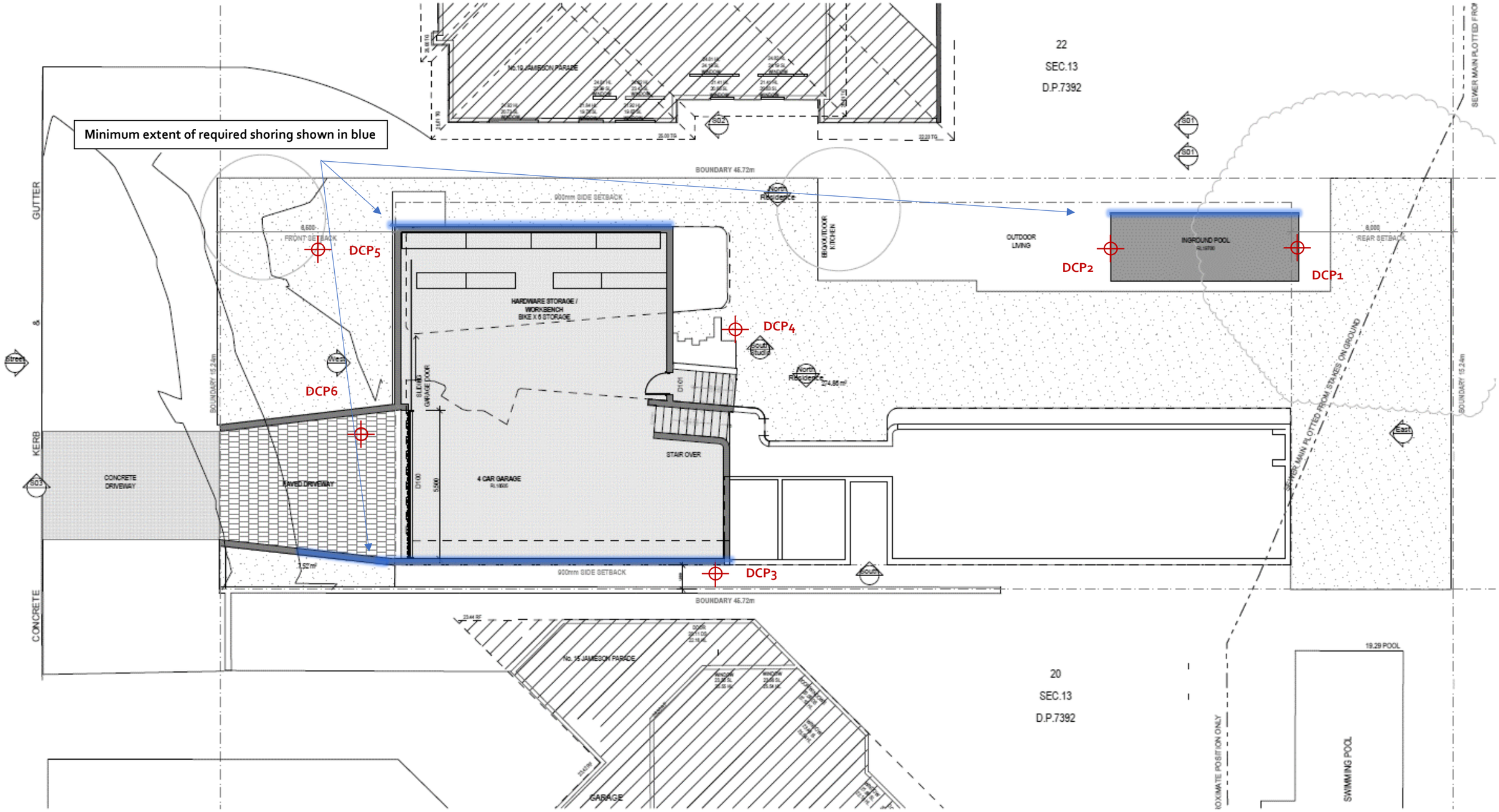
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



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MASCARENHAS RESIDENCE

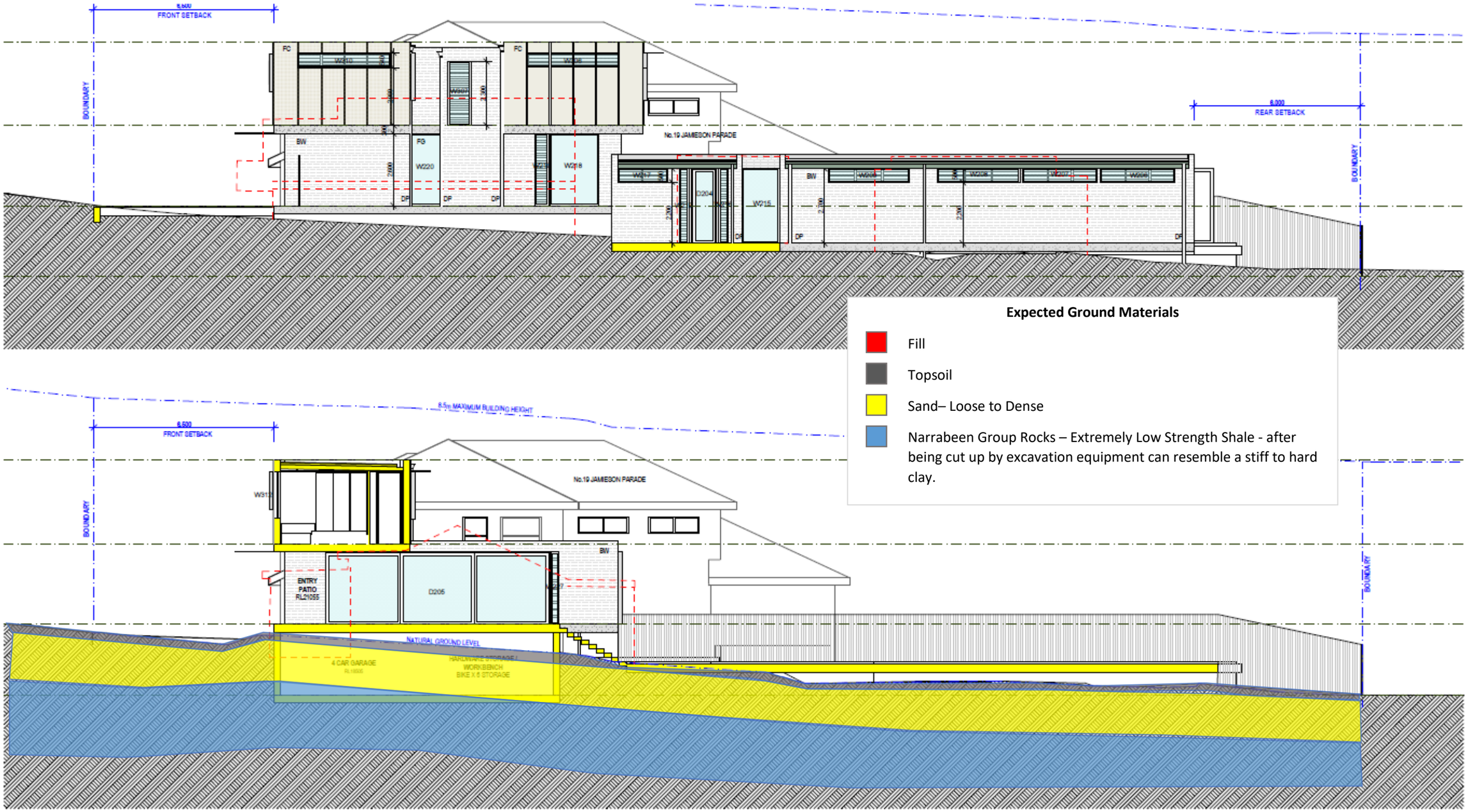
Proposed New Dwelling

17 JAMIESON PARADE COLLAROY NSW 2097

DWG:	DA-B5-02
DATE:	4/29/2021
ISSUE:	A
SCALE:	1:100 @ A2

LOWER GROUND PLAN

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



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MASCARENHAS RESIDENCE

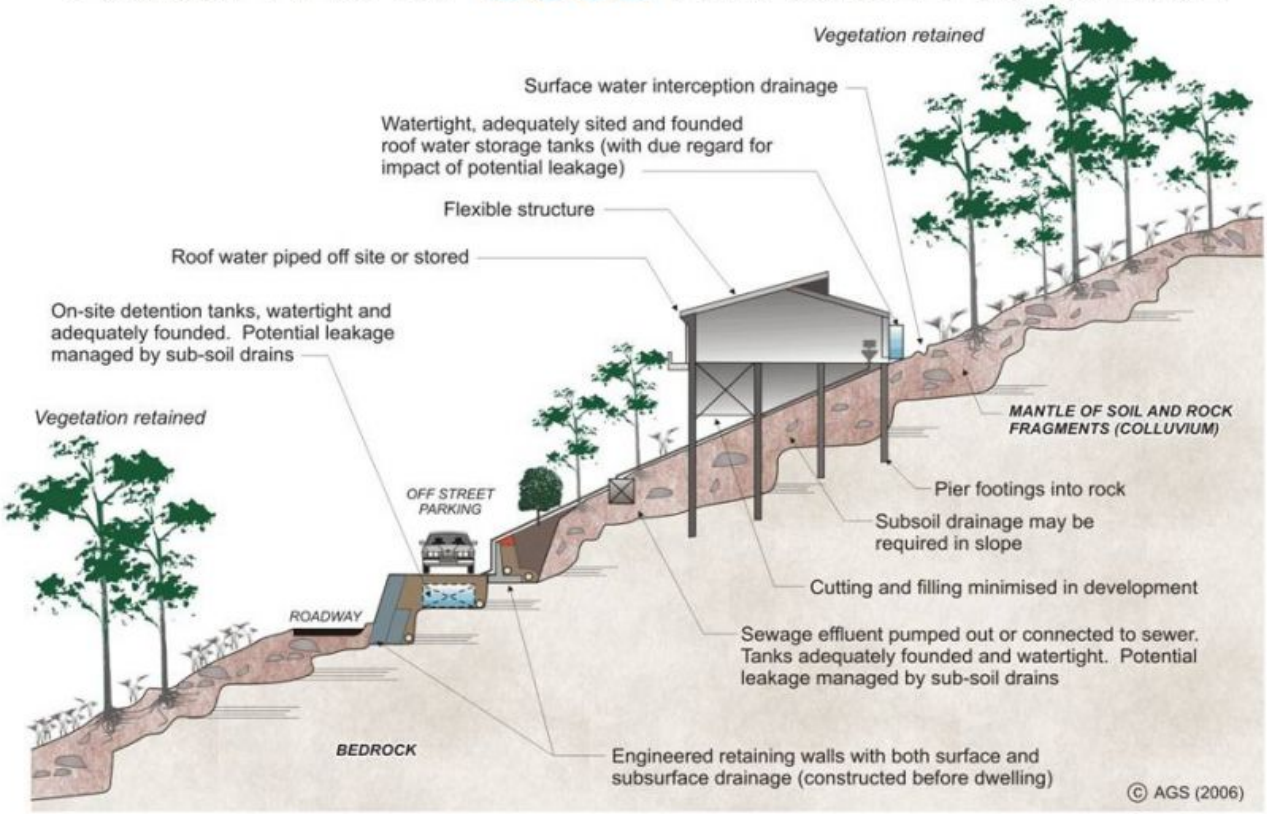
Proposed New Dwelling

17 JAMIESON PARADE COLLAROY NSW 2097

DWG:	DA-BS-07
DATE:	4/29/2021
ISSUE:	A
SCALE:	1:100 @ A2

SOUTH ELEVATIONS

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE