GEOTECHNICAL INVESTIGATION:

New Pool and Additions and Alterations at **26 Parr Avenue, North Curl Curl**

1. Proposed Development

1.1 Install a new pool on the uphill side of the property by excavating to a maximum depth of ~2.5m.

1.2 Level the lawn area on the uphill side of the property by excavating to a maximum depth of ~1.2m.

1.3 Various other external additions and alterations.

1.4 Details of the proposed development are shown on 5 drawings prepared by Outside Living, project number 21-02, drawings numbered 1 to 5, issue B, dated 24th May, 2021.

2. Site Description

2.1 The site was inspected on the 7th June, 2021.

2.2 This residential property is on the corner of Parr Avenue and Playfair Road. It is level with Playfair road and on the uphill side of Parr Avenue. The property has a S aspect. The block is located on the gentle to moderately graded upper-middle reaches of a hillslope. The slope rises across the property at angles averaging ~7° and continues below and similar angles. The slope above the property increases to the crest of the slope.

2.3 Between the road frontage to Parr Avenue and the house is a gently sloping lawn covered fill. The fill is supported by a low stable concrete block retaining wall (Photo 1). A two-storey timber framed and clad house is supported on rendered brick walls (Photo 2). The brick walls show no significant signs of movement. A concrete driveway extends from Playfair Road to a garage on the ground floor of the house

(Photo 3). A gentle to moderately sloping lawn area rises to the upper common boundary (Photo 4). A ~1.0m high brick retaining wall near the upper common boundary supports the cut for the lawn area (Photo 5). This wall is to be demolished as part of the proposed works.

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 (AH) was put down to identify the soil materials. Four 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 ARE ON THE NEXT PAGE

AUGER HOLE 1 (~RL34.3) **–** AH1 (Photo 6)

Depth (m)	Material Encountered
0.0 to 0.4	**SANDY CLAY**, orange, firm, dry, fine to medium grain, fine traces of organic matter.
0.4 to 0.8	**SANDY CLAY**, mottled grey, red, and orange, dry, stiff to very stiff, fine to medium grain.
0.8 to 1.2	**CLAYEY SAND**, grey, dry, loose to medium dense, medium to coarse grained.

Refusal @ 1.2m on rock. No water table 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 (~RL34.4)	DCP 2 (~RL34.4)	DCP 3 (~RL33.6)	DCP 4 (~RL33.5)
0.0 to 0.3	7	5	5	10
0.3 to 0.6	23	7	9	#
0.6 to 0.9	5	#	14	
0.9 to 1.2	#		39	
1.2 to 1.5			32	
1.5 to 1.8			#	
	Refusal on Rock @ 0.65m	Refusal on Rock @ 0.5m	Refusal on Rock @ 1.4m	Refusal on Rock @ 0.3m

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

DCP Notes:

DCP1 – Refusal on rock @ 0.65m, DCP bouncing off rock surface, yellow sand on wet tip.
DCP2 – Refusal on rock @ 0.5m, DCP bouncing off rock surface, red and white impact fragments on damp tip.
DCP3 – Refusal on rock @ 1.4m, DCP bouncing off rock surface, clean damp tip.
DCP4 – Refusal on rock @ 0.3m, DCP bouncing off rock surface, clean damp tip.

5. Geological Observations/Interpretation

The surface features of the block are controlled by the underlying sandstone bedrock that steps up 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 sandy soils, sandy clays, and clayey sands that fill the bench step formation. In the test locations, the depth to Medium Strength Rock ranged between 0.3 to 1.4m below the current surface, being slightly deeper due to the stepped nature of the underlying bedrock. The sandstone underlying the property is estimated to be medium strength or better as the DCP bounced at the end of every test. Similar strength rock is expected to underlie the entire site. 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 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 beside the property. The gentle to moderately graded slope that rises across the property and continues above and below at similar angles is a potential hazard (**Hazard One**). The vibrations from the proposed excavations are a potential hazard (**Hazard Two**). The proposed excavations are a potential hazard until retaining structures are in place (**Hazard Three**).

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two	Hazard Three
TYPE	The gentle to moderate slope that rises across the property and continues above and below failing and impacting on the proposed works.	The vibrations produced during the proposed excavations impacting on the surrounding structures.	The excavations (up to a depth of ~2.5m) collapsing onto the work site before retaining structures are in place.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (12%)	'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	5.3×10^{-7}/annum	8.3×10^{-6}/annum
	This level of risk is 'ACCEPTABLE'.	'UNACCEPTABLE' level of risk to life and property. To move risk to 'ACCEPTABLE' levels, the recommendations in **Section 12** are to be followed.	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.

(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 Parr Avenue. 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

Two excavations are required for the proposed development:

- A new pool to a maximum depth of ~2.5m.
- Levelling across the uphill lawn and construction of a retaining wall on the N common boundary to a maximum depth of ~1.2m.

These excavations are expected to be through sandy soils and firm to stiff sandy clays and clayey sands with Medium Strength Sandstone expected at depths between ~0.3m and ~1.4m below the surface in the area of the proposed excavations.

It is envisaged that excavations through sandy soil, sandy clays, and clayey sands can be carried out with a bucket and excavations through Medium Strength Rock will require grinding or rock sawing and breaking.

12. Vibrations

Possible vibrations generated during excavations through sandy soil, sandy clays and clayey sands will be below the threshold limit for building damage. It is expected that the majority of the excavations will be through Medium Strength Sandstone or better.

Excavations through rock should be carried out to minimise the potential to cause vibration damage to the existing subject house and neighbouring structures to the N and E. Allowing for backwall drainage, setbacks are as follows:

- ~1.5m from the N neighbouring garage.
- ~3.3m from the subject house.
- ~8.0m from the E 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. 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 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

Bulk Excavation for Proposed Pool

The excavation for the proposed pool on the uphill side of the property will reach a maximum depth of ~2.5m. Allowing for backwall drainage, the setbacks are as follows:

- ~0.5m from the subject deck.
- ~3.0m from the subject house.

Only the subject deck will be within the zone of influence of the proposed pool excavation. In this instance, the zone of influence is the area above a theoretical 45° through clay from the top of the Medium Strength Rock towards the surrounding structures and boundaries. This line reduces to 30° through the fill and soil.

Given the shallow depth to rock, we think it is likely the deck is supported on rock. However, to be sure, exploration pits along the deck will need to be put down by the builder to determine the foundation depth and material. These are to be inspected by the geotechnical consultant. If the foundations are found to be supported on rock the excavation may commence. If they are not, the Deck will need to be propped with the props supported beyond the zone of influence of the proposed excavation. Alternatively, the supporting posts and piers of the deck will need to be underpinned to rock or to below the zone of influence of the cut prior to the excavation commencing. See site plan attached for the minimum extent of the required underpinning.

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

Bulk Excavation for the Levelling of the Uphill Lawn

The excavation for the levelling of the uphill lawn and construction of the retaining wall at the N common boundary will reach a maximum depth of ~1.2m. Allowing for backwall drainage, the setbacks are as follows:

- Near flush with the N, W and E boundaries.

The N, W, and E common boundaries are within the zone of influence of these excavations. Where the N, W, and E common boundaries fall within the zone of influence of these excavations, the cut faces will require the installation of a retaining wall installed as the excavation is progressed so the cut face is not left unsupported. An example is installing a sandstone lintel gravity wall as the excavation is progressed. The dimensioned sandstone components of the proposed wall are to be on site before the excavation commences and the supporting blocks are to be placed as the excavation is progressed. Another suitable method

would be 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. Alternatively, staged sacrificial temporary support such as braced form ply or similar support installed along the N, W, and E sides as the excavations are progressed in spans not less than 2.0m horizontally. 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 the minimum extent of the required shoring.

The remaining low-cut batters 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.

Upon completion of the excavations, it is recommended all cut faces 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.

Advice Applying to All Excavations

Upslope runoff is to be diverted from the cut faces by sandbag mounds or other diversion works. Unsupported cut batters through fill and soil are to be covered to prevent access of water in wet weather and loss of moisture in dry weather. The covers are to be tied down with metal pegs or other suitable fixtures so they can't blow off in a storm. The materials and labour to construct the pool structure and retaining walls are to be organised so on completion of the excavation they can be constructed as soon as possible. The excavation is to be carried out during a dry period. No excavations are to commence if heavy or prolonged rainfall is forecast.

During the excavation process, the geotechnical consultant is to inspect the cut faces as they are lowered in 1.5m intervals to ensure ground materials are as expected and that there are no wedges or other defects present in the rock that may require additional support.

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
Fill, Sandy Soil, and Residual Clay	20	0.40	0.55
Rock Up to Low Strength Rock - Jointed	24	0.25	0.35
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 likely hydrostatic pressures are to be accounted for in the structural design.

15. Foundations

The proposed pool is expected to be seated directly on the Medium Strength Sandstone. This is a suitable foundation material.

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 Strength Sandstone with piers as necessary. This will reduce the risk of settlement around the pool that can result from ongoing saturation of the soil.

The proposed retaining walls around the perimeter of the uphill lawn are required are to be taken to the underlying Medium Strength Sandstone.

A maximum allowable bearing pressure of 1000kPa can be assumed for footings on Medium Strength Sandstone.

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

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

16. 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 exploration pits to determine the foundation material for the deck are to be inspected by the geotechnical consultant to determine if underpinning is necessary. This is to occur before the bulk excavation for the pool commences.

- During the excavation process, the geotechnical consultant is to inspect the cut faces as they are lowered in 1.5m intervals to ensure ground materials are as expected 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 and contractors are still onsite and before steel reinforcing is placed or concrete is poured.

White Geotechnical Group Pty Ltd.

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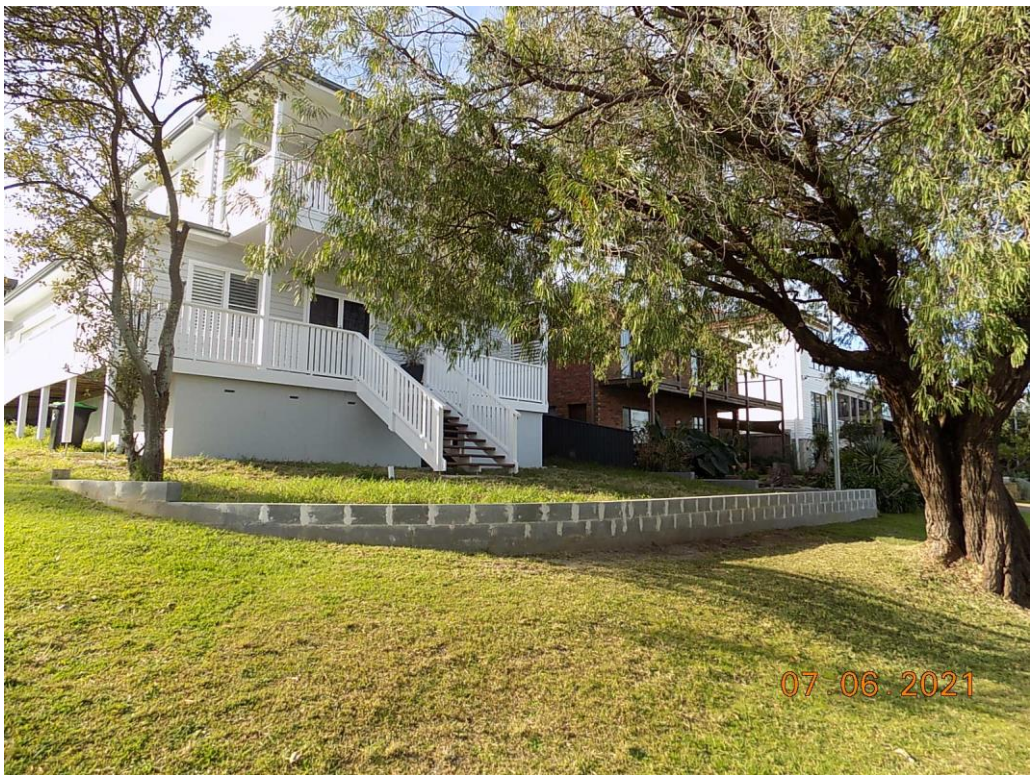


Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

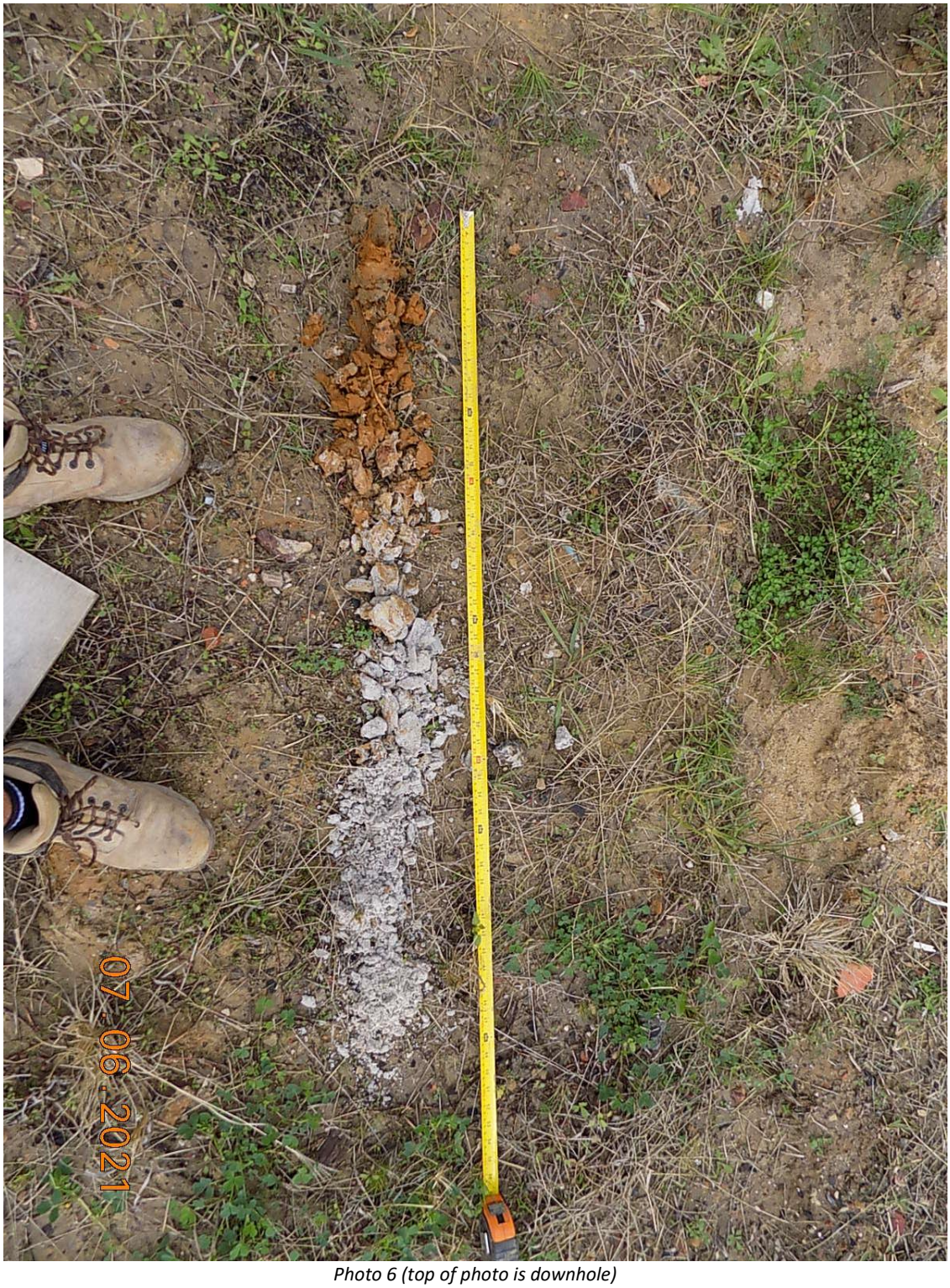


Photo 6 (top of photo is downhole)

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.

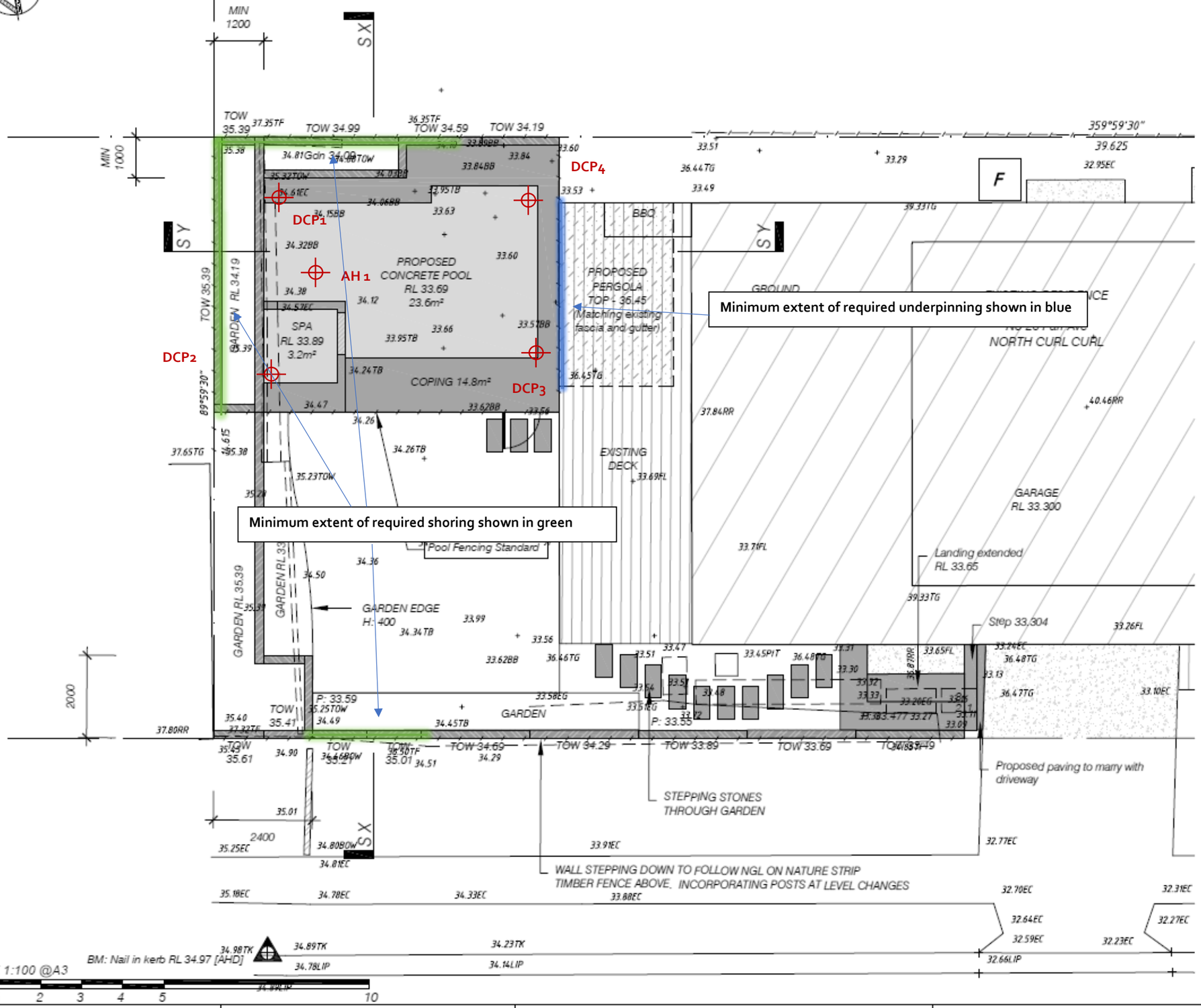
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



LEGEND

- BOUNDARY
- TO BE REMOVED
- EXISTING BUILDING/STRUCTURE
- + 33.56 EXISTING SPOT HEIGHT
- P: 33.59; TOW PROPOSED SPOT HEIGHT/TOP OF WALL
- EXISTING PAVING
- PROPOSED PAVING
- PROPOSED POOL
- EXISTING RETAINING WALL/WALL
- PROPOSED RETAINING WALL/WALL
- EXISTING TREE

IDENTIFY & MARK THE LOCATION OF ALL ABOVE & BELOW GROUND SERVICES PRIOR TO COMMENCING ANY WORK. TAKE ALL REQUIRED PRECAUTIONS TO PREVENT DAMAGE TO SERVICES

F SOUND PROOF FILTER BOX

POOL OVERFLOW TO BE PUMPED TO SEWER TO COUNCIL'S & SYDNEY WATER'S REQUIREMENTS

NOTE- FENCE LOCATIONS HAVE NOT BEEN DETERMINED IN RELATION TO BOUNDARIES

NOTES

1. All dimensions to be verified prior to commencement by the builder. Any discrepancies are to be resolved with the designer.
2. All structural work to engineer's detail.
3. Levels shown are indicative (unless provided by a registered surveyor)
4. All services are to be located and verified prior to commencement of building work.
6. Materials and workmanship to comply with the provisions of the National Construction Code, relevant Australian Standards and the requirements of the Local Government Authority.
7. The structure is to be maintained in a stable condition during construction.

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NOTES TO THE PLAN
THIS PLAN IS TO BE READ AS PART OF A COMPLETE SET OF DRAWINGS RELATING TO THE PROPOSED DEVELOPMENT
THIS PLAN RELATES TO A SPECIFIC DEVELOPMENT INFORMATION RELATING TO THE DEVELOPMENT NEEDS TO BE CONFIRMED ON SITE PRIOR TO CONSTRUCTION
ALL MEASUREMENTS ARE IN MILLIMETRES UNLESS OTHERWISE INDICATED

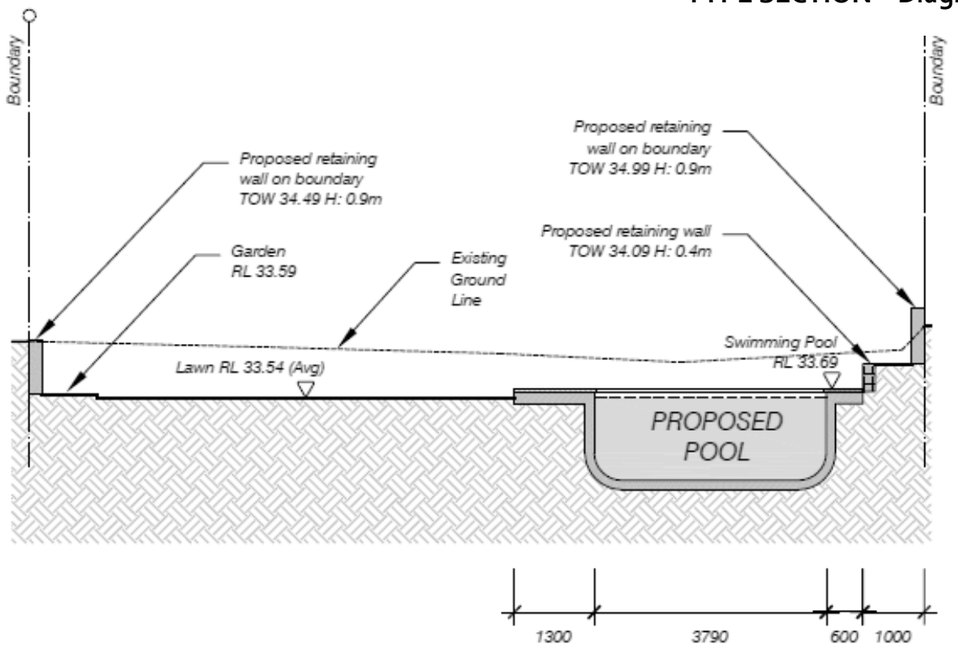
CLIENT
HAINES AND MOSS RESIDENCE
SITE
26 PARR AVE
NORTH CURL CURL

DRAWING
PART SITE PLAN
PROJECT
PROPOSED SWIMMING POOL AND LANDSCAPING

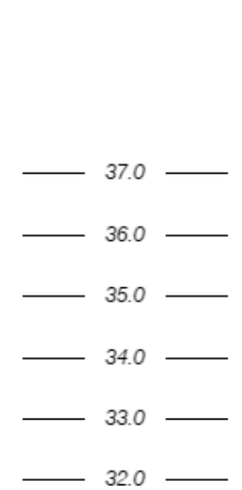
Date of Issue
A 26-02-21
B 24-05-21

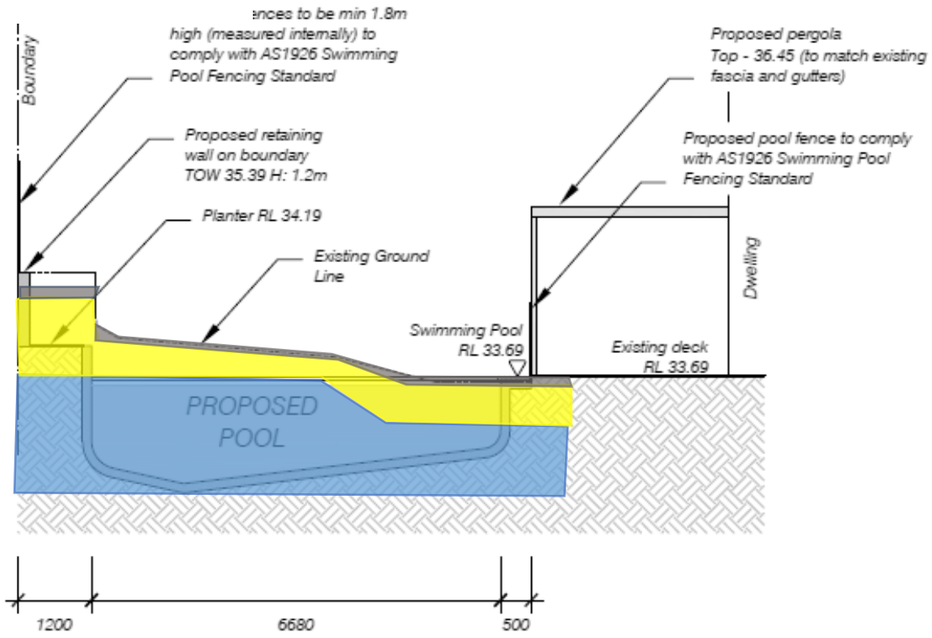
JOB No 21-02
ISSUE B
DWG No 3

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



SECTION X-X





ON Y-Y

Expected Ground Materials

- Fill
- Topsoil
- Sandy Clay and Clayey Sands
- Hawkesbury Sandstone – Medium Strength

NOTES

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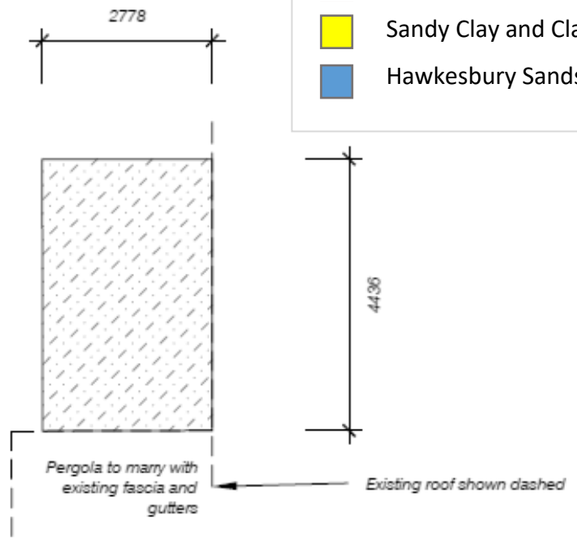
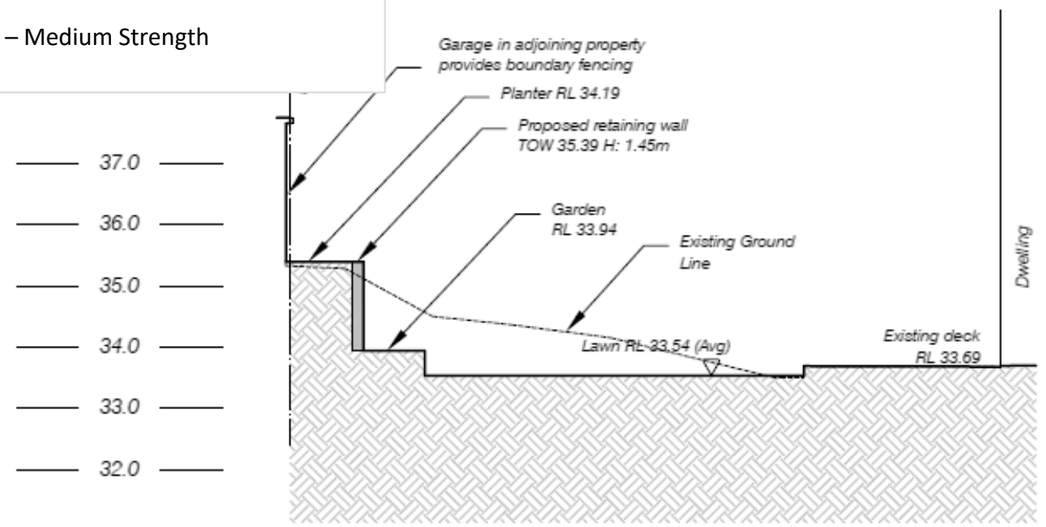


PERGOLA ROOF PLAN



SECTION Z-Z

SCALE 1:100 @A3

0 1 2 3 4 5 10

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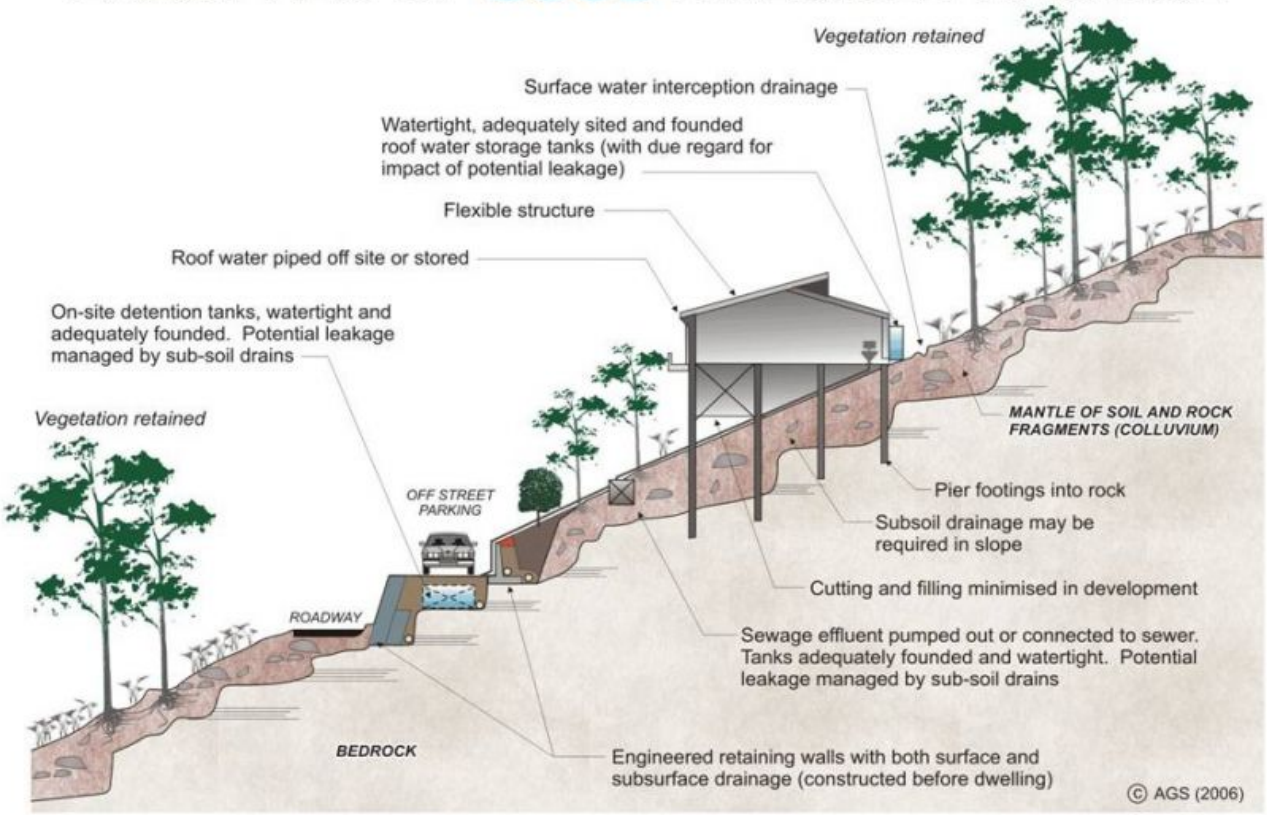
SECTIONS and PERGOLA ROOF PLAN
PROJECT
PROPOSED SWIMMING POOL AND LANDSCAPING

Date of Issue
A 26-02-21
B 24-05-21

JOB No 21-02
ISSUE B
DWG No 5

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE