White geotechnical group

Sydney, Northern Beaches & beyond. Geotechnical Consultants

GEOTECHNICAL INVESTIGATION:

Alterations and Additions at **44 Greycliffe St, Queenscliff**

1. Proposed Development

1.1 Install a new pool by excavating to a maximum depth of ~2.4m.

1.2 Add a new first floor addition to the existing house.

1.3 Extend the existing balcony on the downhill side of the house.

1.4 Various other internal and external alterations to the existing house.

1.5 Details of the proposed development are shown on 15 drawings prepared by Watershed Design, job number 19012. Drawings numbered DA02 to DA15 are Issue B, dated 29/5/20. Drawing number DA20 is undated.

2. Site Description

2.1 The site was inspected on the 31st of July, 2020.

2.2 This residential property is on the low side of the road and has a S aspect. It is located on the steeply graded lower reaches of a hillslope. The natural rock slope steps down the property at an average angle of ~28°. The slope above the property decreases in grade and the slope below the property eases to near levels angles towards the waterfront at Manly Creek.

2.3 At the road frontage a bitumen and concrete right of carriageway (ROW) runs to a brick garage in good condition on the uphill side of the property (Photos 1 & 2). A pavement extends from the uphill property boundary to the existing house (Photo 3). Competent Medium Strength Hawkesbury Sandstone outcrops under the downhill side of the garage and pavement (Photo 4). The garage is supported by concrete columns on the downhill side. The part three storey brick and sandstone block house is supported by brick walls, sandstone block walls and concrete slabs

(Photos 5 & 6). The external supporting walls show no significant signs of movement. A two storey timber balcony supported by steel posts extends of the downhill side of the house (Photo 7). The balcony is in good condition. Outcropping Hawkesbury Sandstone steps down the slope downhill of the house (Photos 8 & 9). No significant geological defects were observed on the exposed rock faces that could affect their stability. A stable ~1.8m high brick retaining wall supports fill above the upper rock face (Photo 8). Manly Creek is located downhill of the property (Photo 10). No signs of slope instability were observed on the property. The adjoining neighbouring properties were observed to be in good order as seen from the street and subject property.

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

Two Dynamic Cone Penetrometer (DCP) tests were put down to determine the relative density of the overlying soil and the depth to weathered rock. The locations of the tests are shown on the site plan. It should be noted that a level of caution should be applied when interpreting DCP test results. The test will not pass through hard buried objects so in some instances it can be difficult to determine whether refusal has occurred on an obstruction in the profile or on the natural rock surface. It is interpreted that DCP1 and DCP2 hit refusal on a concrete slab. 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:

DCP TEST 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	**DCP 1** (~RL18.2)	**DCP 2** (~RL18.2)
0.0 to 0.3	3	3
0.3 to 0.6	3	20
0.6 to 0.9	#	#
	Refusal @ 0.4m	Refusal @ 0.4m

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

DCP Notes:

DCP1 – Refusal @ 0.4m, DCP bouncing, white impact dust on moist tip.
DCP2 – Refusal @ 0.4m, DCP thudding, brown soil on moist tip.

5. Geological Observations/Interpretation

The surface features of the block are controlled by the underlying sandstone bedrock that steps down the property forming sub-horizontal benches between the steps. Where the grade is steeper, the steps are larger and the benches narrower. Where the slope eases, the opposite is true. The rock is overlain by fill, sandy soils and sandy clays that fill the bench step formation. Fill provides a level platform below the balcony on the downhill side of house. It is interpreted that DCP1 and DCP2 hit refusal on the concrete pavement slab below the garden where the tests were done. From observation and measurement of the outcropping rock underneath the pavement, the depth to rock is ~1.0m below the surface of the pavement and ~1.4m below the surface of the garden. 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 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 from above the property will be captured and diverted past the subject property.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed beside the property. The steep slope that falls across the property and continues above is a potential hazard (**Hazard One**). The proposed excavation is a potential hazard until retaining structures are in place (**Hazard Two**). The vibrations from the proposed excavation are a potential hazard (**Hazard Three**).

RISK ANALYSIS SUMMARY ON NEXT PAGE

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two	Hazard Two
TYPE	The steep slope that falls across the property and continues above failing and impacting on the property.	The proposed excavation for the pool collapsing onto the worksite before retaining walls are in place.	The vibrations produced during the proposed excavation impacting on the surrounding structures.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (12%)	'Minor' (8%)	'Medium' (15%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Moderate' (5×10^{-5})	'Moderate' (2×10^{-4})
RISK TO LIFE	8.3×10^{-7}/annum	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 the risk to 'ACCEPTABLE' levels, the recommendations in **Section 13** are to be followed.	This level of risk to property is 'UNACCEPTABLE'. To move risk to 'ACCEPTABLE' levels the recommendations in **Sections 11 & 12** 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 Manly Creek. All stormwater from the proposed development is to be piped to Manly Creek through any tanks that may be required by the regulating authorities.

11. Excavations

An excavation to maximum depth of ~2.4m will be required to install the proposed pool. The excavation is expected to be through the existing pavement slab, sandy soil and sandy clay, with Medium Strength Sandstone expected at a depth of ~1.0m below the existing pavement surface at the location of the proposed pool. The excavation through the pavement slab will require rock sawing to minimise potential vibration damage. It is envisaged that excavations through soil and clay can be carried out with a machine and bucket and excavations through Medium Strength Sandstone or better will require grinding or rock sawing and breaking.

12. Vibrations

The excavation is set back ~0.9m from the brick wall along the W common boundary. From observation on site it appears the wall is supported on the concrete pavement slab. Rock sawing through the slab will be required to minimise the potential to cause vibration damage to the brick wall.

Possible vibrations generated during excavations through soil and clay will be below the threshold limit for building damage.

Excavations through the existing concrete slab and Medium Strength Rock or better should be carried out to minimise the potential to cause vibration damage to the subject house and neighbouring houses to the E and W. Close controls by the contractor over rock excavation are recommended so excessive vibrations are not generated.

Excavation methods are to be used that limit peak particle velocity to 5mm/sec at the subject house and property boundaries. Vibration monitoring will be required to verify this is achieved.

If rock sawing is carried out around the perimeter of the excavation boundaries in not less than 1.0m lifts, a rock hammer up to 300kg could be used to break the rock without vibration monitoring. Peak particle velocity will be less than 5mm/sec at the subject house and property boundaries using this method provided the saw cuts are kept well below the rock to broken.

It is worth noting that vibrations that are below thresholds for building damage may be felt by the occupants of the subject house and neighbouring properties.

13. Excavations Support Requirements

An excavation to maximum depth of ~2.4m will be required to construct the proposed pool.

The low cut batters through soil clay and will stand at near-vertical angles for a short period of time until the retaining walls are in place, provided the cut batters are kept from becoming saturated. Medium Strength Sandstone or better will stand at vertical angles unsupported subject to approval by the geotechnical consultant.

During the excavation process, the geotechnical consultant is to inspect the cut face in 1.5m intervals as it is lowered to ensure ground materials are as expected and that additional support is not required.

All unsupported cut batters through soil 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 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. If the retaining walls are not constructed within a few days of the excavation being completed temporary shoring will be required.

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

14. Retaining Structures

For cantilever or singly propped retaining structures it is suggested the design be based on a triangular distribution of lateral pressures using the parameters shown in Table 1.

Table 1 – Likely Earth Pressures for Retaining Structures

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

For rock classes refer to Pells et al "Design Loadings for Foundations on Shale and Sandstone in the Sydney Region". Australian Geomechanics Journal 1978.

It is to be noted that the earth pressures in Table 1 assume a level surface above the structure, do not account for any surcharge loads and assume retaining structures are fully drained.

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

All retaining structures are to have sufficient back-wall drainage and be backfilled immediately behind the structure with free draining material (such as gravel). This material is to be wrapped in a non-woven Geotextile fabric (i.e. Bidim A34 or similar), to prevent the drainage from becoming clogged with silt and clay. If no back-wall drainage is installed in retaining structures the full hydrostatic pressures are to be accounted for in the retaining structure design.

15. Foundations

The proposed pool is expected to be seated in Medium Strength Sandstone. This is a suitable bearing material. 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 professional on site at the start of the footing excavation to advise on footing depth and material. This mostly prevents unnecessary over excavation in clay like shaly rock but can be valuable in all types of geology.

16. Inspections

The client and builder are to familiarise themselves with the following required 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 and that additional support is not required.

- 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.

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Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7


Photo 8

Photo 9

Photo 10

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.

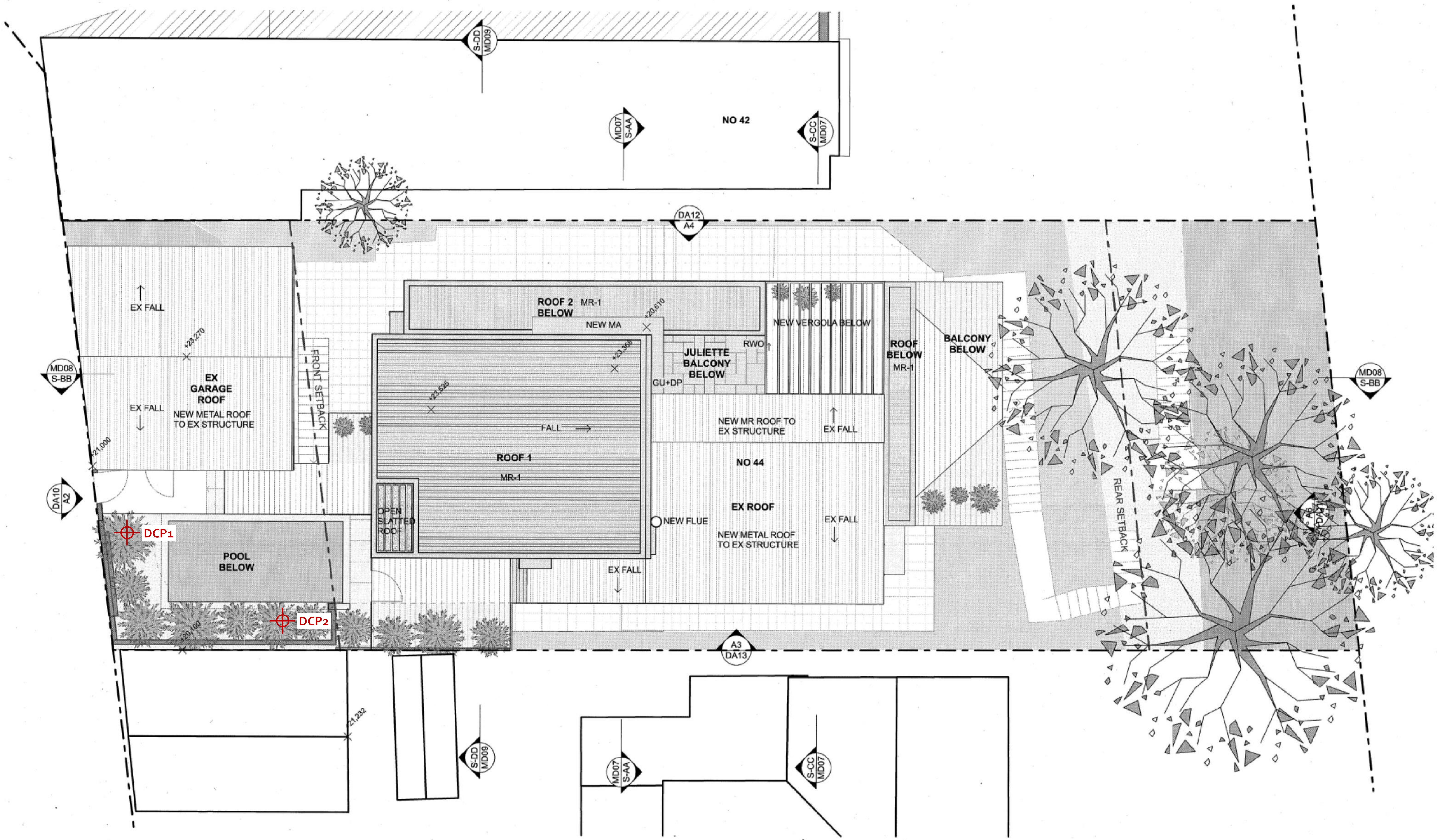
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



NOTES:

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- ONLY SCALE UNDER DIRECTION FROM ARCHITECT.
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Issue ID	Issue Name	Issue Date
A	ISSUE FOR INFORMATION	22/05/20
B	PRE DA MEETING	29/05/20

WATERSHED DESIGN architecture interiors landscapes

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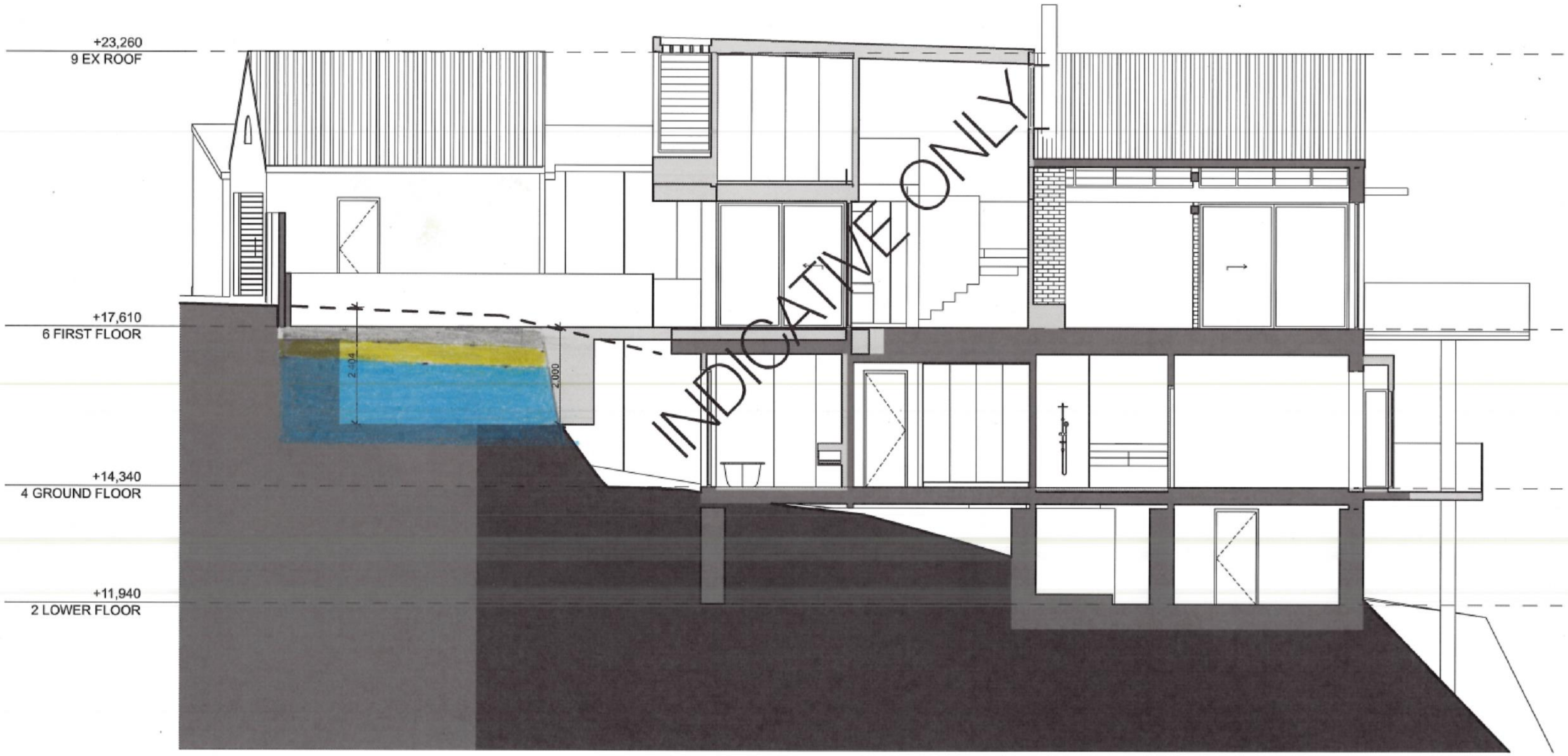
PROJECT:	44 GREYCLIFF ST	DRAWING:	**Site & Roof Plan**	DRAWN:	JK	ISSUE: B
				CHECKED:	MK	
				SCALE:	1:100	

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



- **Topsoil**
- **Clay**
- **Hawkesbury Sandstone – Medium Strength**

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WATERSHED DESIGN architecture interiors landscapes

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				DRAWN:	JK	
PROJECT:	44 GREYCLIFF ST	DRAWING:	SECTION FF DRAFT	CHECKED:	MK	ISSUE:
				SCALE:	1:100	