GEOTECHNICAL INVESTIGATION:

New Shade Structure at **4 Laura Street, Seaforth**

1. Proposed Development

1.1 Demolish the existing shade structure on the downhill side of the house and construct a new shade structure in the same location.

1.2 Details of the proposed development are shown on 2 drawings prepared by Space Landscape Designs, Project number 201046, drawings numbered L-100 and DA-04, Revision B, dated 16/7/20.

2. Site Description

2.1 The site was inspected on the 29th July, 2020, and previously on the 29th July, 2014.

2.2 This residential property is on the low side of the road and has a SE aspect. The property encompasses the lower reaches of a steep slope that rises from the waterfront of middle harbour. At the waterfront the slope rises steeply to the pool at angles of some 40°. Above the pool the slope eases slightly across the remainder of the block.

2.3 Sandstone bedrock is visible at the waterfront and also in the steep slope immediately above (Photos 1 & 2). Several loose boulders are scattered along the waterfront (Photo 1). These appear to be in stable positions. One in particular is lodged at a high angle and has come to rest on several other boulders (Photo 3). This boulder has been in place for a long time and is currently considered stable. The slope around and above the waterfront is currently under construction as part of a separate DA (Photo 1 to 3). Above the waterfront slope, the pool and part three level masonry house step up the slope with the footprint of these structures covering the upper portion of the block (Photos 4 & 5). No signs of movement were observed in the

supporting walls of the house or in the pool. A cut behind the lower level of the house is through stable sandstone bedrock (Photo 6).

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

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. 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:

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	**DCP 1** (~RL5.4)	**DCP 2** (~RL7.2)	**DCP 3** (~RL8.3)	**DCP 4** (~RL13.8)
0.0 to 0.3	3	4	2	3
0.3 to 0.6	6	5	6	4
0.6 to 0.9	5	1	6	5
0.9 to 1.2	4	3	3	33
1.2 to 1.5	2	3	4	#
1.5 to 1.8	8	4	23	
1.8 to 2.1	#	#	17	
2.1 to 2.4			28	
2.4 to 2.7			#	
	Refusal on Rock @ 1.7m	Refusal on Rock @ 1.8m	End of Test @ 2.4m	Refusal on Rock @ 1.2m

#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 @ 1.7m, DCP bouncing off rock surface, yellow brown sandstone fragments on dry tip.
DCP2 – Refusal on rock @ 1.8m, DCP bouncing off rock surface, white impact dust on dry tip.
DCP3 – End of test @ 2.4m, DCP still very slowly going down, clean damp tip.
DCP4 – Refusal on rock @ 1.2m, DCP bouncing off rock surface, grey sandstone fragments on dry tip.

5. Geological Observations/Interpretation

The surface features of the block are controlled by the outcropping and 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 sandy soils and firm to stiff sandy clays that fill the bench-step formation. In the test locations, the depth to rock ranged between 1.2 to

2.4m below the current surface, being deeper due to the stepped nature of the underlying bedrock. The outcropping sandstone on the property is estimated to be Medium Strength or better and similar strength rock is expected to underlie the entire site.

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 in this location is expected to be just above the tide at the base of the slope.

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 Laura Street above.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed below or beside the property. The steeply graded slope that falls across the property and continues above at similar angles is a potential hazard (**Hazard Two**).

RISK ANALYSIS SUMMARY ON NEXT PAGE

Risk Analysis Summary

HAZARDS	Hazard One
TYPE	The steep slope that falls across the property and continues above failing and impacting on the property.
LIKELIHOOD	'Unlikely' (10^{-4})
CONSEQUENCES TO PROPERTY	'Medium' (12%)
RISK TO PROPERTY	'Low' (2×10^{-5})
RISK TO LIFE	9.1×10^{-7}/annum
COMMENTS	This level of risk is 'ACCEPTABLE' provided the recommendations in **Section 13** are carried out.

(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

No significant stormwater runoff will be created by the proposed development.

11. Excavations

Apart from those for footings, no excavations are required.

12. Foundations

Any new footings for the shade structure and/or surrounding masonry walls are to be supported off piers taken to Medium Strength Sandstone. This material is expected at a depth of ~1.2m below the current surface on the downhill side of the house. Assume a maximum allowable bearing pressure of 1000kPa for footings supported off 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.

13. Site Maintenance/Remedial Works

Where slopes approach or exceed 30°, it is prudent for the owners to occasionally inspect the slope (say annually or after heavy rainfall events, whichever occurs first). Should any of the following be observed: movement or cracking in retaining walls, cracking in any structures, cracking or movement in the slope surface, tilting or movement in established trees, leaking pipes, or newly observed flowing water, or changes in the erosional process or drainage regime, then a geotechnical consultant should be engaged to re-assess the slope. We can carry out these inspections upon request. The risk assessment in **Section 8** is subject to this site maintenance being carried out.

REQUIRED INSPECTIONS ARE ON THE NEXT PAGE

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

- 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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Engineering Geologist

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

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
- EXISTING CONTOUR
- TO BE DEMOLISHED
- CONCRETE RETAINING WALL
- POOL FENCE
- STEEL SCREEN
- TIMBER SCREEN
- ALUMINIUM EDGE
- PAVING
- DECKING
- TURF

NEW WORKS COLOURS

- TIMBER
- GLASS
- FIBRE CEMENT SHEETING
- METAL
- MASONRY
- FLOOR TILES

PREVAILING SUMMER BREEZE

CH.74°09'40"-4.83
A.4.875-R.10.06

SITE AREA 976.2m2
LOT 4 DP 249261

Extent of proposed works

DCP1
DCP2
DCP3
DCP4

OVERLOOKING

EXISTING POOL

TIERED GARDENS

DECK

TIERED GARDENS

Waste during construction

ER 1MAIN PLOTTED FROM SYDNEY WATER 3RAM APPROXIMATE POSITION ONLY

SOUTH WEST WINDS AND STORMS

NORTH EAST SUMMER BREEZE

SITE ANALYSIS LEGEND

	SITE VEHICLE ENTRY		OVERLOOKING
	WASTE STORAGE AREA		MATERIALS STORAGE AREA

1800mm high open vertical steel blade screen

Existing stairs removed

Solid timber batten screen with built in door. Painted to match house colour.

New wall structure for cantilever steps to be integrated
Wall structure to create storage area under
Remove existing brushwood fence / screen and replace with 2000mm high masonry wall
Cantilevered masonry staircase
Proposed shade structure
Open vertical steel blade screen on top of masonry wall
BBQ benchtop
Proposed louvered shade structure
Existing shade structure to be removed
Proposed wall to match existing wall 2m high

STORAGE
BALCONY
WALL

SITE PLAN - EXTENT OF PROPOSED WORKS
SCALE 1:50

Gutters connected into existing storm water system

Colourbond metal roof sheets

Section of louvered shade structure

ANCILLARY ROOF PLAN
SCALE 1:100

NOTES:
- Contractors to check and verify all dimensions and setouts on site prior to any work.
- Any discrepancies shall be immediately referred to Space Landscape Designs.
- All works to comply with A.C.A. Statutory Authorities and Australian Building Standards.
- Do not scale drawings if in doubt, ask.

Rev.	Date	Issue	Checked
A	06/07/20	Preliminary Issue	AE
B	16/07/20	DA Issue	AE

SPACE LANDSCAPE DESIGNS

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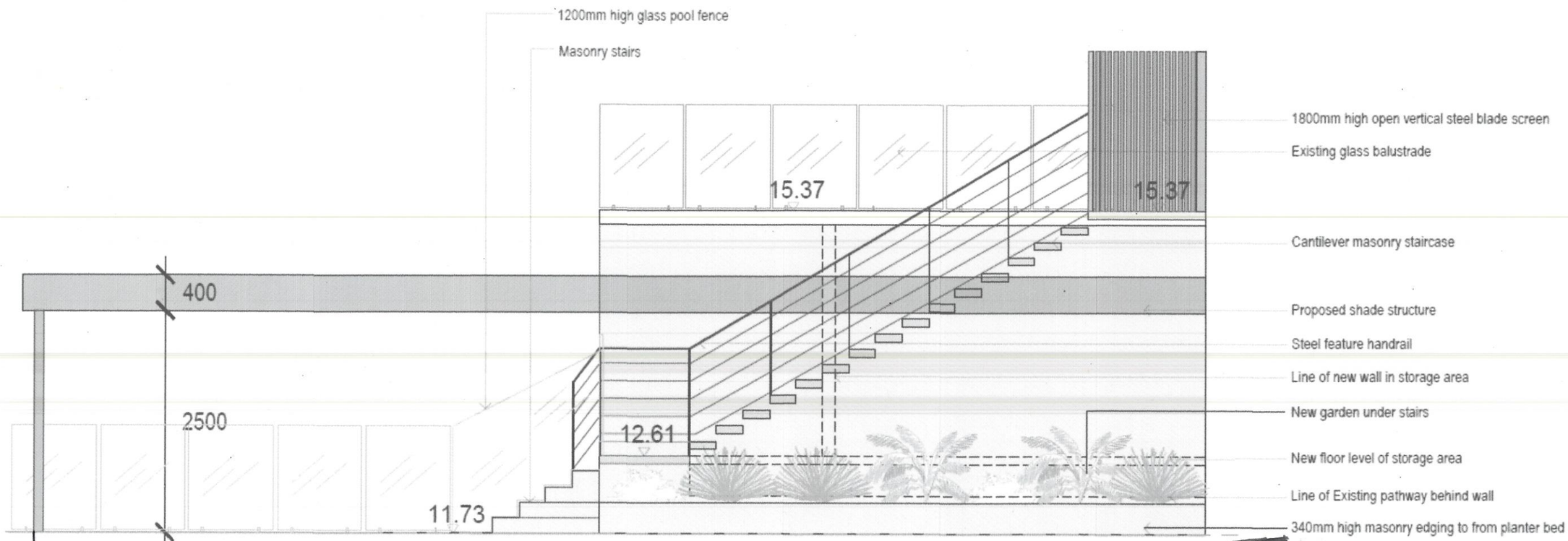
DRN: T.Browne (BLArch)
DATE: 06/07/2020
SCALE: 1:100@A1
PROJECT NO: 201046

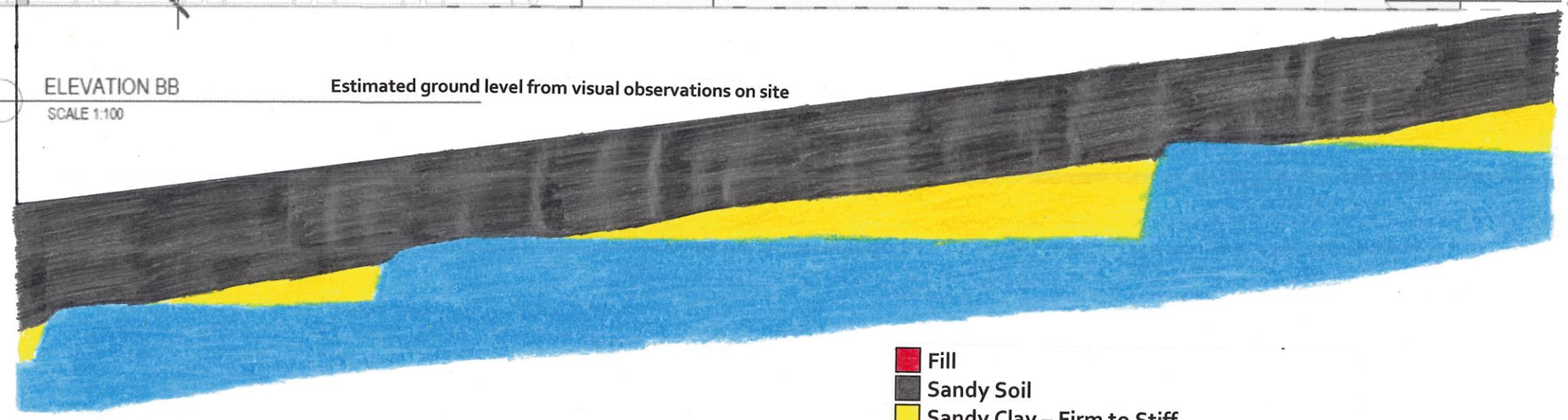
DRAWING TITLE: SITE PLAN / SITE ANALYSIS
DRAWING No: L-100
Rev: B

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials



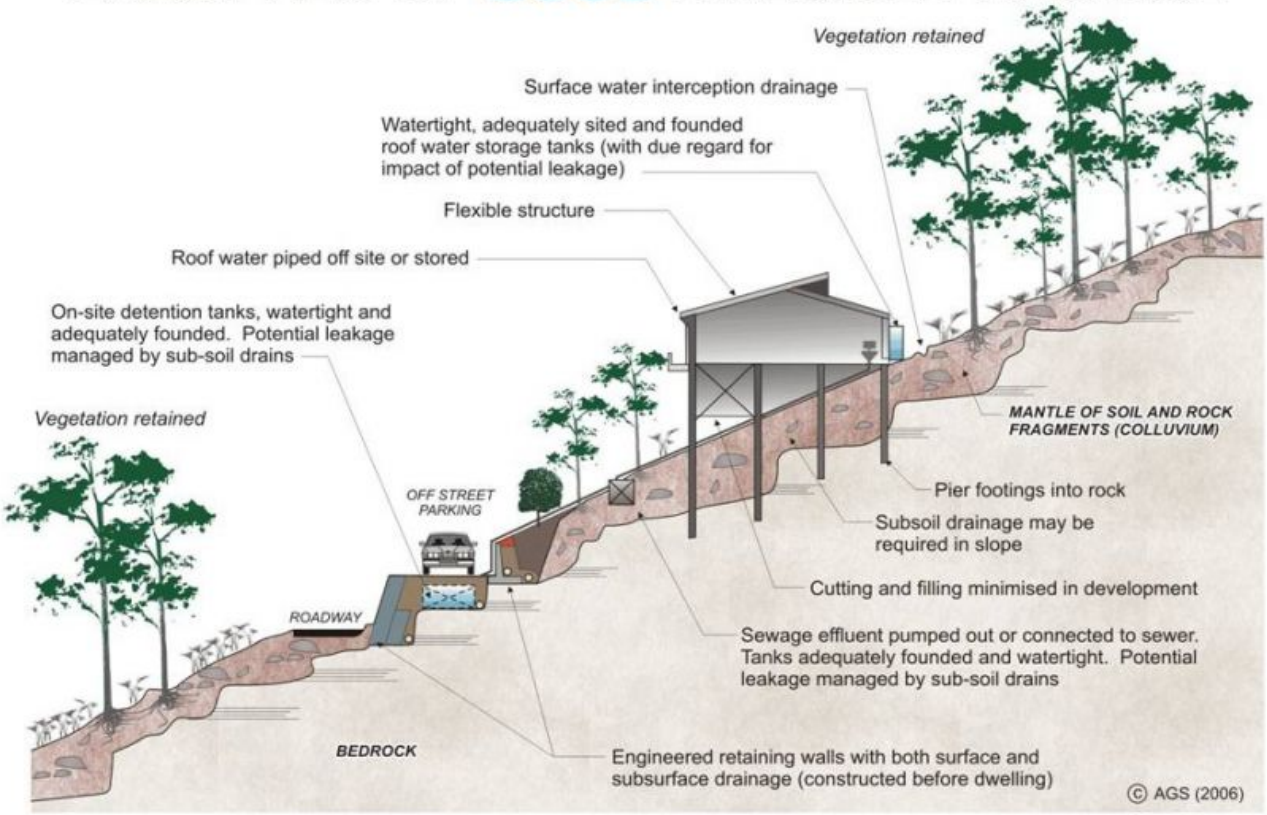
ELEVATION BB
SCALE 1:100

Estimated ground level from visual observations on site



- Fill
- Sandy Soil
- Sandy Clay – Firm to Stiff
- Hawkesbury Sandstone – Medium Strength

EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE