GEOTECHNICAL INVESTIGATION:

New houses and pool at **2 Bardoo Avenue, North Balgowlah**

1. Proposed Development

1.1 Demolish the existing house, subdivide the block and construct two new houses by excavating to a maximum depth of ~0.5m.

1.2 Install a pool in the NE corner of Lot 2 by excavating to a maximum depth of ~2.1m

1.3 Construct new driveways and crossover at the road frontages.

1.4 construct a detached garage for Lot 2 at the road frontage.

1.5 Other external additions and alterations.

1.6 Details of the proposed development are shown on 11 drawings prepared by DU PLESSIS, drawings numbered DA.01 to DA.09, DA.010, and DA.10. All revision A. All dated 08.04.2025.

2. Site Description

2.1 The site was inspected on the 28th March, 2025.

2.2 This residential property is on the corner of Bardoo Avenue and Woodbine Street, it is on the high side of Woodbine St and is level with Bardoo Ave. The property has a SW aspect. It is located on near level terrain. The natural slope falls across the property at an average angle of <5°. The slope above and below the property continue at similar angles.

2.3 At the Woodbine Street frontage, a concrete driveway runs to a garage on the ground floor of the house (Photo 1). The single-story house is supported on brick walls. Stepped cracking of up to 3mm width was observed in the E, S and W supporting walls

of the house (Photo 2). This cracking appears related to minor movement due to differential settlement and possibly rusting lintels across the window openings. The house will be demolished as part of the proposed works. The land surface surrounding the house is lawn covered. A stable shed in the NE corner of the property is supported on a concrete slab which shows no signs of movement (Photo 3). The shed will be demolished for the proposed pool.

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. The test results suggest a more weathered profile than what is generally found in Hawkesbury Sandstone geology.

4. Subsurface Investigation

One hand Auger Hole (AH) was put down to identify the soil materials. Seven Dynamic Cone Penetrometer (DCP) tests were put down to determine the relative density of the overlying soil and the depth to weathered rock/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 have been an issue for this site. But 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:

GROUND TEST RESULTS ON THE NEXT PAGE

AUGER HOLE 1 (~RL85.5) **–** AH1 (Photo 4)

Depth (m)	Material Encountered
0.0 to 0.2	**TOPSOIL**, sandy clayey soil, brown, Very Soft damp, fine to medium grained.
0.2 to 1.7	**RESIDUAL CLAY**, derived from weathered sandstone, orange and grey to pink, Soft to Firm, damp, fine to coarse, bright orange rock fragments included.
1.7 to 2.0	**VERY LOW STRENGTH ROCK**, grey to pink, Firm to Hard, damp, fine to coarse.

End of Test @ 2.0m in Very Low Strength 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 (~RL84.1)	DCP 2 (~RL84.6)	DCP 3 (~RL85.5)	DCP 4 (~RL85.4)	DCP 5 (~RL84.5)	DCP 6 (~RL84.1)	DCP 7 (~RL84.1)
0.0 to 0.3	5	4	2	5	2F	15	5
0.3 to 0.6	7	9	4	5	4	25	15
0.6 to 0.9	8	11	7	7	4	54	20
0.9 to 1.2	25	15	7	12	6	#	11
1.2 to 1.5	#	#	8	22	11		15
1.5 to 1.8			15	19	15		17
1.8 to 2.1			25	20	15		14
2.1 to 2.4			29	30	16		15
2.4 to 2.7			28	#	30		18
2.7 to 3.0			36		#		19
3.0 to 3.3			#				30
3.3 to 3.6							#
	Refusal on Rock @ 1.1m	Refusal on Rock @ 1.2m	Refusal on Rock @ 3.0m	End of Test @ 2.4m	End of Test @ 2.7m	End of Test @ 0.9m	End of Test @ 3.3m

#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 @ 1.1m, DCP bouncing off rock surface, yellow sandy clay on dry tip.
DCP2 – Refusal on Rock @ 1.2m, DCP bouncing off rock surface, yellow sandy clay on dry tip.
DCP3 – Refusal on Rock @ 3.0m, DCP bouncing off rock surface, grey sandy clay on dry tip and in collar above tip.
DCP4 – End of test @ 2.4m, DCP still very slowly going down, brown and white sandy clay on dry tip and in collar above tip.
DCP5 – End of test @ 2.7m, DCP still very slowly going down, brown and white sandy clay on dry tip and in collar above tip.
DCP6 – End of test @ 0.9m, DCP still very slowly going down, clean dry tip.
DCP7 – End of test @ 3.3m, DCP still very slowly going down, grey sandy clay on dry tip and in collar above tip.

5. Geological Observations/Interpretation

The site is underlain by fill, topsoil, deep residual clays and Very Low Strength Rock over sandstone bedrock. In the test locations, Medium Strength Rock was encountered at depths of between 1.1 to 3.0m below the current surface, being shallower towards the W of the property. DCP tests 4, 5 and 7 were terminated at depth due to a high blow count. It is interpreted that the tests were terminated in the Very Low Strength weathered sandstone bedrock. The Very Low Strength Rock is expected to be encountered at depths of between ~0.9m and ~3.0m below the current surface. DCP test 6 is interpreted to have been terminated at 0.9m in compacted fill material next to the neighbouring carport. 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 denser and less permeable clays, and over the buried surface of the rock and through the cracks. Due to the site elevation, the water table is expected to be many metres below the base of the proposed excavations.

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 above, below, or beside the property. The proposed excavations are a potential hazard until the pool structure/retaining walls are in place (**Hazard One**).

Risk Analysis Summary

HAZARDS	Hazard One
TYPE	The proposed excavations collapsing onto the work site and impacting on the N and E neighbouring properties before retaining structures are in place.
LIKELIHOOD	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (20%)
RISK TO PROPERTY	'Moderate' (2×10^{-4})
RISK TO LIFE	5.9×10^{-5}/annum
COMMENTS	This level of risk to life and property is 'UNACCEPTABLE'. 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 Woodbine 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

Two excavations are required for the proposed works:

- An excavation up to a maximum depth of ~2.1m is required to install the proposed pool in the NE corner of Lot 2.
- An excavation to a maximum depth of ~0.5m along the N common boundary is required to create a level platform for the proposed houses.

The excavations are expected to be through shallow soil over clay and Very Low Strength Rock. Medium Strength rock is not expected to encountered during the proposed excavations.

It is envisaged that excavations through soil, clay, and Very Low Strength Rock can be carried out with an excavator and toothed bucket.

12. Vibrations

It is expected the proposed excavations will be carried out with an excavator and bucket and the vibrations produced will be below the threshold limit for building or infrastructure damage using a domestic sized excavator up to 16 tonnes.

13. Excavation Support Requirements

Bulk Excavation for the Pool

The excavation for the proposed pool will reach a maximum depth of ~2.1m. The setbacks are as follows:

- ~0.9m from the E common boundary
- ~1.0m from the N common boundary

As such, the E and N common boundaries will lie within the zone of influence of the proposed excavation. In this instance, the zone of influence is the area above a theoretical 45° line (from horizontal) from the base of the excavation towards the surrounding structures and boundaries. This line reduces to 30° through the fill and soil.

We recommend all portions of the E and N sides of the excavation be temporarily supported with typical pool shoring such as braced sacrificial form ply, until the pool structure is in place. 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 remain unsupported for more than a day before pool construction commences, they are also to be supported with typical pool shoring until the pool structure is in place. The support will need to be designed by the structural engineer. See site plan attached for extent of minimum required shoring shown in blue.

During the excavation process for the pool, the geotechnical consultant is to inspect the cut in 1.5m intervals as it is lowered, while the machine/excavation equipment is on site, to ensure the ground materials are as expected and that the shoring is adequate.

Bulk Excavation for Houses

The excavation to create a level platform for the proposed houses will reach a maximum depth of ~0.5m and will come ~flush with the N common boundary and ~0.2m from a brick wall on the N neighbouring property.

Assuming minimum typical foundation depths (0.4m), the N neighbouring brick wall is expected to be outside the zone of influence of the proposed excavation. As such only the common boundary will lie within the Zone of influence of the proposed excavation.

As such, only the N common boundary will lie within the Zone of Influence of the excavation. The excavation will need to be temporarily or permanently supported prior to the commencement of the excavation, or during the excavation process in a staged manner, to ensure the integrity of the N neighbouring property, and so cut batters are not left

unsupported. See the site plan attached for the minimum extent of the required shoring. The support will need to be designed / approved by the structural engineer in consultation with the Geotechnical Consultant.

Advice Applying to Both Excavations

All unsupported cut batters 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 cannot blow off in a storm. The materials and labour to construct the pool structure 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.

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 distribution of lateral pressures using the parameters shown in Table 1.

TABLE 1 ON THE NEXT PAGE

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 and Topsoil	20	0.40	0.55
Residual Clays	20	0.35	0.45
Very Low Strength Rock	22	0.22	0.35
Medium Strength Rock	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. Site Classification

The site classification is Class M in accordance with AS2870-2011.

16. Foundations

The proposed pool excavation is expected to be partially seated in Very Low Strength Rock. This is a suitable foundation material. It is expected to be exposed across the deepest portion

of the proposed excavation. Where it is not exposed, shallow/bucket piers taken to this material will be required to maintain a uniform foundation material across the structure. A maximum allowable bearing pressure of 600kPa can be assumed for footings on Very Low Strength Rock or better.

The proposed houses and Lot 2 garage can be supported on piers taken to the underlying Very Low Strength Rock. This material is expected at depths of between ~0.9m and ~3.0m below the current surface.

An earthenware sewer main 225 pipe runs under the southern side of the property. The invert is some 1.8m deep at the Eastern end and some 1.6m deep at the western side. See Sydney Water Before You Dig appended. The foundations for the houses and driveway are to follow Sydney water guidelines.

The driveways can be supported off the natural surface after any organic matter has been stripped. A maximum allowable bearing pressure of 100kPa can be assumed for soil of the natural surface. The plans indicate that the driveway is to be piered in places to avoid tree roots. The piers may be taken to the underlying Soft to Stiff clays. A maximum allowable bearing pressure of 200kPa can be assumed for the natural clay. Where the foundation material across the driveway structure changes, construction joints are to be installed to separate the different foundation materials and to accommodate minor differential movement. Alternatively, the entire driveway can be supported on clay.

As the bearing capacity of clay 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 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 and inspected by the geotechnical consultant.

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.

17. 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.

- During the excavation process for the pool, the geotechnical consultant is to inspect the cut in 1.5m intervals as it is lowered, while the machine/excavation equipment is on site, to ensure the ground materials are as expected and that the shoring is adequate.

- 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 – downhole is top to bottom

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

PROJECT DA CONSULTANT TEAM

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ABBREVIATIONS

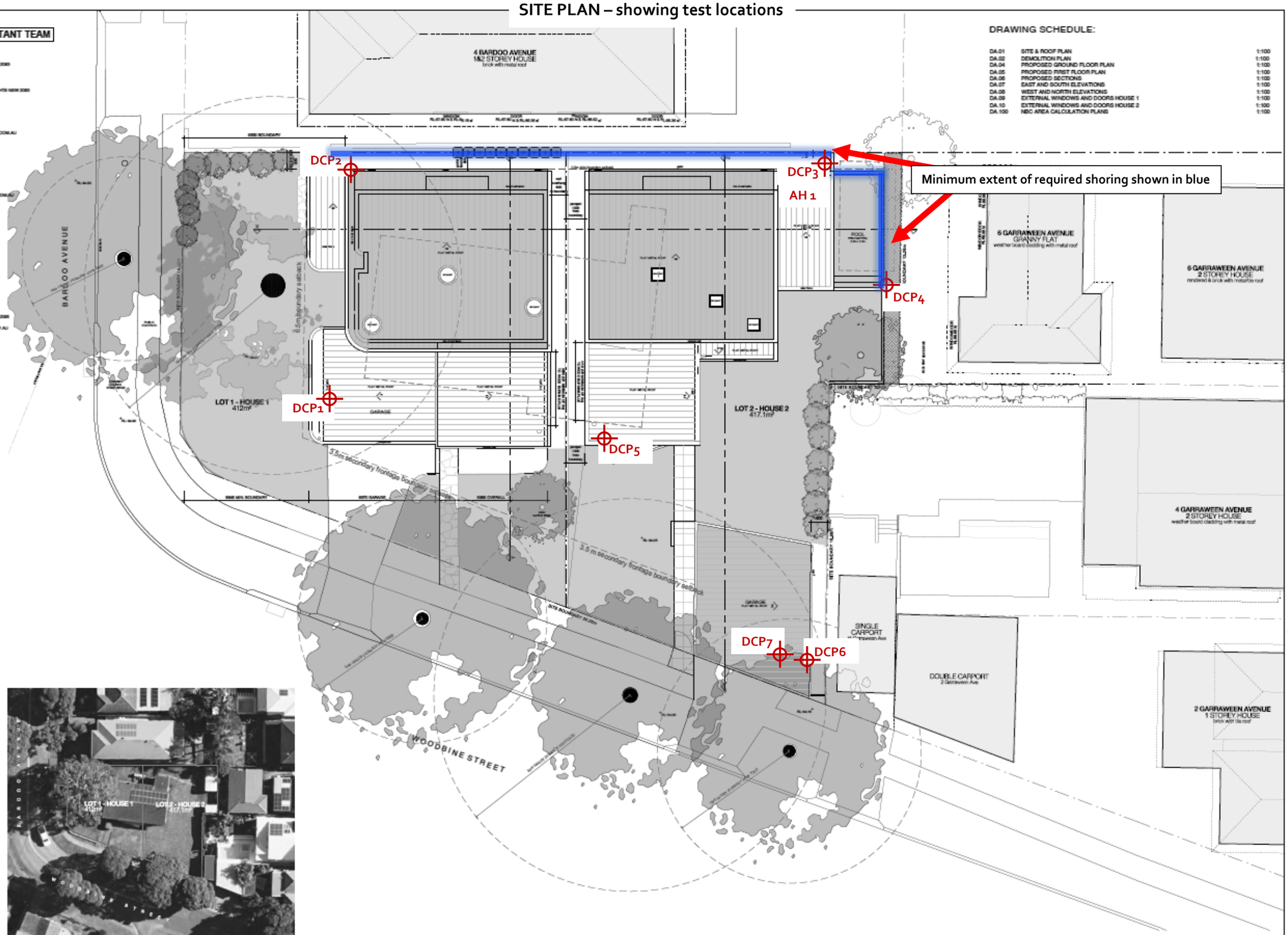
AC	AIR CONDITIONED
AHD	AUSTRALIAN HEIGHT DATUM
AGH	AGHESIVE
AG	AGGREGATE
AL	ALUMINIUM
AW	AWNING
B	BALUSTRADE
BK	BRICK WALL
BKD	BULKHEAD
BOW	BOTTOM OF WALL
BM	BENCHMARK
BW	BLOCKWORK WALL
C	CONCRETE
CL	CENTRE LINE
CW	CONCRETE WALL
CLMN	COLUMN
CPT	CARPET
DIM	DIMENSION
DP	DOWNPIPE
EJ	EXPANSION JOINT
F	FILL TO BE PAVED
FG	FIXED GLAZING
FFL	FINISHED FLOOR LEVEL
FR	FIRE RESISTANT
FW	FLOOR WASTE
G	GLASS
GALV	GALVANIZED
HWS	HOT WATER SYSTEM
LS	LANDSCAPING
LV	LOUVRE
MR	METAL ROOFING
MV	MECHANICAL VENTILATION
NGL	NATURAL GROUND LEVEL
NTS	NOT TO SCALE
OPC	OPP. FORM CONCRETE
OG	OBSCURE GLAZING
OH	OVER HEAD
P	SELECTED PAVING
PB	PLASTERBOARD
PL	PLANTER
PS	PRIVACY SCREEN
PW	PLASTERBOARD WALL
REF	REFERENCE
RW	RENDERED & PAINTED WALL
RWH	RAIN WATER HEAD
RWP	RAIN WATER PIPE
RL	REDUCED LEVEL
RC	REINFORCED CONCRETE
SB	MAIN ELECTRICAL SWITCH BOARD
SC	STEEL COLUMN
SHR	SHOWER
SLD	SLIDING DOOR
SPEC	SPECIFICATION
SS	STAINLESS STEEL
STW	STONE WALL
SWP	STORM WATER PIT
T	TILE
TG	TIMBER DECKING
TOW	TOP OF WALL
US	UNDERSIDE
V	VENTILATION
WPM	WATER PROOFING MEMBRANE

DRAWING SYMBOLS

- WINDOW LABEL
- DOOR LABEL
- JOINERY DETAIL REFERENCE
- PLAN/SECTION REFERENCE
- SECTION LINES
- ROOM LABELS & FLOOR FINISH
- FLOOR LEVEL RL'S
- TOP OF STRUCTURE RL'S

DRAWING SCHEDULE:

DA.01	SITE & ROOF PLAN	1:100
DA.02	DEMOLITION PLAN	1:100
DA.04	PROPOSED GROUND FLOOR PLAN	1:100
DA.05	PROPOSED FIRST FLOOR PLAN	1:100
DA.06	PROPOSED SECTIONS	1:100
DA.07	EAST AND SOUTH ELEVATIONS	1:100
DA.08	WEST AND NORTH ELEVATIONS	1:100
DA.09	EXTERNAL WINDOWS AND DOORS HOUSE 1	1:100
DA.10	EXTERNAL WINDOWS AND DOORS HOUSE 2	1:100
DA.100	NBC AREA CALCULATION PLANS	1:100



LOCATION PLAN NTS

SITE/ROOF PLAN
SCALE 1:150/A1

scales
1:20 1:50 1:100
A1 SHEET

LEGEND

- LOT BOUNDARIES / PROPERTY BOUNDARIES AS PER CMS SURVEY PLAN
- DEMOLITION
- EXISTING AND PROPOSED BUILDINGS / PROPOSED DEVELOPMENT
- NEW STRUCTURE
- ROOF: PITCHED TILE ROOF TO FALLS
- ROOF: FLAT COLORBOND METAL ROOFING TO FALLS
- GLAZING
- NBC SETBACK AND HEIGHT LINE
- RL LEVELS AS PER SURVEY PLAN
- LOWERED CEILING

NOTES

* SITE SURVEY INFORMATION:
THE SITE INFORMATION HEREIN HAS BEEN TRANSPOSED FROM THE CMS SURVEY PLANS #22444, REFER TO THE SURVEY DRAWING TO CONFIRM BOUNDARIES, EXISTING FEATURES, RL LEVELS & DATUM SURVEYED SITE CONDITIONS AND BUILDING SET OUT TO BE CONFIRMED BY THE BUILDER BEFORE CONSTRUCTION COMMENCES.

* COORDINATION:
REFER TO ALL DOCUMENTS FOR INFORMATION CONTAINED IN THE ARCHITECTURAL DRAWINGS AND THE DOCUMENTATION OF OTHER CONSULTANTS WITH THE SPECIFICATION FOR BUILDING WORKS, REPORT OR DRAWINGS. BETWEEN THE DOCUMENTS AND/OR WITH CONDITIONS ON SITE TO THE ARCHITECT FOR DIRECTION PRIOR TO PROCEEDING WITH THE WORKS.

* DETAIL DRAWINGS:
LARGER SCALE DRAWINGS SHALL REFER TO DETAIL DRAWINGS FOR WITHOUT INFORMATION. DETAIL DRAWINGS AT LARGER SCALES TAKE PRECEDENCE OVER GENERAL ARRANGEMENT DRAWINGS AT SMALLER SCALES. IF IN DOUBT NOTIFY ARCHITECT FOR DIRECTION PRIOR TO PROCEEDING WITH THE WORKS.

* EXECUTION OF THE WORKS:
ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CURRENT EDITION OF THE BUILDING CODE OF AUSTRALIA (AS AMENDED), CURRENT EDITIONS OF RELEVANT AUSTRALIAN STANDARDS, OTHER PUBLISHED STANDARDS AND THE REQUIREMENTS OF COUNCIL AND/OR OTHER AUTHORITIES.

CONTRACTORS TO VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING WORK.

FIGURED DIMENSIONS ARE TO BE TAKEN IN PREFERENCE TO SCALING.

ALL DIMENSIONS ARE IN MILLIMETRES (UNO).

PLEASE NOTIFY DU PLESSIS + DU PLESSIS ARCHITECTS IMMEDIATELY SHOULD ANY ERRORS/OMISSIONS BE FOUND.

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ALL WORKS TO BE IN ACCORDANCE WITH THE RELEVANT BCA, CURRENT BCA 2022 AND COUNCIL RELATING REQUIREMENTS.

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PROJECT TITLE:
2 BARDOO AVENUE
2 New Detached Houses

CLIENT:
H&S Hughes Property Pty Ltd

ADDRESS:
2 Bardoo Avenue,
North Balgowlah NSW 2093

DRAWING TITLE:
SITE/
ROOF PLAN

DRAWN:	CHECKED:
D DU PLESSIS	E DU PLESSIS

SCALE:
1:100 [A1]

DRAWING NO:
DA.01

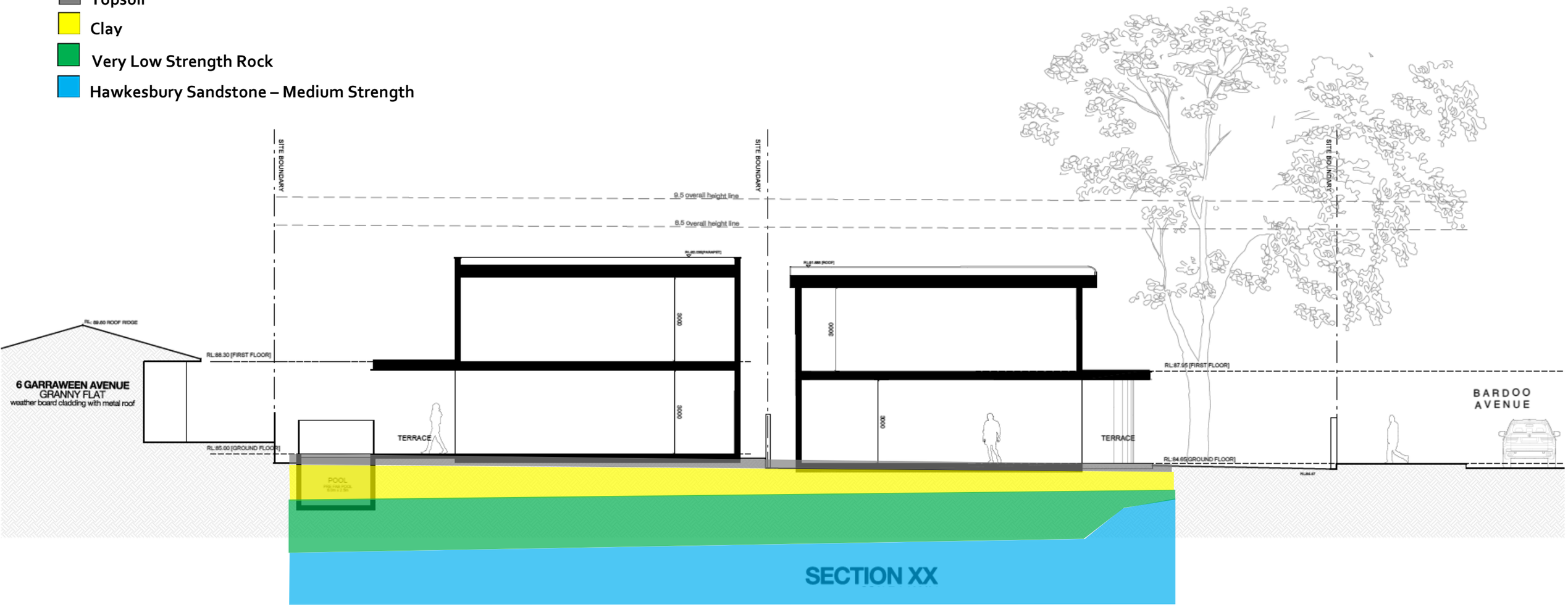
ISSUE:	DATE:
A	08.04.2025

DRAWING STATUS:
DEVELOPMENT APPLICATION

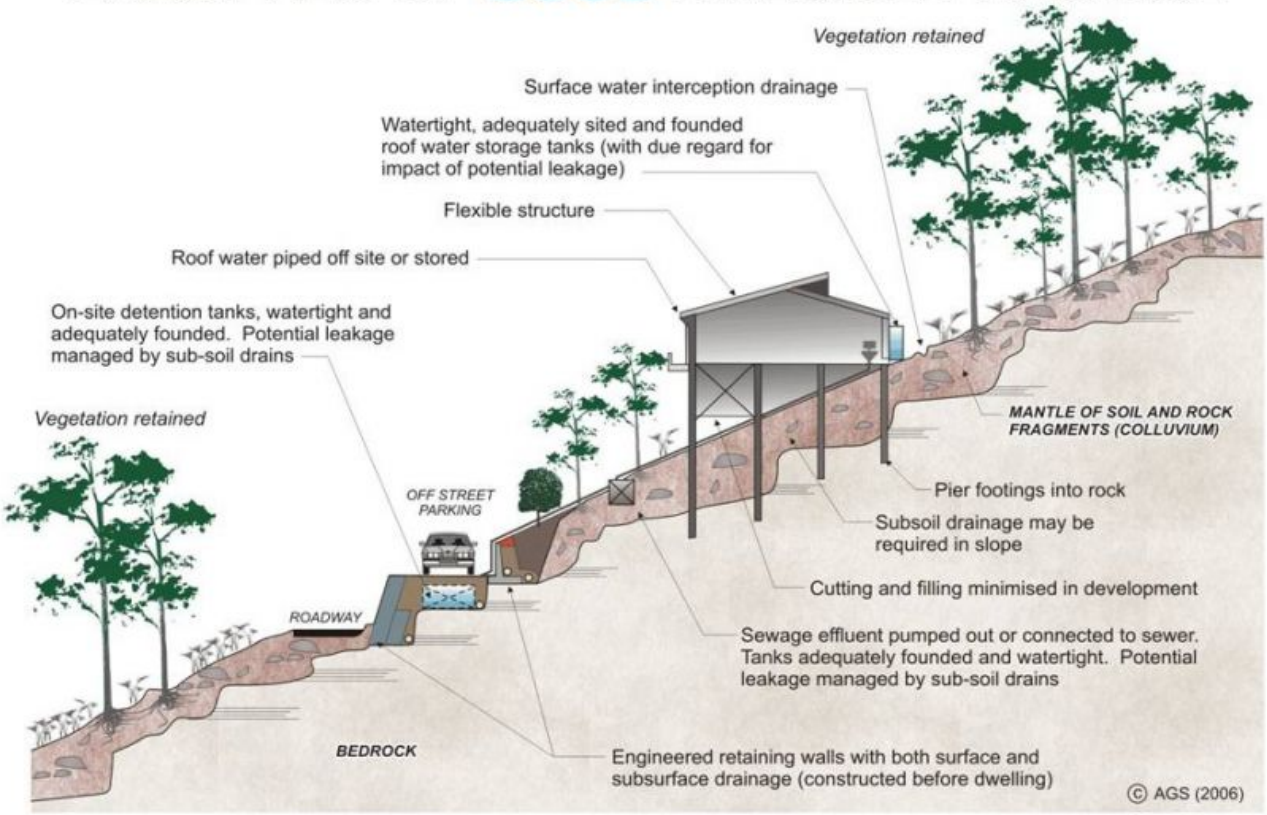
TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials

Expected Ground Materials

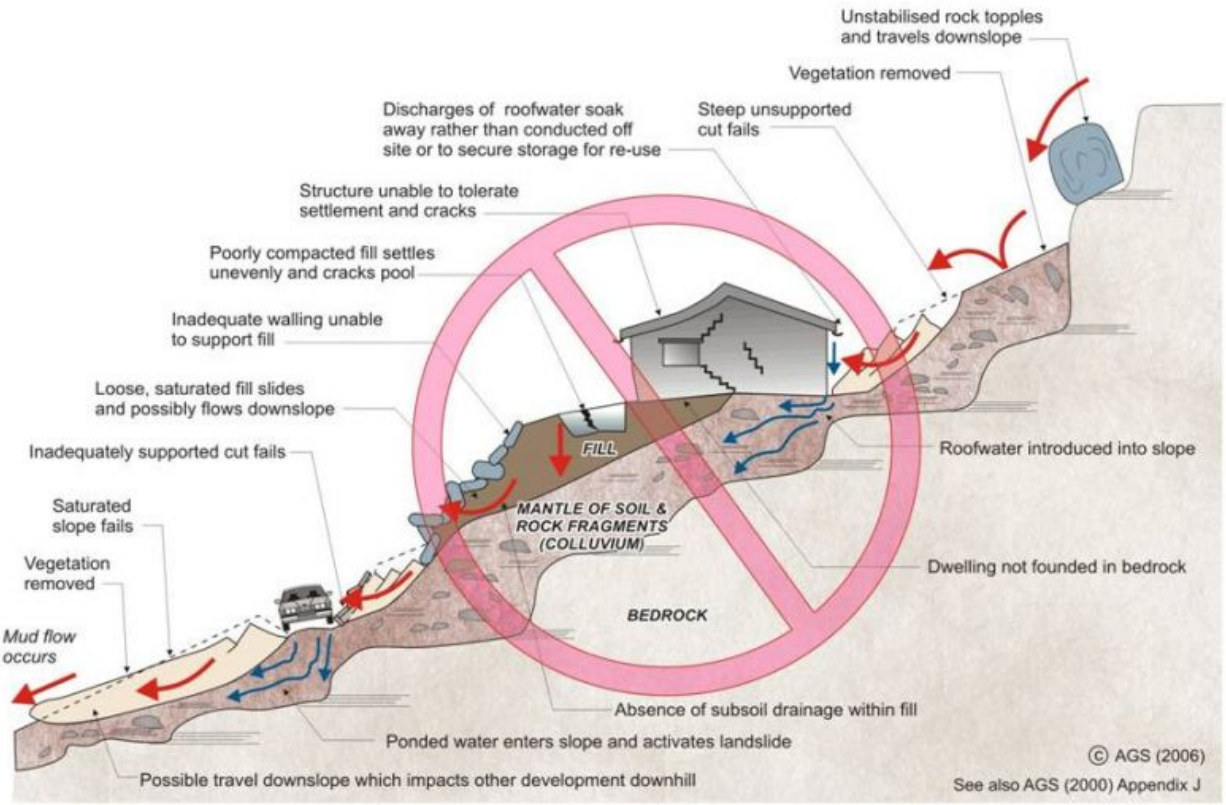
- Topsoil
- Clay
- Very Low Strength Rock
- Hawkesbury Sandstone – Medium Strength

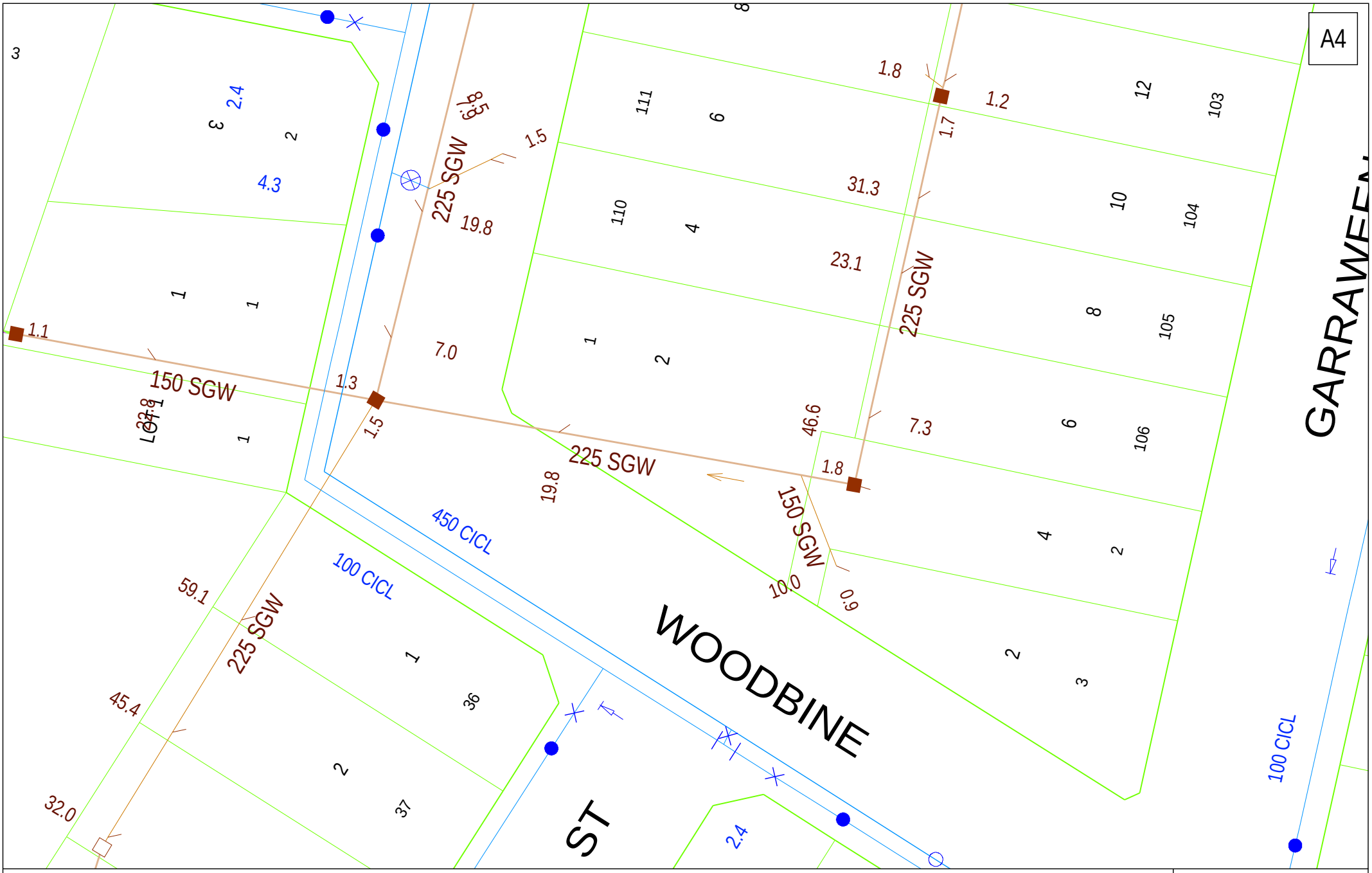


EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE





DBYD Address:
2 Bardoo Av
North Balgowlah
NSW 2093

DBYD Job No: 38965055

DBYD Sequence No: 252878941

No warranty is given that the information shown is complete or accurate.

SYDNEY WATER CORPORATION

Scale: 1:500

Date of Production: 27/03/2025

Plan 1 of 1

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0m 2m 4m 6m 8m 10m