GEOTECHNICAL INVESTIGATION:

New Pool at **14 O'Connors Road, Beacon Hill**

1. Proposed Development

1.1 Install a pool on the E side of the property by excavating to a maximum depth of ~1.5m.

1.2 Landscape the area around the proposed pool requiring minor leveling.

1.3 Other minor external additions and alterations.

1.4 Details of the proposed development are shown on 20 drawings prepared by Andys Home Design, Project number 14AHD0724, drawings numbered DA102 to DA104, DA106 to DA109, DA201, DA301, DA400, DA500, DA501, DA601 to DA605, DA700 to DA702. All dated 19/12/2024.

2. Site Description

2.1 The site was inspected on the 4th December, 2024.

2.2 This residential property is on the corner of O'Connors Road and Mary Street; it is on the low side of Mary Street and is level with O'Connors Road. The property has a S aspect. It is located on the gently graded middle reaches of a hillslope. The natural slope falls across the property at an average angle of ~6°. The slope above the property continues at similar gentle angles. The slope below the property gradually increases in grade.

2.3 At the Mary Street frontage (Photo 1), a concrete driveway runs to a stable brick garage on the W side of the property (Photo 2). Between the garage and the house is a stable deck. Fill for a level lawn below the deck is supported by a stable low brick retaining wall which approximates the S common boundary (Photo 3). The single-story house is supported on brick and sandstone block walls and brick piers. Some of the walls and piers were observed to be supported on outcropping competent Medium Strength Sandstone from within the foundation space of the house. One of the piers supported on rock exhibits tilting (Photo 4). This appears to have been how it was initially constructed. As such, all foundations are considered stable. Between the O'Connors Road frontage and the E side of the house is a gently sloping lawn (Photo 5). A low masonry retaining wall supporting fill in this location was observed to be cracked and tilting towards the house (Photo 6). Due to the wall's low height and location, it is not considered a threat to life or property should further movement occur. This wall will be demolished as part of the proposed works. At the O'Connors Road frontage, a ~2.0m high cut for an electrical box has been taken through Very Low to Medium Strength Sandstone (Photo 7). No significant geological defects were observed in the rock face and it is considered stable.

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 hand Auger Hole (AH) was put down to identify the soil materials. Five 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 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:

AUGER HOLE 1 (~RL128.8) **–** AH1 (Photo 8)

Depth (m)	**Material Encountered**
0.0 to 0.3	**TOPSOIL**, brown, medium dense, dry, fine to medium grained, weathered sandstone fragments included.
0.3 to 0.4	**WEATHERED SANDSTONE**, orange, medium dense to dense, dry, coarse grained, sugary texture.

Refusal @ 0.4m on rock. Auger grinding. 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** (~RL127.0)	**DCP 2** (~RL129.0)	**DCP 3** (~RL129.0)	**DCP 4** (~RL128.5)	**DCP 5** (~RL128.6)
0.0 to 0.3	Rock Exposed at Surface	8	5	16	5
0.3 to 0.6		#	20	10	3
0.6 to 0.9			24	#	23
0.9 to 1.2			17		#
1.2 to 1.5			16		
1.5 to 1.8			#		
		Refusal on Rock @ 0.3m	Refusal on Rock @ 1.3m	Refusal on Rock @ 0.4m	Refusal on Rock @ 0.9m

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

DCP Notes:

DCP1 – Low to Medium Strength Sandstone exposed at O'Connors Road frontage.

DCP2 – Refusal on rock @ 0.3m, DCP bouncing off rock surface, clean dry tip.

DCP3 – Refusal on rock @ 1.3m, DCP bouncing off rock surface, white and maroon impact dust on dry tip, maroon and orange sandy clay in collar above tip.

DCP4 – Refusal on rock @ 0.4m, DCP bouncing off rock surface, white impact dust on dry tip

DCP5 – Refusal on rock @ 0.9m, DCP bouncing off rock surface, white and maroon impact dust on dry tip

5. Geological Observations/Interpretation

The surface features of the block are controlled by the outcropping and underlying sandstone bedrock that steps across 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. Where the rock is not exposed, it is overlain by shallow soils over clays that fill the bench step formation. Filling has been placed around the house for landscaping. In the test locations, where the rock is not exposed, it was encountered at depths of between 0.3 to 1.3 m below the current surface, being slightly deeper due to the presence of fill and the stepped nature of the underlying bedrock. The outcropping sandstone on the property is estimated to be Very Low to Medium Strength. A similar strength rock was encountered during the DCP testing as the DCP ended after a high blow count for some tests. The Very Low Strength Rock is expected to be encountered at depths of between 0.3m and 0.6m below the current surface. 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 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 Mary Street above.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed above, below, or beside the property. The vibrations from the proposed excavation are a potential hazard (**Hazard One**). A loose boulder, wedge, or similar geological defect toppling onto the work site during the excavation process is a potential hazard (**Hazard Two**).

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The vibrations produced during the proposed excavation impacting on the surrounding structures.	A loose boulder, wedge, or similar geological defect toppling onto the work site during the excavation process.
LIKELIHOOD	‘Possible’ (10^{-3})	‘Possible’ (10^{-3})
CONSEQUENCES TO PROPERTY	‘Medium’ (15%)	‘Medium’ (20%)
RISK TO PROPERTY	‘Moderate’ (2×10^{-4})	‘Moderate’ (2×10^{-4})
RISK TO LIFE	5.3×10^{-7}/annum	6.6×10^{-5}/annum
COMMENTS	This level of risk to property is ‘UNACCEPTABLE’. To move risk to ‘ACCEPTABLE’ levels, the recommendations in **Section 12** are to be followed.	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

No significant additional stormwater runoff will be created by the proposed works.

11. Excavations

An excavation up to a maximum depth of ~1.5m is required to install the proposed pool.

The excavation is expected to be through fill, soil, clay, and Very Low Strength Sandstone with Medium Strength Sandstone, where it is not already exposed, expected at depths of between 0.3m and 1.3m below the surface in the area of the proposed excavation.

It is envisaged that excavations through fill, soil, clay, and Very Low Strength Sandstone can be carried out with an excavator and bucket, and excavations through rock will require grinding or rock sawing and breaking.

12. Vibrations

Possible vibrations generated during excavation through fill, soil, clay, and Very Low Strength Sandstone will be below the threshold limit for building damage utilising a domestic-sized excavator up to 16 tonnes. It is expected that the majority of the excavation will be through Medium Strength Sandstone or better.

Excavations through Medium Strength Rock or better should be carried out to minimise the potential to cause vibration damage to the subject house, the electrical box at the road frontage, as well as the S neighbouring house. The setbacks from the proposed excavation to the existing structures are as follows:

- ~3.5m from the existing subject house.
- ~3.7m from the S neighbouring residence (No. 16).
- ~6.1m from the electrical box at the O'Connors Road frontage.

Dilapidation reporting carried out on the S neighbouring property is recommended prior to the excavation works commencing to minimise the potential for spurious building damage claims.

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 house walls and electrical box. Vibration monitoring will be required to verify this is achieved. Vibration monitoring must include a light/alarm so the operator knows if vibration limits have been exceeded. The equipment is to 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, as well as reducing hammer size as necessary.
- Use of rock grinders (milling head).

Should excavation induced vibrations exceed vibration limits after the recommendations above have been implemented, excavation works are to cease immediately and our office is to be contacted.

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

13. Excavation Support Requirements

The excavation for the proposed pool will reach a maximum depth of ~1.5m and will be set back ~0.3m from the E boundary. Very Low to Medium Strength Sandstone was encountered at shallow depths and excavations through this material are expected to stand at vertical angles unsupported subject to approval by the geotechnical consultant. As such, no structures or boundaries are expected to lie within the zone of influence of the excavation.

The fill, soil, and clay portions of the proposed pool excavation 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.

All unsupported cut batters through fill, soil, clay, and Very Low Strength Sandstone 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.

During the excavation process, the geotechnical consultant is to inspect the later stages of the pool excavation 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.

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 NEXT PAGE

Table 1 – Likely Earth Pressures for Retaining Structures

Unit	Earth Pressure Coefficients		
	Unit weight (kN/m³)	'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. Foundations

The proposed pool excavation is expected to be entirely seated in Very Low to Medium Strength Sandstone. This is a suitable foundation material and is expected at depths of between ~0.3m to ~1.3m below the current surface in the area of the proposed pool.

A maximum allowable bearing pressure of 600kPa can be assumed for footings on Very Low to 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 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, the geotechnical consultant is to inspect the later stages of the pool excavation 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

Photo 7

Photo 8 (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.

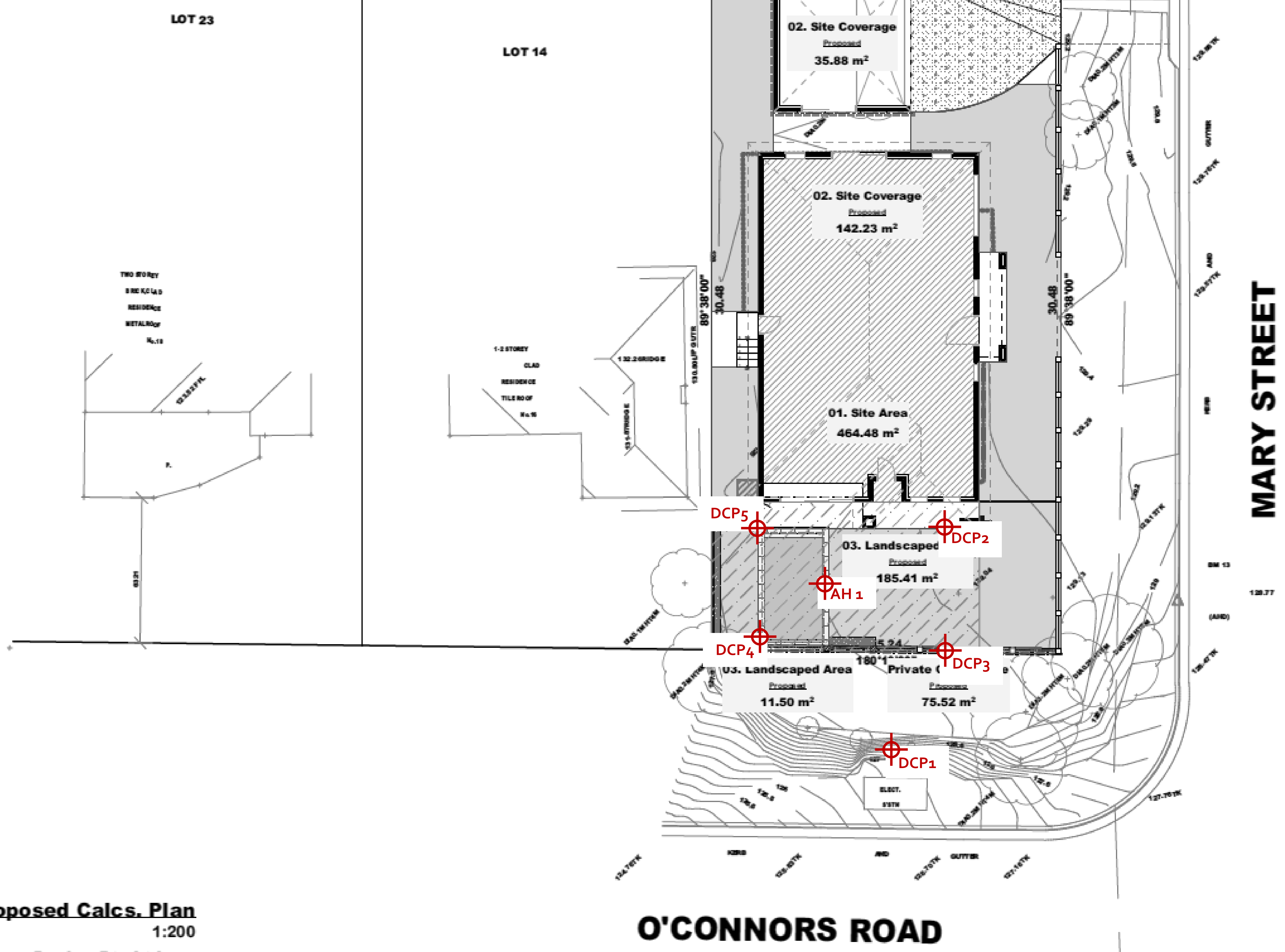
- This report should not be applied to any other project other than that outlined in section 1.0.

- 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.

CALCULATIONS PLAN – showing test locations

Site & Landscape Calculations				
Surface Type	**Status**	**Surface Area (m²)**	**% Calculations**	**Compliance**
01. Site Area		464.48		
02. Site Coverage	Proposed	178.11		
03. Landscaped Area	Proposed	196.91	Max. 42% of Site Area / 185.8m2	Yes



Proposed Calcs. Plan
1:200

LEGEND

Site Area	Proposed Footprint	Proposed Landscape Open Space	Proposed Private Open Space

PROJECT NORTH

Andy's Home Design PTY LTD
Director: Andy Seller
ABN: 32 624 682 024
BDAA ACC#: 6849
Phone: 0430-592-043
Email: info@andyshome.design

DRAWING TITLE :
SITE PLANS
Proposed Calculations Plan
SITE :
LOT 13 D.P. 18645
14 O'connors Road, Beacon Hill, NSW 2100

Drawn | Checked	Andy Seller |
Publish Date:	19/12/2024
Project Status	Development Application
Client	Lisa Lin
Project NO.	14AHD0724
Revision NO.	DA
Drawing Scale:	1:200, 1:1
Sheet Size:	A3

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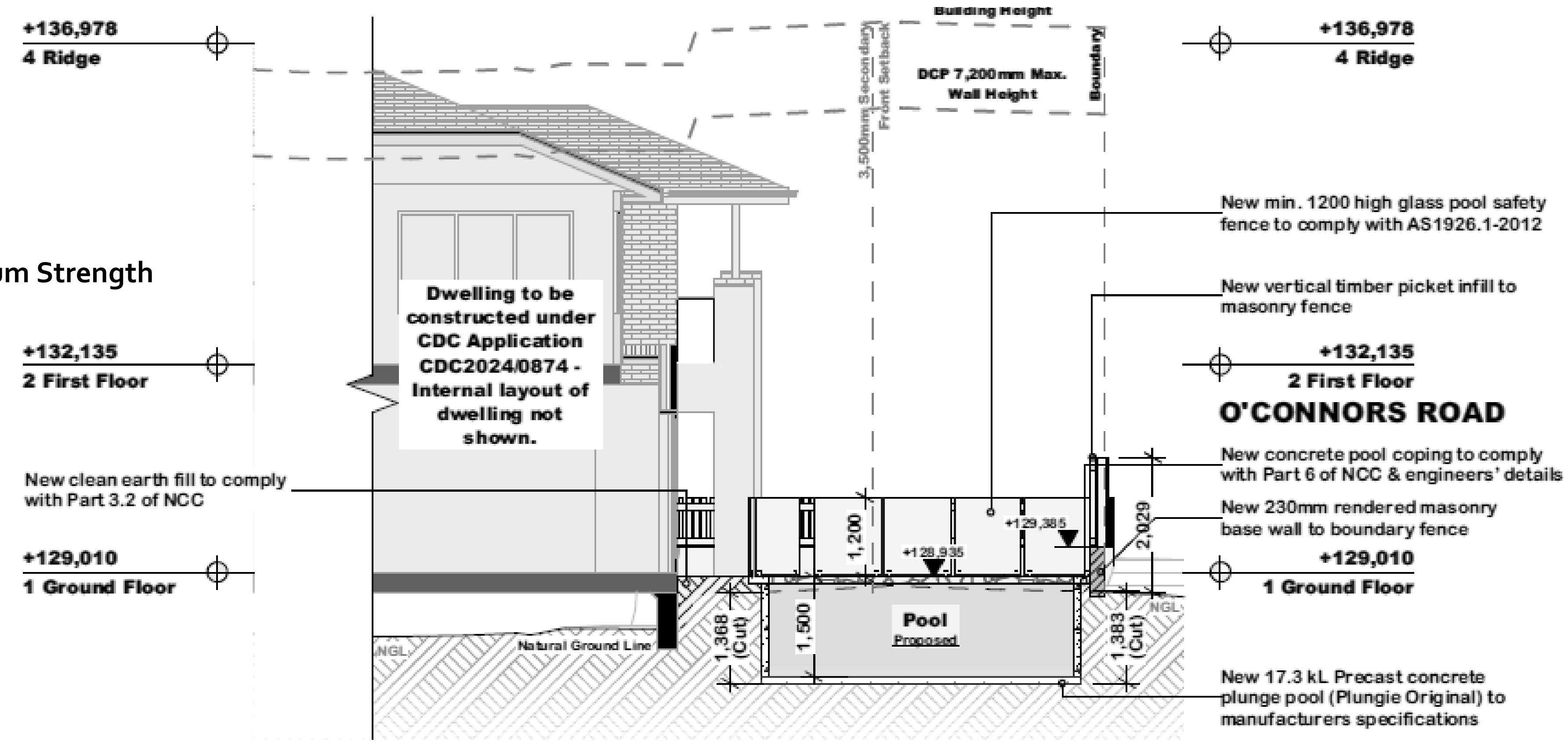
DESIGN • DRAFTING • PLANNING

PROJECT NAME:
Project O'Connors
DRAWING NO.
DA107
STRICTLY FOR:
Development Application

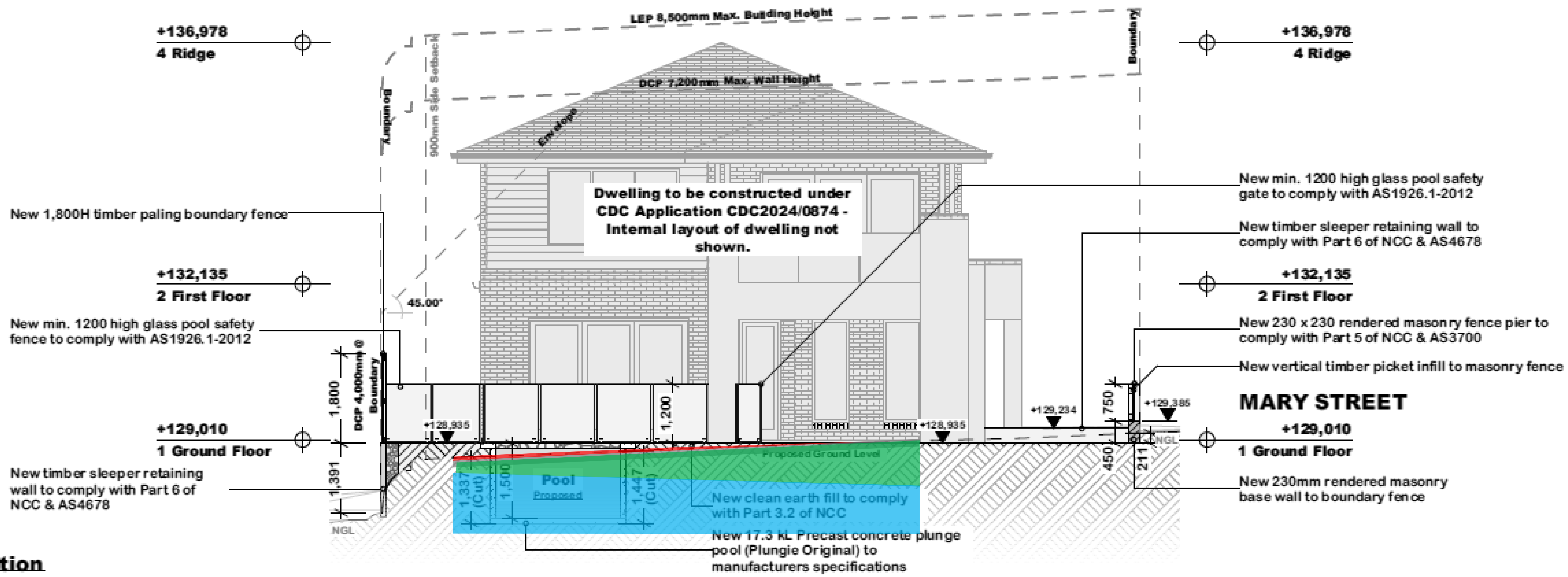
TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials

Expected Ground Materials

- Fill (red)
- Topsoil (grey)
- Very Low Strength Rock (green)
- Hawkesbury Sandstone – Medium Strength (blue)



S-01 **S-Section**
1:100



S-02 **L-Section**
1:100

LEGEND

Proposed Works | Demolition | Existing/ Remains as is
Existing | Masonry | Concrete | Roof Above
Demolished | Timber | Concrete Block | Structure Above/ Below

PROJECT NORTH

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DRAWING TITLE:
SECTIONS
Sections 1

SITE:
LOT 13 D.P. 18645
14 O'connors Road, Beacon Hill, NSW 2100

Drawn | Checked	Andy Seller |
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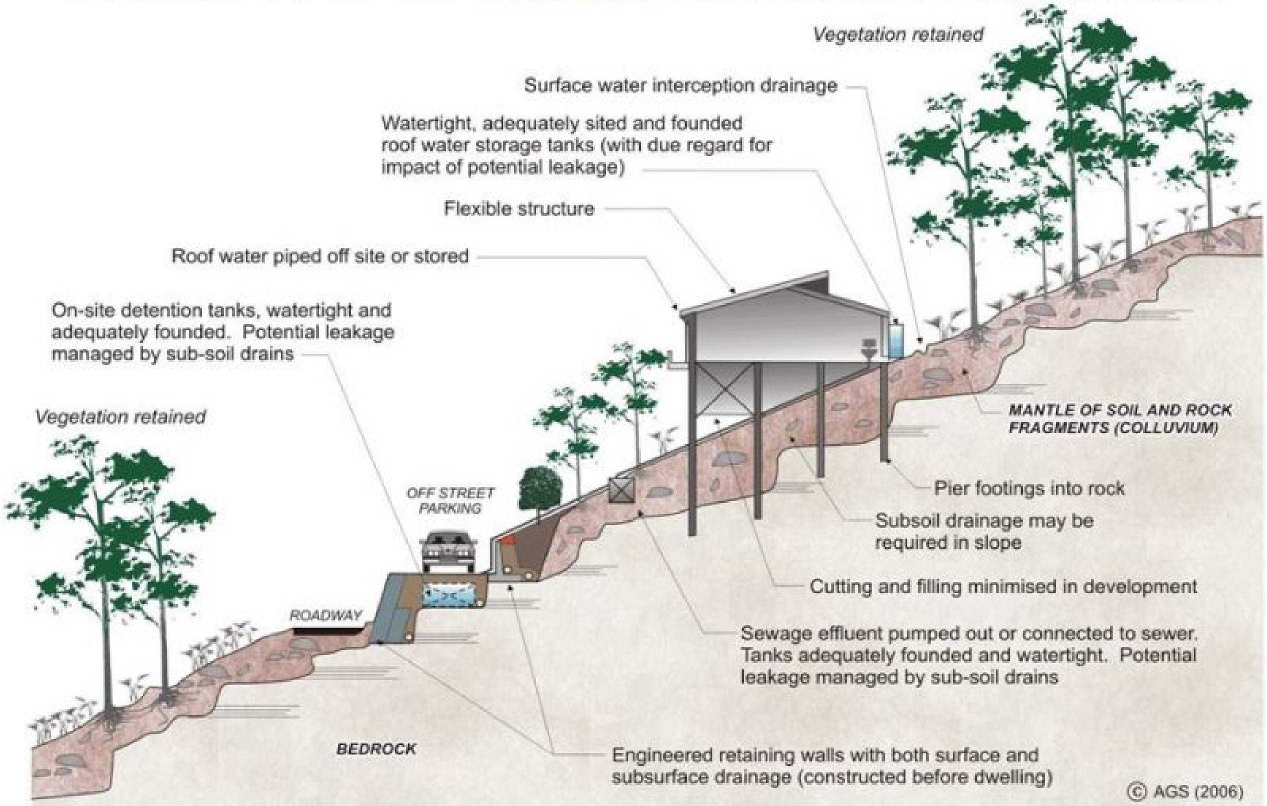
ANDY'S HOME DESIGN
DESIGN • DRAFTING • PLANNING

PROJECT NAME:
Project O'Connors
DRAWING NO.
DA400
STRICTLY FOR:
Development Application

EXAMPLES OF GOOD HILLSIDE PRACTICE



EXAMPLES OF POOR HILLSIDE PRACTICE