GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1 – To be submitted with Development Application

Development Application for _____
Name of Applicant

Address of site 32 Bellara Avenue, North Narrabeen

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk ***Declaration made by geotechnical engineer or engineering geologist or coastal engineer (where applicable) as part of a geotechnical report***

I, Ben White *on behalf of* **White Geotechnical Group** Pty Ltd
(Insert Name) (Trading or Company Name)

on this the 29/10/24 certify that I am a geotechnical engineer or engineering geologist or coastal engineer as defined by the Geotechnical Risk Management Policy for Pittwater - 2009 and I am authorised by the above organisation/company to issue this document and to certify that the organisation/company has a current professional indemnity policy of at least $10million.

I:
Please mark appropriate box

☒ have prepared the detailed Geotechnical Report referenced below in accordance with the Australia Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009

☒ am willing to technically verify that the detailed Geotechnical Report referenced below has been prepared in accordance with the Australian Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009

☐ have examined the site and the proposed development in detail and have carried out a risk assessment in accordance with Section 6.0 of the Geotechnical Risk Management Policy for Pittwater - 2009. I confirm that the results of the risk assessment for the proposed development are in compliance with the Geotechnical Risk Management Policy for Pittwater - 2009 and further detailed geotechnical reporting is not required for the subject site.

☐ have examined the site and the proposed development/alteration in detail and I am of the opinion that the Development Application only involves Minor Development/Alteration that does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.

☐ have examined the site and the proposed development/alteration is separate from and is not affected by a Geotechnical Hazard and does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.

☐ have provided the coastal process and coastal forces analysis for inclusion in the Geotechnical Report

Geotechnical Report Details:

Report Title: Geotechnical Report **32 Bellara Avenue, North Narrabeen**

Report Date: 24/10/24

Author: BEN WHITE

Author's Company/Organisation: **White Geotechnical Group Pty Ltd**

Documentation which relate to or are relied upon in report preparation:

Australian Geomechanics Society Landslide Risk Management March 2007.

White Geotechnical Group company archives.

I am aware that the above Geotechnical Report, prepared for the abovementioned site is to be submitted in support of a Development Application for this site and will be relied on by Pittwater Council as the basis for ensuring that the Geotechnical Risk Management aspects of the proposed development have been adequately addressed to achieve an "Acceptable Risk Management" level for the life of the structure, taken as at least 100 years unless otherwise stated and justified in the Report and that reasonable and practical measures have been identified to remove foreseeable risk.

Signature _____

Name Ben White

Chartered Professional Status MScGEOL AIG., RPGeo

Membership No. 10306

Company **White Geotechnical Group Pty Ltd**

GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1(a) - Checklist of Requirements for Geotechnical Risk Management Report for Development Application

Development Application for _____
Name of Applicant

Address of site 32 Bellara Avenue, North Narrabeen

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk Management Geotechnical Report. This checklist is to accompany the Geotechnical Report and its certification (Form No. 1).

Geotechnical Report Details:

Report Title: Geotechnical Report **32 Bellara Avenue, North Narrabeen**

Report Date: 24/10/24

Author: BEN WHITE

Author's Company/Organisation: **White Geotechnical Group Pty Ltd**

Please mark appropriate box

☒ Comprehensive site mapping conducted **25/10/19**
(date)

☒ Mapping details presented on contoured site plan with geomorphic mapping to a minimum scale of 1:200 (as appropriate)

☒ Subsurface investigation required
- ☐ No Justification _____
- ☒ Yes Date conducted **15/8/19**

☒ Geotechnical model developed and reported as an inferred subsurface type-section

☒ Geotechnical hazards identified
- ☐ Above the site
- ☒ On the site
- ☒ Below the site
- ☐ Beside the site

☒ Geotechnical hazards described and reported

☒ Risk assessment conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- ☒ Consequence analysis
- ☒ Frequency analysis

☒ Risk calculation

☒ Risk assessment for property conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009

☒ Risk assessment for loss of life conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009

☒ Assessed risks have been compared to "Acceptable Risk Management" criteria as defined in the Geotechnical Risk Management Policy for Pittwater - 2009

☒ Opinion has been provided that the design can achieve the "Acceptable Risk Management" criteria provided that the specified conditions are achieved.

☒ Design Life Adopted:
- ☒ 100 years
- ☐ Other _____
specify

☒ Geotechnical Conditions to be applied to all four phases as described in the Geotechnical Risk Management Policy for Pittwater - 2009 have been specified

☒ Additional action to remove risk where reasonable and practical have been identified and included in the report.

☐ Risk assessment within Bushfire Asset Protection Zone.

I am aware that Pittwater Council will rely on the Geotechnical Report, to which this checklist applies, as the basis for ensuring that the geotechnical risk management aspects of the proposal have been adequately addressed to achieve an "Acceptable Risk Management" level for the life of the structure, taken as at least 100 years unless otherwise stated, and justified in the Report and that reasonable and practical measures have been identified to remove foreseeable risk.

Signature _____

Name Ben White

Chartered Professional Status MScGEOL AIG., RPGeo

Membership No. 222757

Company **White Geotechnical Group Pty Ltd**

GEOTECHNICAL INVESTIGATION:

New House at **32 Bellara Avenue, North Narrabeen**

1. Proposed Development

1.1 Construct a new three-story house by excavating to a maximum depth of ~6.2m into the slope.

1.2 Fill to a maximum height of ~1.8m for landscaping around the proposed house as well as for formwork below slabs.

1.3 Details of the proposed development are shown on 10 drawings prepared by Inlet Design Studio, drawings numbered A01 to A10. All dated 27/9/224.

2. Site Description

2.1 The site was inspected on the 25th October 2024, and previously in June, 2020, May 2018, and March 2015.

2.2 This vacant lot is located at the end of Bellara Avenue. The property has a SW aspect and runs lengthways to the S so the slope is a cross-fall. It is located on the moderately graded upper reaches of a hillslope. The natural slope rises across the property at an average angle of ~16°. The slope above the property eases at the crest of a ridge. The slope below the property gradually increases in grade.

2.3 At the road frontage, a stable sandstone clad concrete block retaining wall reaching ~3.1m high supports a cut for the turning circle. Vehicle access to the property is mid-way up the block (Photo 1). The proposed new house is to be constructed uphill of the road access and retaining wall. Loose sandstone boulders are scattered across the moderately graded slope and are either resting or embedded in stable positions (Photo 2). A stable 1.5m high stack rock retaining wall extends along

the uphill boundary (Photo 3). Stable sandstone bedrock was observed to be outcropping above the subject property (Photo 4).

3. Geology

The Sydney 1:100 000 Geological Sheet indicates the contact of Hawkesbury Sandstone and the Narrabeen Group Rocks is on the uphill side of the property, although at a residential scale the map is not always accurate. Ground testing and observations on site indicate that the proposed works are underlain by geology which is consistent with the Narrabeen Group. The Narrabeen Group rocks are described as interbedded laminite, shale, and quartz to lithic quartz sandstone.

4. Subsurface Investigation

Two hand Auger Holes (AH) were put down to identify the soil materials. 12 Dynamic Cone Penetrometer (DCP) tests were put down to determine the relative density of the overlying soil and the depth to rock. 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 expected to have occurred for DCP 7 and 11. 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 (~RL33.5) **–** AH1 (Photo 5)

Depth (m)	**Material Encountered**
0.0 to 0.1	**TOPSOIL**, Sandy soil, fine grain, dark brown
0.1 to 0.2	**SILTY SAND**, fine grain, light brown.

End of hole @ 0.2m. No water table encountered.

AUGER HOLE 2 (~RL31.5) **–** AH2 (Photo 6)

Depth (m)	**Material Encountered**
0.0 to 0.1	**TOPSOIL**, Sandy soil, fine grain, dark brown
0.1 to 0.2	**CLAY**, stiff clay, light brown with maroon shale fragments.

End of hole @ 0.2m hitting shale. No watertable 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** (~RL)	**DCP 2** (~RL)	**DCP 3** (~RL)	**DCP 4** (~RL31.5)	**DCP 5** (~RL32.8)	**DCP 6** (~RL37.0)
0.0 to 0.3	15	12	13	8	13	5
0.3 to 0.6	18	18	24	25	21	18
0.6 to 0.9	15	32	47	6	13	30
0.9 to 1.2	20	20	50	#	26	#
1.2 to 1.5	30	#	#		23	
1.5 to 1.8	27				19	
1.8 to 2.1	#				31	
2.1 to 2.4					#	
	End Test @ 1.8m	Refusal @ 1.2m	End Test @ 1.2m	Refusal @ 0.7m	End of test @ 2.1m	Refusal @ 0.8m

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

DCP TEST RESULTS CONTINUED ON THE 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 7** (~RL35.0)	**DCP 8** (~RL35.0)	**DCP 9** (~RL31.8)	**DCP 10** (~RL31.0)	**DCP 11** (~RL28.4)	**DCP 12** (~RL28.5)
0.0 to 0.3	15	12	2	2	1	5
0.3 to 0.6	23	28	10	8	11	8
0.6 to 0.9	#	15	7	12	#	9
0.9 to 1.2		28	11	14		10
1.2 to 1.5		#	26	17		17
1.5 to 1.8			#	24		16
1.8 to 2.1				35		#
2.1 to 2.4				#		
	Refusal @ 0.4m	Refusal @ 1.2m	Refusal @ 1.5m	End of Test @ 2.1m	Refusal @ 0.6m	Refusal @ 1.8m

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

DCP Notes:

DCP1 – End of test @ 1.8m, DCP still very slowly going down, white shale fragments on dry tip.

DCP2 – Refusal @ 1.2m, maroon to orange shale fragments on wet tip.

DCP3 – End of test @ 1.2m, DCP still very slowly going down, maroon to orange shale fragments on wet tip.

DCP4 – Refusal on rock @ 0.7m, DCP bouncing off rock surface, maroon fragments on dry tip.

DCP5 – End of test @ 2.1m, DCP still very slowly going down, white fragments on dry tip.

DCP6 – Refusal on rock @ 0.8m, DCP bouncing off rock surface, white impact dust on dry tip.

DCP7 – Refusal on rock @ 0.4m, DCP bouncing off rock surface, clean dry tip.

DCP8 – Refusal on rock @ 1.2m, DCP bouncing off rock surface, clean dry tip.

DCP9 – Refusal @ 1.5m, DCP bouncing at refusal, nothing on tip.

DCP10 – End of Test @ 2.1m, DCP still very slowly going down, white impact dust on dry tip.

DCP11 – Refusal @ 0.6m on obstruction likely.

DCP12 – Refusal @ 1.8m, DCP thudding at refusal, nothing on tip.

5. Geological Observations/Interpretation

The contact between the Hawkesbury Sandstone and Narrabeen Group of Rocks underlies the property. Above the location of the proposed house, the surface features are controlled by the outcropping and 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 geomorphology underneath and below the house is indicative of a shale-derived slope typical of the Narrabeen Group. The contact is interpreted to cut through the subject property above the proposed house. However, it is to be noted that the exact location will not be known until the excavation or exploration drilling commences. In the location of the proposed works, the depth to Extremely Low to Very Low Strength Rock ranges from between ~0.7m and ~1.8m. These are overlain by shallow soil and residual sandy clays. We point out around the contact of two rock types (sandstone & shale) groundwater seepage can be higher than usual. 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 clay and weathered shale layers, as well as the buried surface of the sandstone. 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. As above, ground water seepage may be slightly elevated around the contact of the Hawkesbury Sandstone and Narrabeen Group.

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 or above the property. The moderately graded slope that rises across the property and continues below at increasing angles is a potential hazard (**Hazard One**). Potential vibrations from the proposed excavation are a potential hazard (**Hazard Two**). The proposed excavation is a potential hazard until the retaining walls are in place (**Hazard Three**). The surcharge loads from the proposed house acting on the retaining wall at the road frontage is a potential hazard (**Hazard Four**).

Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The moderate slope that rises across the property and continues above and below failing and impacting on the proposed works.	Potential vibrations produced during the proposed excavation impacting on the surrounding structures.
LIKELIHOOD	'Unlikely' (10^{-4})	'Possible' (10^{-3})
CONSEQUENCES TO PROPERTY	'Medium' (12%)	'Minor' (10%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'Moderate' (5×10^{-4})
RISK TO LIFE	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 risk to 'ACCEPTABLE' levels, the recommendations in **Section 12** are to be followed.

(See Aust. Geomech. Jnl. Mar 2007 Vol. 42 No 1, for full explanation of terms)

RISK ANALYSIS SUMMARY CONTINUED ON THE NEXT PAGE

HAZARDS	Hazard Three	Hazard Four
TYPE	The excavation (to a height of ~6.1m) collapsing onto the work site before retaining walls are in place.	The proposed house surcharge loads acting on the ~3.1m high retaining wall at the road frontage, causing damage or failure (Photo 1).
LIKELIHOOD	'Likely' (10^{-2})	'Likely' (10^{-2})
CONSEQUENCES TO PROPERTY	'Medium' (25%)	'Medium' (11%)
RISK TO PROPERTY	'High' (2×10^{-3})	'Moderate' (5×10^{-4})
RISK TO LIFE	5.9×10^{-4}/annum	7.4×10^{-7}/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.	This level of risk to property is 'UNACCEPTABLE'. To move the risk to 'ACCEPTABLE' levels, the recommendations in **Section 16** 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 Bellara 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

The excavation for the proposed house will reach a maximum depth of ~6.2m on the E side of the cut for the lower ground floor.

The excavation is expected to be through soil and clay with Extremely Low to Very Low Strength Rock expected at depths of between ~0.7m and ~1.8m in the location of the proposed works.

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

12. Vibrations

Possible vibrations generated during excavations through soil, clay, and Extremely Low to Very Low Strength Rock will be below the threshold limit for building damage utilising a domestic-sized excavator up to 16 tonnes. The excavation may encounter Medium Strength Rock or better.

Excavations through Medium Strength Rock or better should be carried out to minimise the potential to cause vibration damage to the NW neighbouring house. Allowing ~0.5m for backwall drainage, the excavation will be set back ~8.5m from the NW neighbouring house.

Dilapidation reporting carried out on the NW 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 NW neighbouring house walls. 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

It is recommended, before the structural design commences for the project, exploration core drilling is to be carried out on the site to confirm to the rock quality and strength. This is to be arranged and supervised by the geotechnical consultant and should consist of a minimum of two cored bore holes taken to a depth of not less than 8.0m each. The following ground support advice can be considered preliminary and will be reviewed on recovery of the drill core.

As this job is considered technically complex and due to the depth of the excavation, we recommend it be carried out by builders and contractors who are well experienced in similar work and can provide a proven history of completed work. We recommend a pre-construction

meeting between the structural engineer, the builder, and the geotechnical consultant to discuss and confirm the excavation plan and to ensure suitable excavation equipment will be on site.

The excavation for the proposed house will reach a maximum depth of ~6.2m at the cut for the lower ground floor. Allowing 0.5m for back wall drainage, the excavation will be set back ~0.7m from the E common boundary.

As such, the E common boundary 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 soil.

Due to the depth of the excavation and its proximity to the E common boundary, it is recommended ground support be installed prior to the excavation commencing along any portion of the house excavation that is expected to exceed 2.0m depth. See the site plan attached for the minimum required extent of the shoring shown in blue.

A spaced piled retaining wall is one suitable method of support. Pier spacing for the wall is typically ~2.0m but can vary between 1.6 to 2.4m depending on the design. The machine selected to drill the pier holes for the wall should be decided following the recommended exploration drilling to ensure the excavation equipment is capable of reaching the required depths. Alternatively, a mini piling rig or similar that can excavate through Medium to High Strength Rock is recommended as the ground testing did not extend to the likely required depth of the piles. As the excavation is lowered in 1.5m lifts, infill sprayed concrete panels or similar are added between the piers to form the spaced wall. Drainage is installed behind the panels. The piers can be temporarily/permanently supported by embedment below the base of the excavation, or by a combination of embedment and temporary propping. The embedment depths are to be calculated by the structural engineer using the earth pressure properties provided in **Section 14** “Retaining Structures”. Upon completion of the excavation,

the piled walls are to be tied into the house structure where possible to provide permanent bracing. Alternatively, the wall can be designed to be anchored. Where anchors need to be drilled into and below the adjoining property, the owners of the neighbouring property and Northern Beaches Council will need to grant their permission.

The geotechnical consultant is to inspect the drilling process of the entire first pile and the ground materials at the base of all pier holes/excavations for ground support purposes.

Loose boulders immediately above the proposed excavation faces are to be removed before any excavation commences.

Due to the grade of the slope across the location of the proposed works the remaining sides of the excavation will need to be temporarily supported until retaining walls are in place so cut batters are not left unsupported. The support will need to be designed by the structural engineer in consultation with the Geotechnical Consultant.

During the excavation process, 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 the shoring is adequate.

Upslope runoff is to be diverted from the cut faces by sandbag mounds or other diversion works. 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.

All excavation spoil is to be removed from site following the current Environmental Protection Agency (EPA) waste classification guidelines.

14. Retaining Walls

For cantilever or singly propped retaining walls 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 Walls

Unit	Earth Pressure Coefficients			
	Unit weight (kN/m^3)	'Active' K_a	'At Rest' K_0	Passive
Topsoil and silty sand	20	0.40	0.55	N/A
Residual Clays	20	0.35	0.45	Kp = 2.0 'ultimate'
Extremely Low Strength Rock	22	0.25	0.38	Kp = 2.5 'ultimate'
Very Low Strength Rock or better	22	0.22	0.35	400kPa 'ultimate'

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 wall and do not account for any surcharge loads from the slope above, noting that surcharge loads from the structures above will be acting on the wall. It also assumes retaining walls are fully drained. It should be noted that passive pressure is an ultimate value and should have an appropriate safety factor applied. No passive resistance should be assumed for the top 0.4m to account for any disturbance from the excavation. Ground materials and relevant earth pressure coefficients are to be confirmed on site by the geotechnical consultant.

All retaining walls are to have sufficient back-wall drainage and be backfilled immediately behind the wall 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 wall, the likely hydrostatic pressures are to be accounted for in the structural design.

15. Fill

15.1 Fill will be placed underneath the downhill side of the house to a height of ~1.2m. We recommend the fill is used as formwork only and the structures above are suspended, and not supported on the fill. This simplifies the building process as the fill does not require engineer supervised compaction and testing. If it is desired to support structures on fill, it is to be laid as an engineered fill. Our office can be contacted for advice on this procedure.

15.2 Fill will also will be placed around the footprint of the proposed house for landscaping. No fills are to be laid until retaining walls are in place. The fills will reach a maximum height of ~1.8m. The surface is to be prepared before any fills are laid by removing any organic matter and topsoil. Fills for landscaping are to be laid in a loose thickness not exceeding 0.3m before being moderately compacted. Tracking the machine over the loose fill in 1 to 2 passes should be sufficient. Immediately behind the retaining walls (say to 1.5m), the fills are to be compacted with light weight equipment such as a hand-held plate compactor so as not to damage the retaining walls. Where light weight equipment is used, fills are to be laid in a loose thickness not exceeding 0.15m before being compacted. No structures are to be supported on fill.

16. Foundations

The proposed house and lift can be supported on a thickened edge / raft slab with piers taken to Extremely Low to Very Low Strength Rock where necessary. This material is expected to be exposed across the uphill side of the proposed excavation. Where it is not exposed, and where the footprint of the house falls outside the footprint of the proposed excavation, piers will need to be taken to and embedded no less than 0.6m into this material to maintain a uniform foundation material across the structure. The piers are to be sufficiently embedded below the zone of Influence of the ~3.1m retaining wall for the turning circle (Photo 1). Extremely Low to Very Low Strength Rock is expected at depths of between ~0.7m and ~1.8m below the current surface in the location of the proposed house.

A maximum allowable bearing pressure of 600kPa can be assumed for footings on Extremely Low to Very Low Strength Rock. It should be noted that this material is a soft rock and a rock auger will cut through it so the builders should not be looking for refusal to end the footings.

As the bearing capacity of clay and shale 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 or shale 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. Geotechnical Review

The structural plans are to be checked and certified by the geotechnical engineer as being in accordance with the geotechnical recommendations. On completion, a Form 2B will be issued. This form is required for the Construction Certificate to proceed.

18. Inspections

The client and builder are to familiarise themselves with the following required inspections as well as council geotechnical policy. We cannot provide certification for the Occupation Certificate or the owner if the following inspections have not been carried out during the construction process.

- The geotechnical consultant is to inspect the ground materials while the first pier for the ground support is being dug to assess the ground strength and to ensure it is in line with our expectations.

- All finished pier holes for piled wall/excavations for ground support are to be inspected and measured before concrete is placed.

- During the excavation process, 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 the shoring is adequate.

- 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.

Nathan Gardner B.Sc. (Geol. & Geophys. & Env. Stud.)
AIG., RPGeo Geotechnical & Engineering.
No. 10307
Engineering Geologist & Environmental Scientist.

Reviewed By:

Ben White M.Sc. Geol.,
AIG., RPGeo Geotechnical & Engineering.
No. 10306
Engineering Geologist.

REGISTERED PROFESSIONAL GEOSCIENTIST
AUSTRALIAN INSTITUTE OF GEOSCIENTISTS
BENJAMIN WHITE
RPGeo No:
10306

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5 – downhole is top to bottom

Photo 6 - 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.

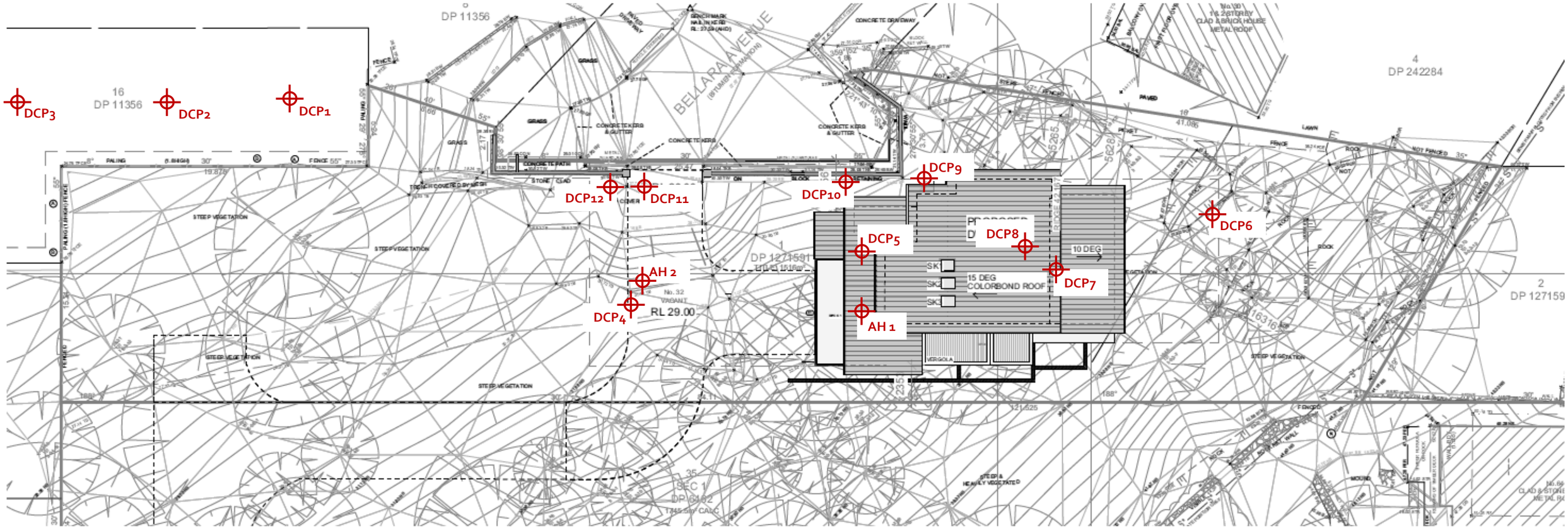
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- 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



1 Site Plan
Scale: 1:250

SITE FEATURES	AREA
PROPOSED LGF	32.3msq
GARAGE 42.2sqm	10sqm
PROPOSED GF	104.4sqm
PROPOSED FF	102.6msq
TOTAL FLOOR AREA	249.3msq
PROPOSED BUA	174.8sqm
PRIVATE OPEN SPACE	45.6msq
LANDSCAPE AREA HARD	29.2msq
LANDSCAPE AREA SOFT	1169msq
TOTAL SITE AREA	1516msq
FLOOR SPACE RATIO	0.17:1

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ABN: 26 075 061 335

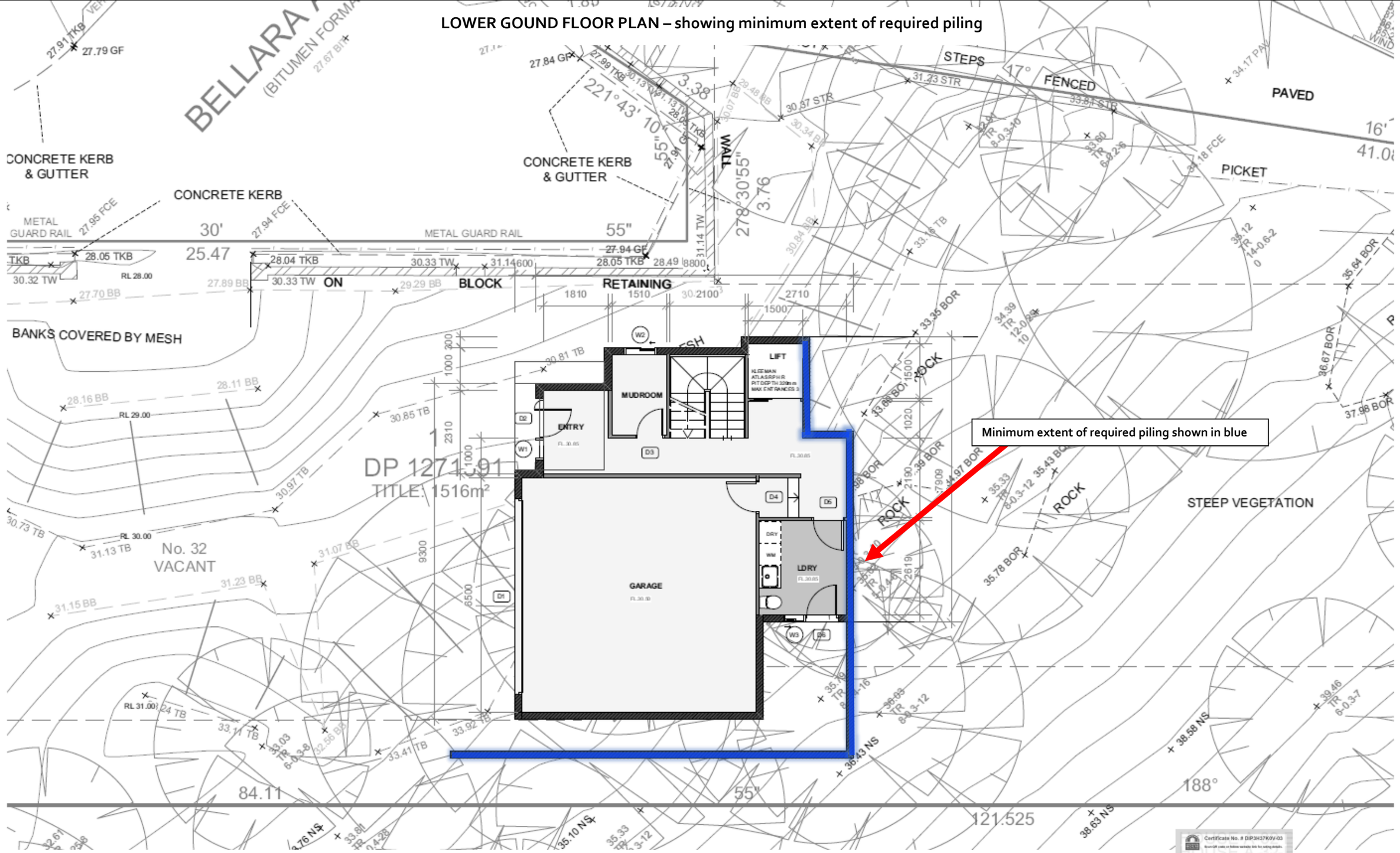
REVISION: DATE: REVISION NOTE:

CLIENT: ERIC & JILL SANDERSON

ADDRESS: 32 BELLARA AVE
NORTH NARRABEEN

DRAWING: SITE PLAN ANALYSIS
DRAWN: IW
SHEET NO: A01
PROJECT: PROPOSED DWELLING
CHKD: RJ
SCALE @ A3: 1:250
PROJECT NO: BEL001
ISSUE TYPE: 1
ISSUE DATE: 27/09/24
REVISION:

LOWER GOUND FLOOR PLAN – showing minimum extent of required piling



1 LOWER GROUND FLOOR PLAN
Scale: 1:100

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REVISION:	DATE:	REVISION NOTE:

CLIENT: ERIC & JILL SANDERSON

ADDRESS: 32 BELLARA AVE
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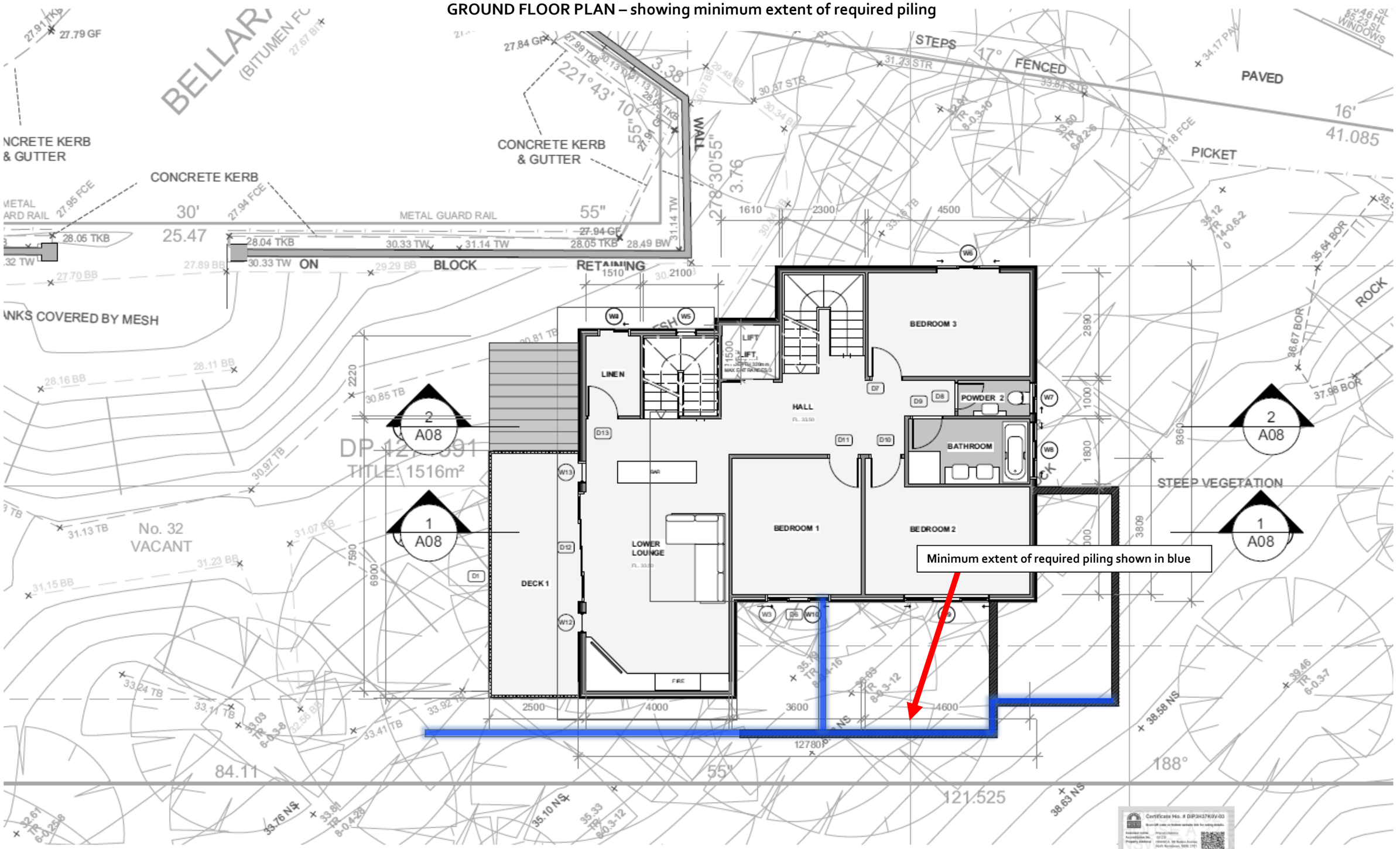
DRAWING: LOWER GROUND FLOOR PLAN		DRAWN: IW	SHEET NO: A03
PROJECT: PROPOSED DWELLING		CHK'D: RJ	SCALE @ A3: 1:100
PROJECT NO: BEL001	ISSUE TYPE: 1	ISSUE DATE: 27/09/24	REVISION:

GROUND FLOOR PLAN – showing minimum extent of required piling



1 GROUND FLOOR PLAN
Scale: 1:100

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REVISION:	DATE:	REVISION NOTE:

CLIENT: ERIC & JILL SANDERSON

ADDRESS: 32 BELLARA AVE
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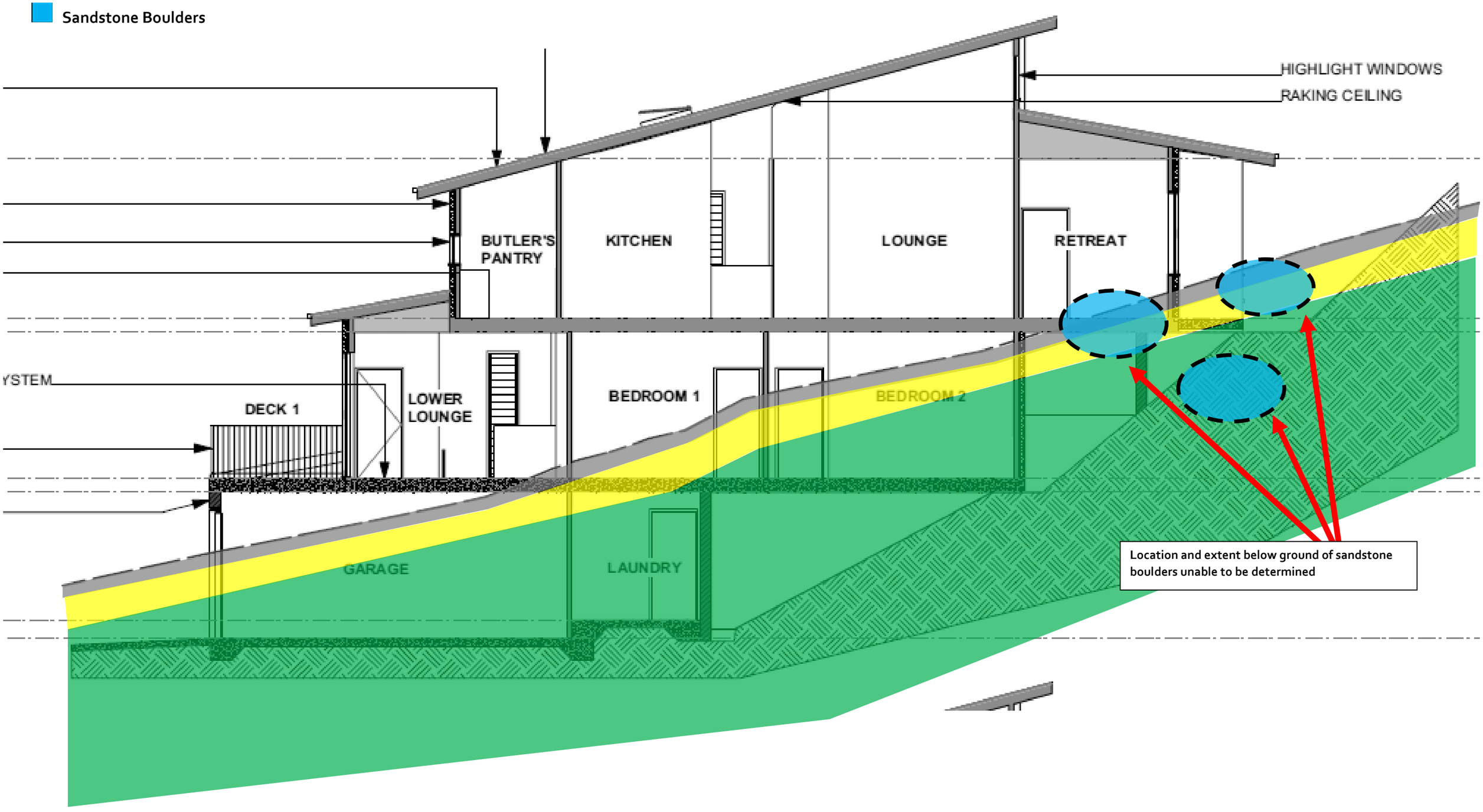
DRAWING:	DRAWN:	SHEET NO:
GROUND FLOOR PLAN	IW	A04
PROJECT:	CHKD:	SCALE @ A3:
PROPOSED DWELLING	RJ	1:100
PROJECT NO: / ISSUE TYPE:	ISSUE DATE:	REVISION:
BEL001 / 1	27/09/24	

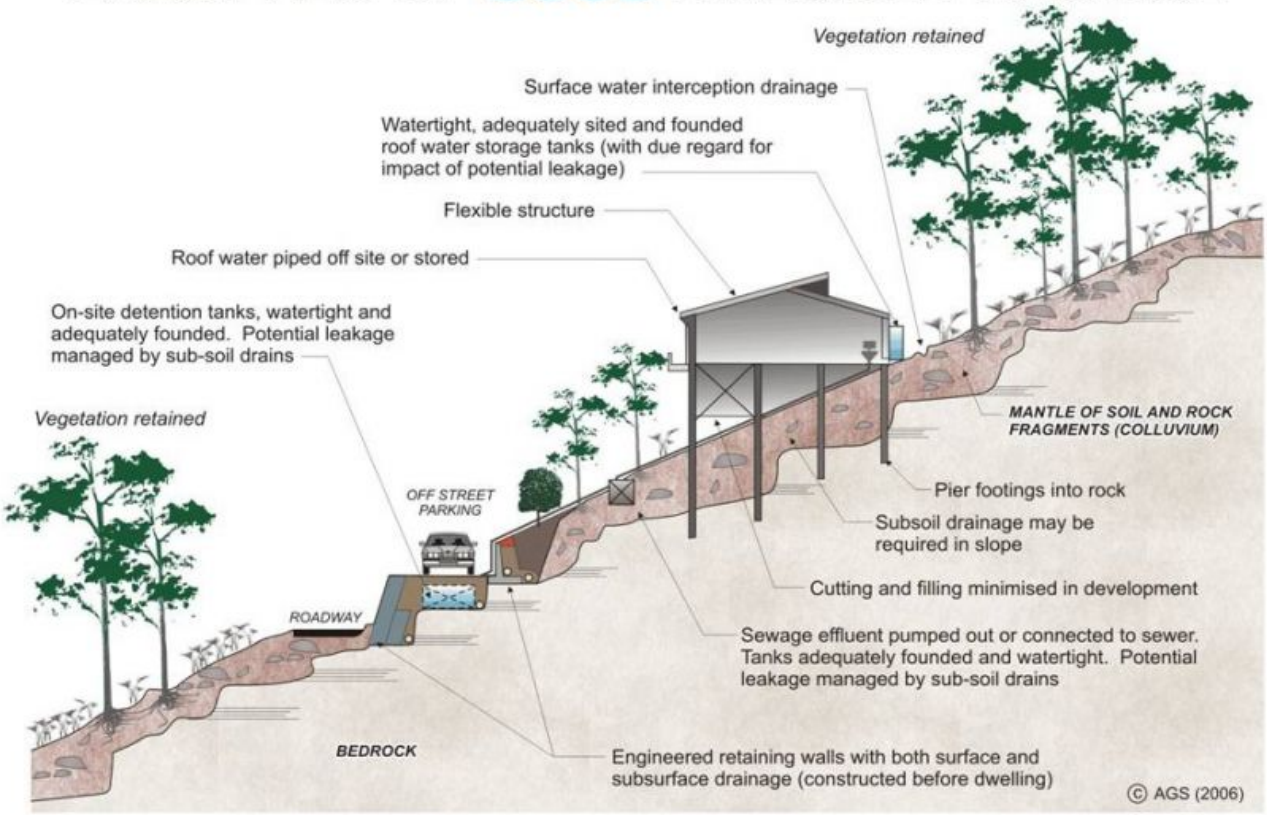
TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials

Expected Ground Materials

- Topsoil and silty sand
- Clay
- Narrabeen Group Rocks – Extremely Low to Very Low Strength Shale.
- Sandstone Boulders



EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE