GEOTECH INVESTIGATIONS PTY LTD

REPORT ON
LANDSLIDE SUSCEPTIBILITY ASSESSMENT FOR

PROPOSED FARM BUILDING AT
NO.550 COOLAMON SCENIC DRIVE, COORABELL
LOT 1 ON DP 123290

PREPARED FOR
CATHERINE & GEOFF WIJNBERG

PROJECT REF: GI 7100-a

11 SEPTEMBER 2023

GEOTECHNICAL ENVIRONMENTAL DRILLING

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1. INTRODUCTION

This report details the results of a landslide susceptibility assessment for the proposed farm building at No.550 Coolamon Scenic Drive, Coorabell, described as Lot 1 on DP 123290.

Plans for the farm building by Drafting Plans indicate that the structure will comprise slab on ground construction with lightweight colorbond walls and roof. Earthworks are proposed for the development to achieve a level pad with a new rock retaining wall supporting the associated cut. In addition, a new driveway is proposed to extend along the southern boundary of adjoining sites to the west then transecting downslope to the farm building, refer to attached 'large site plan in Appendix A.

2. OBJECTIVES AND SCOPE OF SERVICE

Geotech Investigations Pty Ltd (GI) was engaged by Catherine & Geoff Wijnberg (land owner) to complete the investigation, which was to determine information regarding the subsurface conditions at various locations and how this influences the design of the proposed development. The investigation and report involved the following:-

- Summarise the subsurface conditions, including any groundwater observations at the time;
- A 'Landslide Susceptibility Assessment' typically in accordance Australian Geomechanic Society (AGS) Guidelines;
- Indicative shrink-swell movements, Site Classification in accordance with AS2870-2011;
- Earthworks, temporary and permanent batter slopes; and
- Retaining wall design parameters;

3. SITE LOCATION AND DESCRIPTION

A site visit was carried out on the 11th of September 2023 by an experienced Senior Geotechnical Engineer from GI, with the purpose of viewing specific areas of the subject site and making observations of the local geology, existing vegetation and the existing stability of the natural slopes surrounding the subject site. The overall subject site is approximately 1.8 ha and the investigation was limited to two main areas of interest, described below; the farm building site and the proposed driveway.

Farm Building Site

- The building area is positioned approximately 15 m north of the mid section of the southern boundary, refer to attached site plan.
- The 'natural' topography slopes from south to north, typically and grades at about 12 to 14 degrees. The upper portion of the site is slightly steeper at 14 to 18 degrees, typically. Localised slopes do vary from these typical graders.
- To the north of the area there are some localised areas which slope steeper, however the existing vegetation does obscure the slopes and allow accurate measurements.
- There are some localised trees to the west with heavier vegetation along the southern boundary and north of the farm building location.
- No signs were observed of recent slope movement within the farm building envelope or immediate (30 m) surrounds.

Proposed Driveway

- The proposed driveway traverses from Coolamon Scenic Drive along the southern boundaries of Lot 7, 8 and 9 on DP 5676 before intersecting the western boundary of Lot 1 on DP 123290. The driveway then continues east to the farm building location.
- The southern boundary typically forms the ridgeline which is Coolamon Scenic Drive which sloped down to the west at less than 7 degrees. The ridgeline also slopes down to the north at 16 to 18 degrees with some localised slopes increasing up to 22 degrees.
- The area was typically covered with recently slashed grass and some localised trees.

Some of the features described above are detailed in the photos taken from the site walkover, described as Figures 1 to 4 below.

Figure 1: Farm Building Site Looking West

Figure 2: Farm Building Site Looking East

DRILLING ENVIRONMENTAL GEOTECHNICAL

Figure 3: Upper Slopes and Part of Proposed Driveway Location Looking West

Figure 4: Upper Slopes and Part of Proposed Driveway Location Looking East

4. GEOTECHNICAL CONDITIONS

4.1 Geotechnical Model

Reference to geological mapping by the Geological Survey of New South Wales 1:250,000 series 'Tweed Heads' sheet indicates the site may be underlain by Tertiary age 'Lismore Basalt'; mainly comprising basalt, sub-alkali basalt with members of rhyolite, trachyte, tuff, agglomerate, conglomerate and andesite.

4.2 Field Work Methodology

Fieldwork was undertaken on the 9th of August 2023 and comprised the drilling and sampling of two (2) boreholes designated BH 1 and BH 2, using a GT 10 drilling rig with auger attachment. The boreholes were undertaken at accessible locations continuing to the '3m depth (BH 2)' or 'refusal (BH 1)'.

Dynamic cone penetrometer test/s (DCPs) were carried out adjacent to the boreholes to provide an estimate of the strength consistency or relative density of the subsurface soils.

Material description was assessed using visual and tactile methods typically in accordance with AS 1726 – 2017[1]. Pocket Penetrometer testing was carried out in the cuttings and walls of the test pits to assess approximate undrained shear strengths of the cohesive soils (guide only). Rock strength was based on experience with similar materials, using the drilling rig and observations of the penetration (however should be used as a guide only).

The approximate locations of the boreholes are shown on Site Plan S01 attached in Appendix B.

[1] Australian Standard AS 1726-2017 *'Geotechnical site investigations'*, Standards Australia

4.3 Field Work Results

The results of the fieldwork are detailed on the Engineering Logs attached in Appendix B, along with explanatory notes. Table 1 below provides a summary of these conditions.

Table 1: Summary of Subsurface Conditions *(depth in metres below existing surface level)*

BH I.D.	Topsoil(1) (m)	Residual Clays (m)	Rock(2) (m)	TD (m)
BH 1	0.0 to 0.2	0.2 to 0.6	0.6 to 0.8	0.8
BH 2	NE	0 to 3.0	NE	3.0

Notes: (-) – Not Encountered TD – Terminated Depth

(1) – Topsoil is described as soil containing organics

(2) – This layer could be a large boulder which are common in the area and often difficult to distinguish using small diameter augers.

Groundwater seepage was not observed during the investigation, while the borehole remained open. It should be noted that groundwater is affected by climatic conditions, varying soil permeability, and will therefore vary over time. It must be noted that it is often common to find springs in the Lamington Volcanic geology formations and these can occur and be more prominent following rain events.

5. ASSESSMENT OF THE LIKELIHOOD OF SLOPE INSTABILITY USING AGS GUIDELINES

5.1 Discussion

Natural hill slopes are formed by processes which reflect the site geology, climate and environment. The natural process can be influenced by human intervention in the form of earthworks, construction or other related activities. The risk associated in hill side construction is far greater than level construction. Good hill side building practices should be adopted to decrease the risk associated with it. Figures on good and bad hillside construction are presented in Appendix E of this report.

To define a slope as being 'stable' or 'unstable' is not technically feasible, however assessing the likelihood of slope movement can help in defining the stability of the site. Several methods can be adopted to assess the likelihood of slope movement including existing surface features supplemented with knowledge of the subsurface profile and experience gained on similar sites.

A five-fold subdivision of landside likelihood categories has been developed by the Australian Geomechanics Society-Sydney Group (AGS-SG) and is described in their 1985 paper on "Geotechnical Risk Associated with Hillside Development". In March 2003, the AGS Sub-Committee on landslide Risk Management subsequently published "Landslide Risk Management Concepts and Guidelines" which review the earlier publication and the most current review in the 2007 publications.

The guidelines typically is to define and assess the "risk" as a function of the likelihood or probability of an event occurring (i.e. landslide, batter failure etc.) and the damage that this event may have (i.e.

damage to property, loss of life etc.). Landslide and hazard risk zoning is a method of identifying different areas on a site with regard to the potential of a hazard or risk and incorporating this risk into local planning and development. The risk assessment process involves answering the following:-

- What might happen?
- How likely is it?
- What damage or injury may result?
- How important is it?
- What can be done about it?

It is normal to carry out a preliminary assessment of the first two points and is generally based on the site observations and soil profiles, which has been completed for this investigation.

The causes of slope instability are well documented in the above mentioned literature and include the following factors:-

- Slope angle;
- Underlying geology and soil types;
- Vegetation cover;
- Variable and transient factors such as rainfall intensity, overland water flows, groundwater flows, piezometric pressures and seismic vibrations;
- Presence of soil masses in an unstable condition (ie. past movement); and
- Man made factors such as construction activity including earthworks, removal of vegetation and changes to the surface and subsurface drainage, retaining walls, etc.

For any given area some of the above factors can be identified, while other possible contributing factors can be considered. From studying existing slope instabilities and the failure mechanisms, it is possible to make an assessment of the potential, relative likelihood of similar conditions arising in other areas. Slope instabilities can also be induced from man made factors including:-

- The construction of fill slopes;
- Undermining of steep slopes;
- Changing of water flow paths, in particular at the toe of slopes;
- Concentrated stormwater flow onto building platforms;
- Inadequate design and/or construction of retaining walls; and
- Saturation of soil below septic waste disposal absorption fields.

The terminology of the AGS Guidelines has been employed in the descriptions of hazards and the qualitative assessment of the likelihood, consequence and risk of slope instability. The following guidelines can be used for describing the likelihood of slope movement:-

Likelihood	**Probability**	**Qualitative Risk**	**Significance**
Barely Credible	10^{-6}	Very Low	Acceptable
Rare	10^{-5}	Low	Usually Acceptable
Unlikely	10^{-4}	Moderate	May be tolerated
Possible	10^{-3}	High	Unacceptable
Likely	10^{-2}	Very High	Unacceptable
Almost Certain	10^{-1}	Extremely High	Unacceptable

Any proposed residential development should generally include works which result in 'acceptable' or 'usually acceptable' risk level to the property after construction. In some cases, subject to appropriate monitoring and maintenance programs, a 'may be tolerated' risk may be accepted. Definitions of acceptable and tolerable risk included in the AGS Guidelines are attached as Appendix E.

5.2 Risk Categorisation

The site has been qualitatively classified in general accordance with the methods of the AGS. The effect of these hazards on the existing dwelling site and proposed dwelling site has been summarised in Tables 2 and 3, together with a qualitative assessment of likelihood, consequence and risk to the property in its proposed conditions.

Table 2: Hazard and Risk Summary for Existing Farm Building and Driveway

Hazard No.	Hazard	Likelihood	Possible Consequence	Risk Category
1	Landslip in natural slopes less than 12 degrees	Barely Credible	- Major damage to farm building, driveway, retaining wall and services. - Injury / Loss of Life to Person/s	Very Low Low
2	Landslip in natural slopes between 12 to 18 degrees	Unlikely	- Major damage to farm building, driveway, retaining wall and services. - Injury / Loss of Life to Person/s	Moderate **High**
3	Boulder fall / Debris Flow	Almost Certain (occurred)	- No foreseen damage to structures downslope. - Injury / Loss of Life to Person/s	**Low** **Very High**
4	Surface water from upper slopes weakening founding soils	Possible	- Minor damage to farm building, driveway, retaining wall and services.	Moderate

Notes: Possible consequence 'damage' rating is based on cost of repair

The analysis summarised in Table 2 indicates **"unacceptable"** risks which requires mitigation measures to reduce these risks to acceptable levels. Risks identified as **"moderate"** may be tolerable however mitigation measures have also been provided to reduce these risks. Risks identified as **"low"** are considered acceptable levels of risk and good engineering practices and design will assist with maintaining these risks or reducing them.

A stability risk map S02 has been attached as Appendix C which identifies the risk category zones prior to the mitigation measures.

Personal injury / loss of life is considered a 'catastrophic' consequence in accordance with the AGS guidelines which places some of the 'high' risk zones into 'very high' risk zones and 'moderate' risk zones into 'high' risk zones etc. For the purpose of clarity, the risk zones on the summary above are for 'property' damage only and not for personal injury / loss of life.

5.3 Constraints to Residential Development

Based on the slope stability assessment, subsurface information and site observations, a number of development constraints are proposed for the residential development as outlined in Table 3.

Table 3: Proposed Development Constraints on Existing Dwelling Site

Hazard No.	Hazard Mitigation Measures	Revised Risk Category
1	- Good engineering and construction practices. - Locate footings a minimum 500 mm into **very stiff** residual clays as per Section 6.3. - Minimise earthworks where possible to maximum **unsupported** fill of no more than 1 m. Cut embankments battered no steeper than 2H:1V are recommended to a maximum height of 1 m unless site specific engineering advice is provided. Steeper and deeper unsupported cut / fill must be supported with engineered designed retaining walls (not boulder walls). - Earthworks procedures to be carried out as per Section 6.1. - Gravity type retaining walls may be used in these provided a global stability analysis is completed by qualified person. - Refer to general conditions in Section 5.3.1.	Very Low
2	For moderate likelihood zones, development constraints 'as per Hazard No.1 measures' with the following additional or amended measures to be adopted:- - Footing design will require 900 mm socket into the residual clays of very stiff or better stiffness. - No unsupported cut or fill.	Low

Hazard No.	Hazard Mitigation Measures	Revised Risk Category
	- Minimise earthworks for supported cut or fill to a maximum height of 2 m. - Use pole home type construction where possible with minimum slab on ground construction recommended. - No septic treatment areas to be constructed near the building areas (both above or below) and GI must be contacted to provide advice on a suitable location of septic system treatment area, if required.	
3	The following measures are required:- - Excavations of spoil containing rock / boulders require a suitable treatment / protection to minimise the likelihood of debris flow (boulders rolling down slope). Small bund walls can be used as a design option. Further advice with contractor and GI are required as part of the construction management plans.	Low
4	- All surface water from the upper areas is collected and / or diverted away from the building envelope, top of batters and retaining walls, or into the stormwater system or natural water course (provided this is an LPD). Preventing additional runoff on the site is essential in maintaining and improving the existing risk of instability.	Low

5.3.1 General Conditions

The following recommendations are also aimed to assist with reducing or maintaining the risk of slope instability within the proposed building areas:-

- All maximum long term embankment slopes and heights are to be adhered too, refer to Section 6.4.
- Retaining structures will need to be suitably 'engineered designed', refer to Section 6.5.
- All loads must not surcharge any proposed retaining walls, or the crest of batters, with all loads required to be deepened below the walls' / batters' zone of influence.
- Embankment protection is to be placed on the embankment faces (e.g. mulching, planting vegetation) to limit the degree of rill erosion from water runoff and drying out / cracking if left exposed, as these will influence the potential for inducing landslips.
- Earthworks procedures to be carried out as per Section 6.1.
- Ensure all stormwater management plans and drainage plans are adhered to, particularly in relation to ensuring that all surface water is collected and diverted away from the building

envelopes, top of batters and retaining walls. Preventing additional runoff on the site is essential in maintaining and improving the existing risk of instability.

5.3.2 Geotechnical Declaration Forms

Following the above quantitative analyses, GI has provided a Proforma Geotechnical Certification refer to Appendix D for the proposed building site. The proposed farm building site and driveway technically can not be certified due to the existing level of risk and unknown footing design / construction details.

It recommended by GI, in accordance with the AGS Guidelines that documentation control include declaration forms both during the design stages and post construction. These forms are typically to be completed by the Geotechnical Engineer and Design Engineers (structural and civil) and will assist the regulator / certifier with understanding that the geotechnical mitigation measures described within this report are adhered to both in the design documentation and then completed during construction prior to the release of the occupancy certificate. Examples of typical forms have been provided by the AGS and are attached in Appendix E.

6. RECOMMENDATIONS

6.1 Earthworks

6.1.1 General

The advice provided in Tables 3 must be followed for detailed design and take precedence over all recommendations within this report. Should additional earthworks be required during detailed civil design, this office must be contacted to provide further advice. In this case, it is likely that further investigation and assessment will be required.

6.1.2 Earthworks Preparation for Proposed Farm Building Pad

Generally, all earthworks are to be carried out in accordance with AS 3798 – 2007[2], however the following earthworks procedures can be used as a guide to support a concrete slab-on-ground (if required) and pavements:-

- The subgrade must be prepared by removing all topsoil and loose soils or wet soils or large cobbles (greater than 200 mm diameter). Where the area exposes any existing "uncontrolled" fill, remove the fill to expose the natural ground.

  HOLD POINT: Inspection by a geotechnical engineer required.

- Continue earthworks as per Section 6.1.3 to achieve the design levels and continue.

[2] Australian Standard AS 3798-2007 *'Guidelines on earthworks for residential and commercial developments'*, Standards Australia

6.1.3 General Earthworks Procedures

- The exposed subgrade should be test rolled using a 12 tonne roller (or similar), loaded water truck or dump truck to determine the presence of any soft spots, which should be further excavated out to expose a suitable base, as guided by the representative geotechnical engineer.
- The site area that will accept new fill is required to be benched at a maximum vertical height of 1 m with the bench sloped slightly forward at 1V:10H to promote drainage.
- The exposed surface should then be tyned to 0.2 m depth, moisture conditioned and then compacted, unless the base is exposed basalt.

  HOLD POINT: Inspection by geotechnical personnel required.

- It is expected that the existing natural clays could be re-used for general bulk fill, depending upon the performance requirements, moisture control and conditioning, and ensuring any oversize particles and deleterious materials are removed.
- Structural fill for earthworks should be uniformly compacted to 95% Standard MDD (or higher), with moisture content within 2% wet or dry of OMC for cohesive material.
- Layer thickness depends on the compaction equipment, however 200 mm to 250 mm loose layer thickness is generally considered suitable for most mechanical compaction equipment.
- Where backfill for service trenches is carried out, the above layer thickness applies however if vibrating plates are used, the layers are to be placed in 100mm loose thickness.

  HOLD POINT: Inspection and testing by geotechnical personnel required similar to 'Level 1' standard during the above process.

- Field testing must be carried out to confirm the standard of compaction achieved and the moisture content during the construction. The test frequency and extent of testing is to be carried out as per AS 3798, Section 8.0 and compaction testing is to be carried out by a NATA accredited laboratory.
- The placement of fill material to support building loads and pavements must be placed and compacted under 'Level 1' full-time geotechnical inspections and testing.

It is expected that the existing clayey soils will be susceptible to softening due to increase in moisture content, such as following rainfall, etc. Therefore, areas exposed to the elements should be minimised, and a layer of compacted select granular fill should be considered to improve trafficability, especially in access and egress areas.

6.2 Shrink-Swell Movements and Site Classification

A Site Classification is provided to allow the determination of appropriate footing sizes and slab details to be designed, and is based on the soil profile, the soil reactivity, and the climatic conditions at the site. The soil profile is identified by the site investigation drilling and in-situ testing, while the soil reactivity is determined from laboratory testing to provide the Shrink-Swell Index (I_{SS}). On the majority of sites, this information is used to calculate the characteristic surface movement (y_S), which is an estimation of the amount of movement at the surface of the site, subject to normal seasonal wetting and drying. Based on previous laboratory testing on similar 'Volcanic' soils, an I_{SS} of 3.0 to 4% has been adopted in the y_S calculations.

Climatic conditions for this site are based on published data by Barnett-1999[3], which indicate this region is located within Climatic Zone 1 'Alpine/wet coastal'. A value for the change in soil suction at the surface (Δu) of 1.2 picofarads (pF) and a design depth soil suction change (H_S) value of 1.5 m could be adopted in calculations to determine y_S. AS 2870 indicates that seasonal cracking to a 'crack depth' of $H_S/2$ should be considered for natural sites and 0 m for filled sites (less than 5 years since placement).

The results of the analysis above indicate that shrink-swell (y_S) movements of the in-situ soil profile, at the time of construction, with response to seasonal moisture variation is in the order of 40 mm to 50 mm. Therefore, considering the calculated shrink-swell movements, the site in its current condition may be classified as **'Class H1'** (highly reactive) in accordance with AS 2870. Where the site is cut or filled these movements will increase and GI must be contacted to provide additional advice. Suggested design information is provided in Section 6.3 below.

This classification is relevant to sites subject to seasonal moisture changes only. Abnormal moisture conditions, such as from the removal or planting of trees (including on adjacent sites), poor site drainage, and development of gardens adjacent to the footings, may cause higher movements to occur, probably resulting in damage, which may or may not be within acceptable ranges.

6.3 Footing Recommendations Propose Farm Building Site

Based on the results of the fieldwork, the exposed subgrade in the area of the proposed dwelling is likely to comprise residual soils and weathered rock.

All footings must be found in accordance with Tables 3.

Footings found into the very stiff residual clays may be designed for an allowable bearing pressure of 100 kPa. Bored piers found into the very stiff residual clays may be designed for an allowable end bearing pressure of 150 kPa.

Inspection of footing trenches, bored piers or founding subgrade level MUST be carried out by GI for confirmation of the above bearing pressures prior to placement of concrete.

[3] Barnett, I. C. and Kingsland, R.I., 1999: *"Assignment of AS2870 Soil Suction Change Profile Parameters to TMI Derived Climatic Zones for NSW"* Australian Geomechanics, Volume 34, No 3, September 1999, Australian Geomechanics Society, Barton ACT

6.4 Batter Slopes and Embankments in Soil

Stable batter angles in soils are strongly dependent upon fill type and compaction, soil type and strength, strength of underlying soils, slope angle / height and surcharge loadings. For the purpose of preliminary design, the batter slopes presented in Table 4 are considered to be suitable for the different soil and rock conditions encountered on the site. Where soil / rock conditions vary from those presented in Table 4, GI may provide guidance and alternative slope angles on site during construction. At these batter slopes, some movement at and behind the slope crest, as well as some localised slumping of batter faces may occur.

If batter heights exceed 1 m, then this will require batters to be separated by a minimum horizontal bench width of 1 m, which is to slope away at 1V:10H to promote drainage. The batter slopes assume that no surcharge loadings will be applied to the crest of the slope, and that no seepage out of the batter is present. If seepage is encountered or present at any stage, site specific geotechnical advice on batter stability should be obtained, and likely positive support options considered. All permanent batter slopes are to be protected from erosion and scour by use of appropriate drainage and vegetation.

Table 4: Slopes Angles for Batter Heights < 1 m (Unsurcharged, Horizontal Ground Behind Crest) (1)

Material Description	Short Term (Maximum)	Long Term (Maximum)(1)
'Controlled' Fill Batters(2) (3)	1V:1H (45°)	1V:2H (26°)
Residual Soils	1V:1H (45°)	1V:2H (26°)

Notes:

(1) A geotechnical engineer from GI is required to be on site during excavations of embankments and placement of fill batters to confirm safe batter slopes. These slopes assume the batters are not underlain by lower bearing strata.

(2) All 'controlled' fill batters should be overfilled, compacted and cut back at a maximum angle given in Table for filled batters. These slope angles are dependent on the fill material used.

(3) Due to the moderately sloping nature of the subject site, additional design consideration and analysis must be given to the construction of 'controlled' fill batters. A maximum height of 1 m is to be adopted within the fill material.

6.5 Geotechnical Retaining Wall Design Parameters

Flexible retaining walls (i.e., those which are free to rotate or tilt) may be designed using a triangular pressure distribution, adopting the earth pressure parameters and 'active' earth pressure coefficient (K_a) provided in Table 5 below. These include cantilevered, single propped or anchored retaining walls. Walls that are rigid and unable to rotate or tilt (i.e. wall that is tied to an upper level concrete floor), the 'at-rest' earth pressure coefficient (K_O) should be adopted for design. The values provided in Table 5 are ultimate values, and appropriate safety factor or strength reduction factor should be included.

No boulder or gravity type retaining walls are to be used on the site, unless these walls can be socketed into the weathered rock and designed and certified by a qualified engineer.

Table 5: Earth Pressure Design Parameters (non-sloping crest)

Material Description	Unit weight (kN/m³)	Internal Angle of Friction (ϕ')	K_O	K_A	K_P
Filled CLAY	17	23	0.61	0.44	2.28
Residual CLAYS	19	26	0.56	0.39	2.56

Notes: k_o – coefficient of lateral earth pressure at rest; k_a – coefficient of active lateral earth pressure; k_p – coefficient of passive lateral earth pressure

The design of all retaining walls will need to take into account any sloping ground surface behind the walls, as well as the usual design constraints and issues. The lateral earth pressure coefficients provided in Table 5 have not made allowances for surcharge loadings from future structures and these should be taken into consideration when designing the retaining wall system. Any backfill placed behind the wall should be loose granular material.

Footings for the retaining wall/s may be designed in accordance with the above recommendations, See Section 6.3. The base of all footing trenches must be clear of loose, disturbed or wet soil, and concrete cast without delay.

6.6 General Comments

The above information are based on existing site soils and assumes moisture conditions within site soils vary due to seasonal effects only. If abnormal moisture conditions occur (due to drying by tree root action, or wetting by leaking pipes, water ponding, etc.), significantly greater movements are considered possible, and the Site Classification should be reconsidered.

It is recommended that good engineering practices be adopted in the design of all structures and foundations and in particular, the following should be considered for movement in sensitive areas underlain with reactive materials:-

- Trees and shrubs should not be planted or be allowed to remain closer than their mature height to movement sensitive structures / features. Where trees exist within this distance, deeper foundations may be required and GI should be notified immediately to provide such recommendations;
- Soil moisture should be controlled to limit moisture content change during or following construction;
- The site should be graded to allow surface water to easily flow into a suitable stormwater system, and prevent ponding, particularly adjacent to the footings; and
- Underground services should be made flexible where possible.

During periods of high rainfall, concentrated surface water runoff or ponding may occur on the site. Suitable drainage and diversion of all runoff into the stormwater articulation systems to prevent water ponding is necessary prior, during and after the construction of any proposed residential development.

7. LIMITS OF INVESTIGATION

Recommendations given in this report are based on the information supplied regarding the proposed building construction in conjunction with the findings of the investigation. Any change in the development or building location may require additional testing and/or make recommendations invalid.

Every reasonable effort has been made to locate the test sites so that the test pits are representative of the soil conditions within the area to be investigated. The client should be made aware, however, that this assessment has been based on limited site data using relatively limited excavations, and that subsurface conditions may vary across the area.

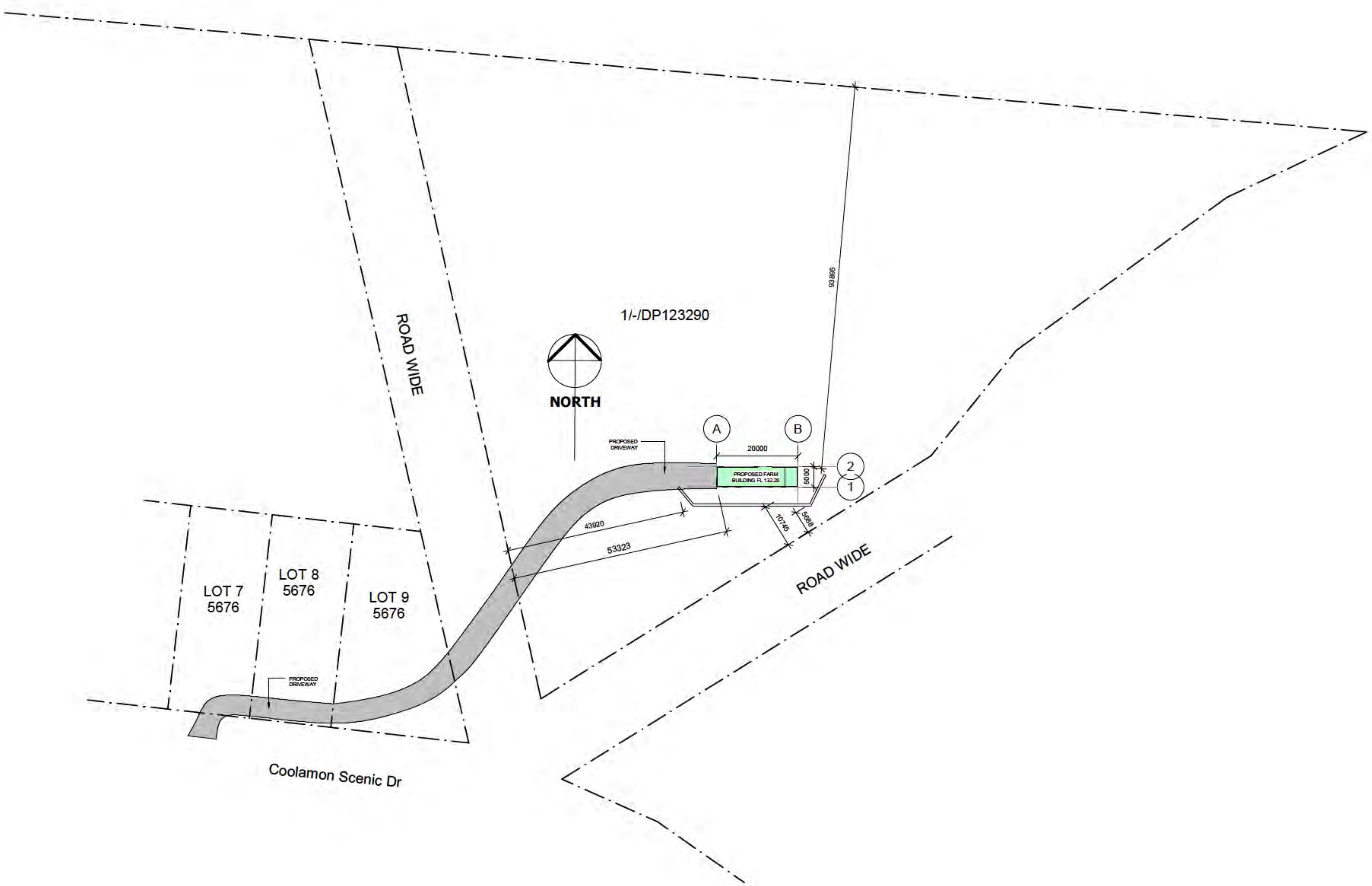
If you should require any further information or clarification, please do not hesitate to contact this office.

Yours faithfully
For and on behalf of
Geotech Investigations Pty Ltd

James Walle *RPEQ (15701), RPEng (Civil), BEng (Civil)*
Senior Geotechnical Engineer

APPENDIX A

SELECTED BUILDING PLANS BY DRAFTING PLANS



1 LARGE SITE PLAN
1 : 500

DRAFTING PLANS

Mob 0405 183 552
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jonathon@draftingplans.com.au

Client:
Catherine & Geoff Wijnberg

Project Address:
550 Coolamon Scenic Dr, Coorabell NSW 2479

Sheet Name:
LARGE SITE PLAN

Project:
FARM BUILDING

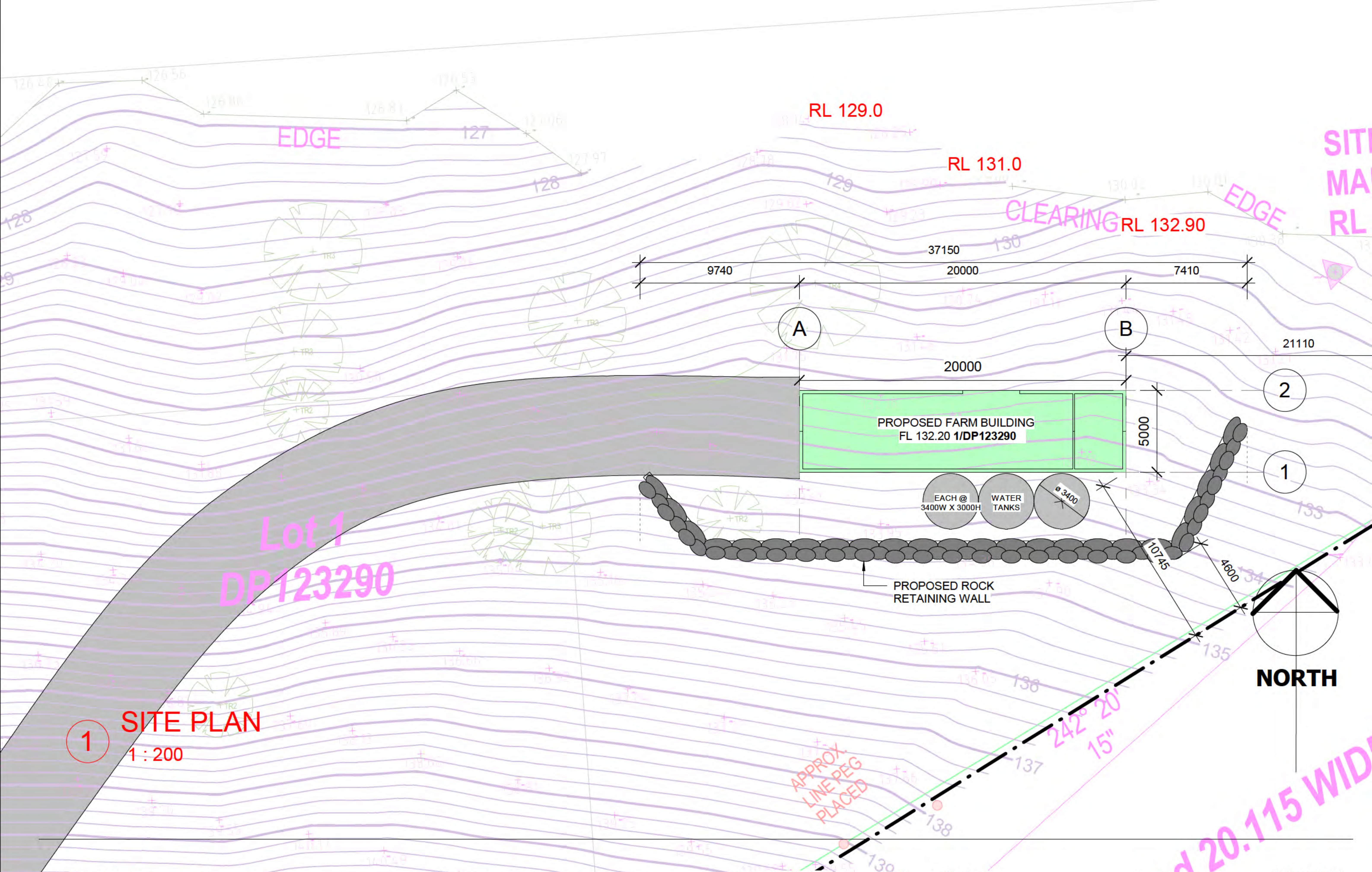
Drawn By: JP

Issue Date:
01/02/2023

Project Number:
J716

Sheet Number:
02

Rev



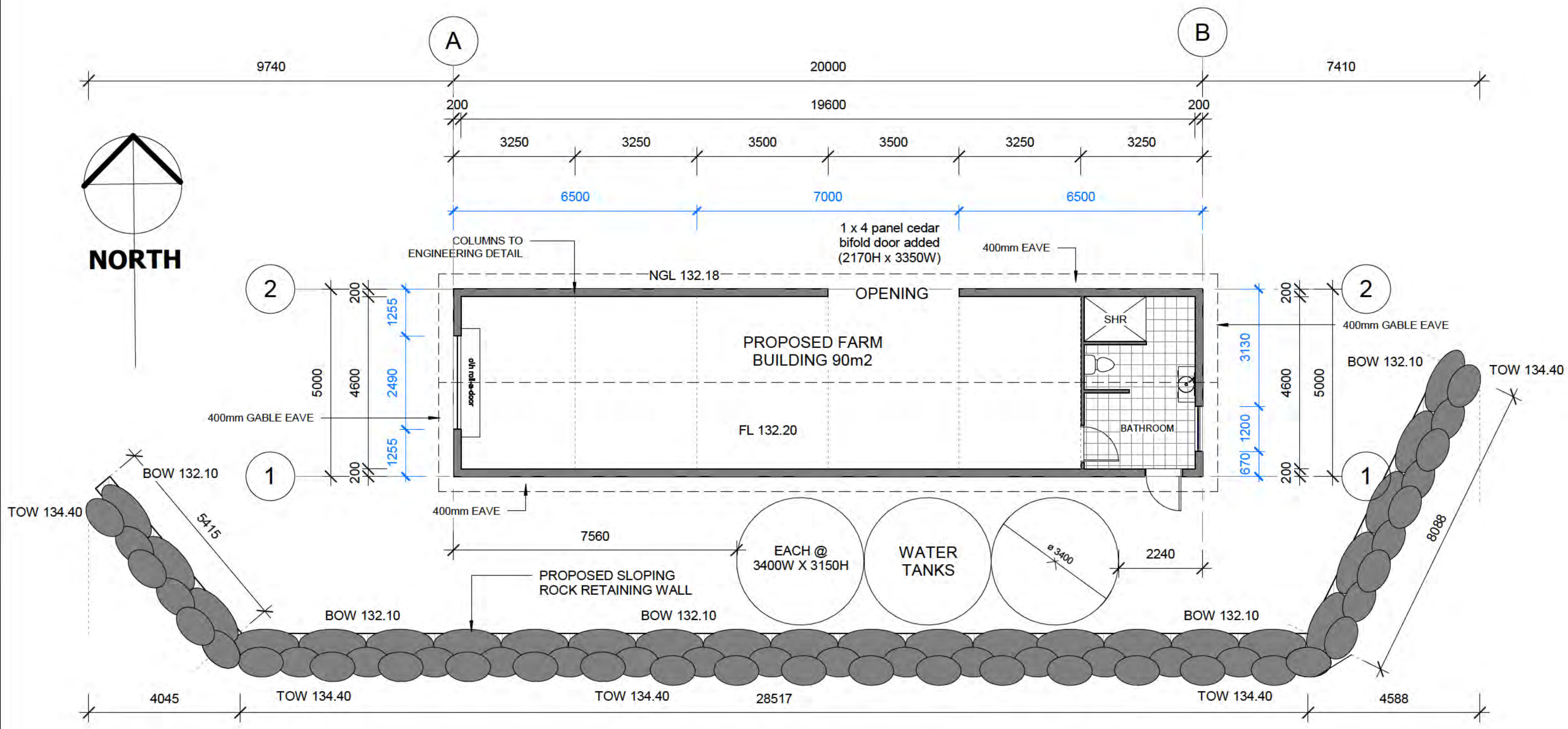
1 SITE PLAN
1 : 200

DRAFTINGPLANS Mob 0405 183 552 www.draftingplans.com.au jonathon@draftingplans.com.au	Client: Catherine & Geoff Wijnberg	Project Address: 550 Coolamon Scenic Dr, Coorabell NSW 2479	Project Number: J716 Issue Date: 01/02/2023 Drawn By: JP

Project: FARM BUILDING

SITE PLAN

03



1 FLOOR PLAN

1 : 100

DRAFTINGPLANS

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Client: Catherine & Geoff Wijnberg

Project Address: 550 Coolamon Scenic Dr, Coorabell NSW 2479

Project Number: J716

Issue Date: 01/02/2023

Drawn By: JP

Project: FARM BUILDING

FLOOR PLAN

CONSTRUCTION NOTES

- CONFIRM ALL DIMENSIONS ON SITE TO EXISTING RESIDENCE PRIOR TO COMMENCEMENT OF ANY WORK.
- SUPPLY AND INSTALL 'BIFLEX' CHEMICAL TERMITE TREATMENT (UNLESS OTHERWISE APPROVED) TO COMPLY WITH AS3660.1 AND MANUFACTURER'S SPECIFICATIONS
- ALL BRICKWORK (INCLUDING BRICK VENEER) SHALL BE IN ACCORDANCE WITH AS3700- MASONRY CODE
- ALL TIMBER FRAMING SHALL BE IN ACCORDANCE WITH AS1684. - UNLESS OTHERWISE APPROVED ROOF FRAMING SHALL BE OF TRADITIONAL TIMBER FRAMED CONSTRUCTION
- FOR ALL STRUCTURAL MEMBERS, FOOTINGS, & LOAD BARING WALLS REFER TO STUCTURAL DOCUMENTATION PREPARED BY ENGINEERS.
- - ELECTRICIAN TO SUPPLY AND INSTALL APPROVED HARD WIRED SMOKE ALARMS IN ACCORDANCE WITH AS3786. (❁ SD INDICATES NEW LOCATIONS)

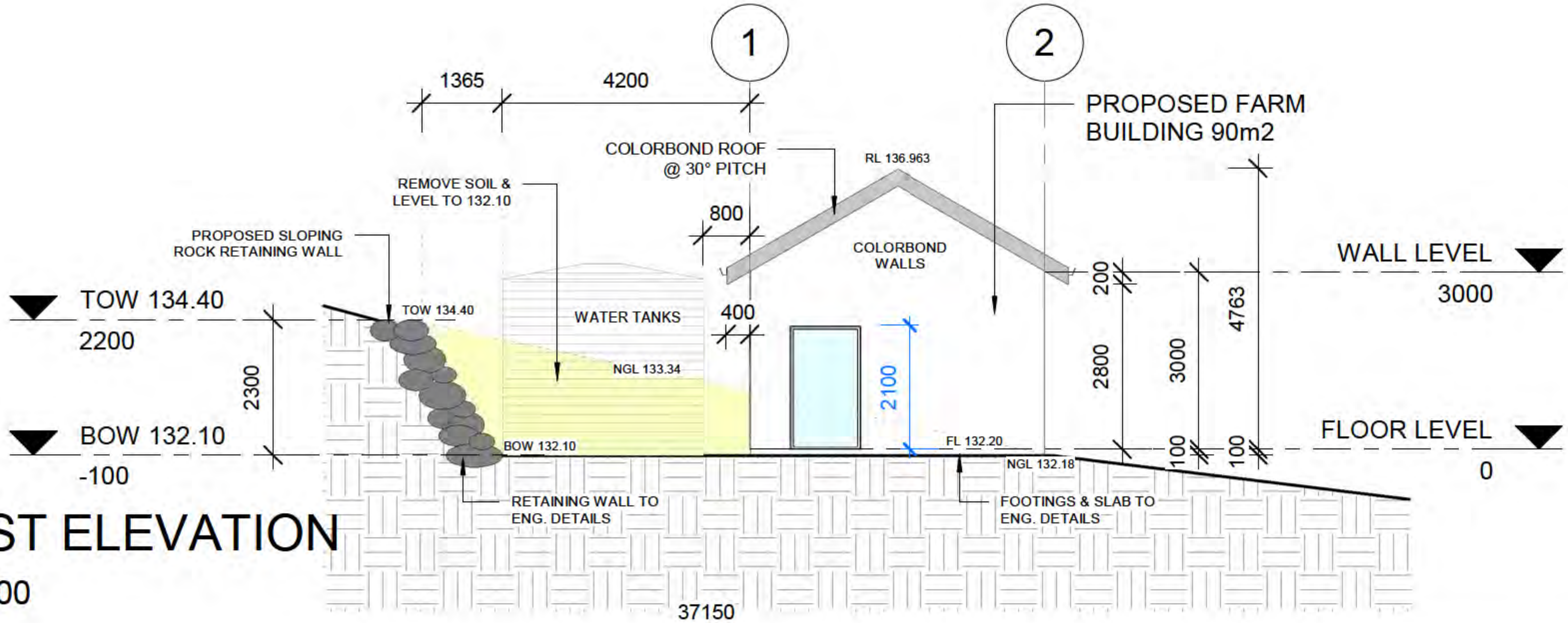
. WHAT THE LAW STATES:
(HIA.COM.AU/BATHROOM VENTILATION/30 JULY 2000)
VOLUME 2 OF THE BCA COVERS VENTILATION REQUIREMENTS FOR HOUSING IN PART 3.8.5. THE ACCEPTABLE CONSTRUCTION PRACTICE IS SPECIFICALLY COVERED IN CLAUSE 3.8.5.2 (A), (B) AND (C).

. FIRSTLY, IF A WINDOW IS INSTALLED IN THE ROOM, THEN IT BECOMES THE PRIMARY SOURCE OF VENTILATION FOR THE ROOM. THEREFORE, IRRESPECTIVE OF WHETHER AN EXHAUST FAN IS INSTALLED, IF THE ROOM IN QUESTION HAS A WINDOW INSTALLED IN ACCORDANCE WITH THE PROVISIONS OF SUB-CLAUSE (A) THEN THE VENTILATION REQUIREMENTS FOR THE ROOM COMPLIES WITH THE BCA.

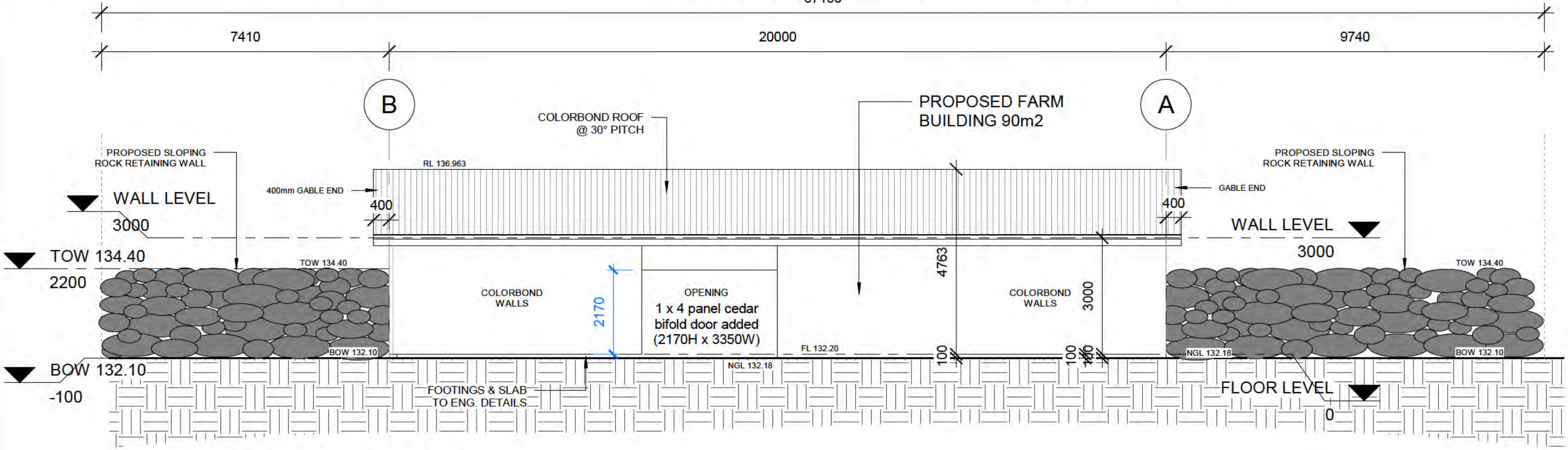
. SIMILARLY IF THE ROOM HAS VENTILATION BORROWED FROM AN ADJOINING ROOM IN ACCORDANCE WITH SUB-CLAUSE (B) IT ALSO COMPLIES WITH THE BCA.

. IF INSTALLED, AN EXHAUST FAN ONLY NEEDS TO COMPLY WITH SUB-CLAUSE (C) IF IT IS THE ONLY SOURCE OF VENTILATION TO THE ROOM.

THEREFORE IN ACCORDANCE WITH SUB-CLAUSE (C),
. OPEN EAVES;
. ROOF VENTS, INCLUDING A VENTED RIDGE;
. A TILED ROOF WITHOUT SARKING



1 EAST ELEVATION
1 : 100



2 NORTH ELEVATION
1 : 100

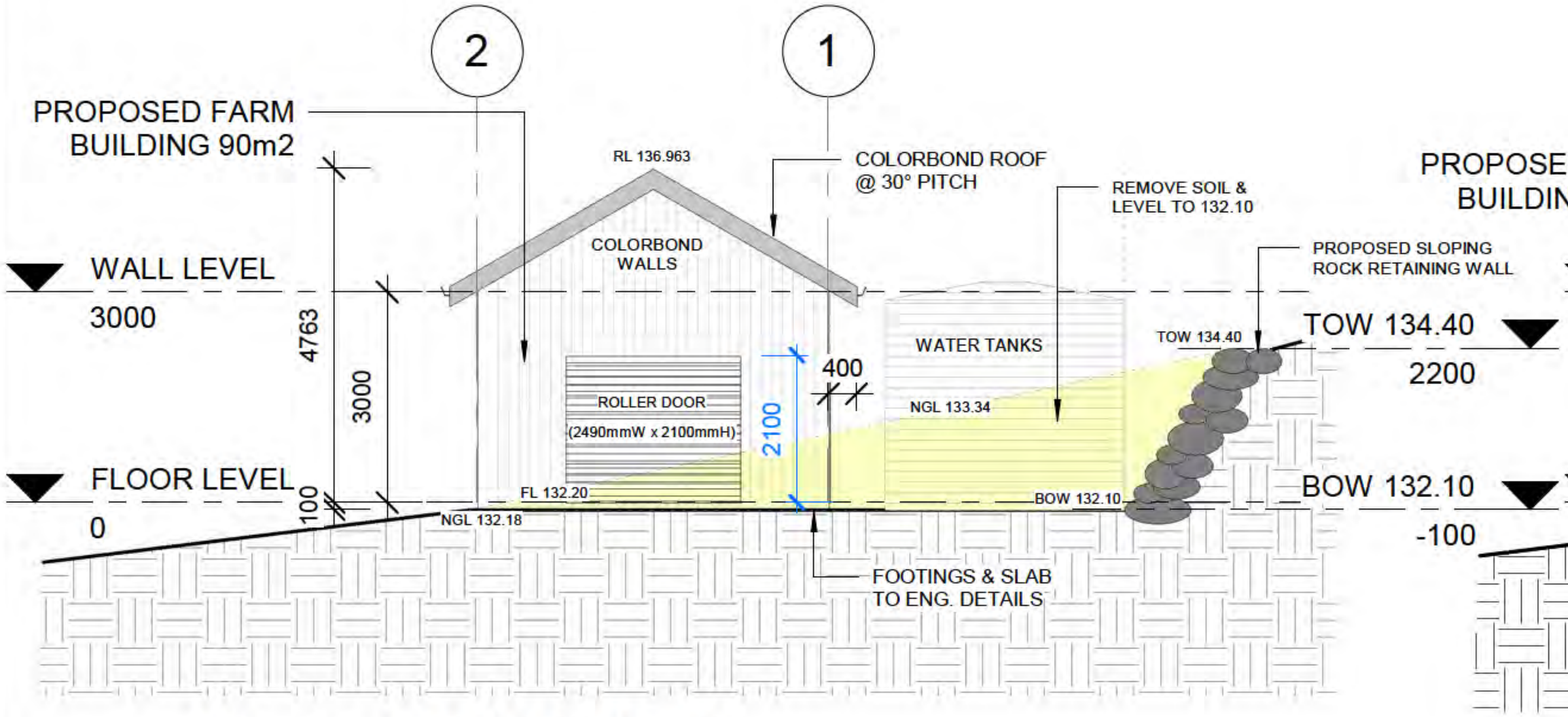
DRAFTING**PLANS**

Mob 0405 183 552
www.draftingplans.com.au
jonathon@draftingplans.com.au

Client:	Catherine & Geoff Wijnberg
Project Address:	550 Coolamon Scenic Dr, Coorabell NSW 2479
Project Number:	J716
Issue Date:	01/02/2023
Drawn By:	JP
Project:	FARM BUILDING

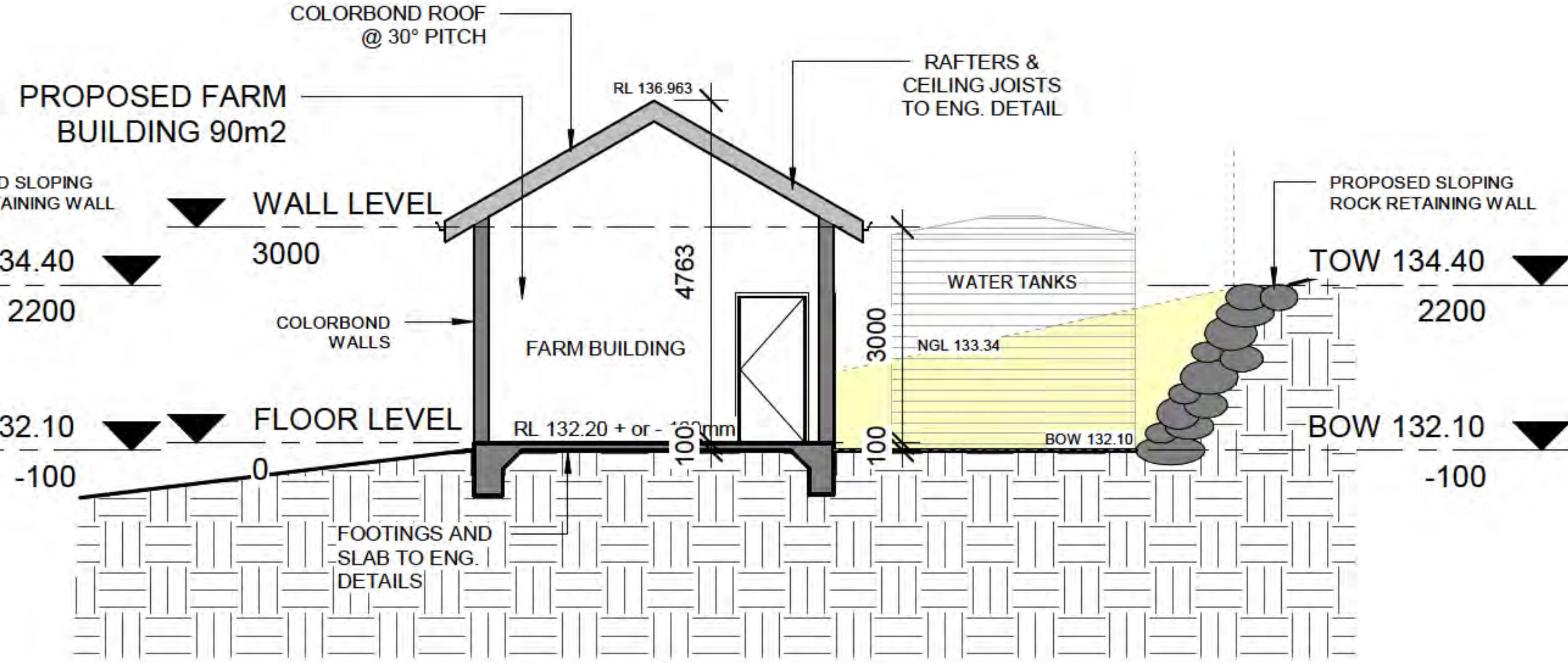
01 ELEVATIONS

06



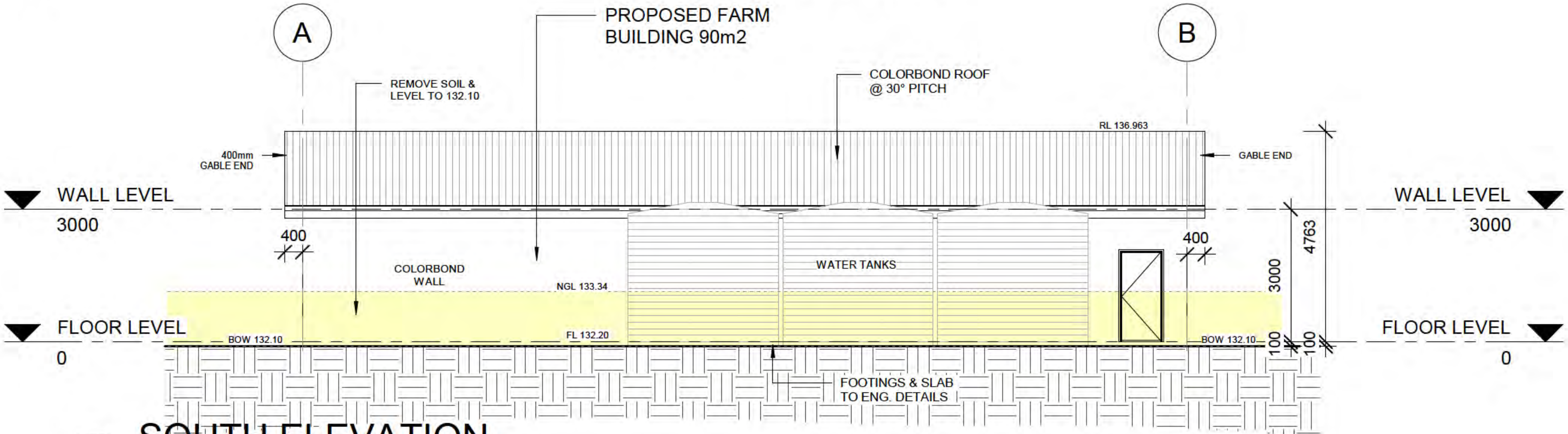
1 WEST ELEVATION

1 : 100



3 SECTION VIEW

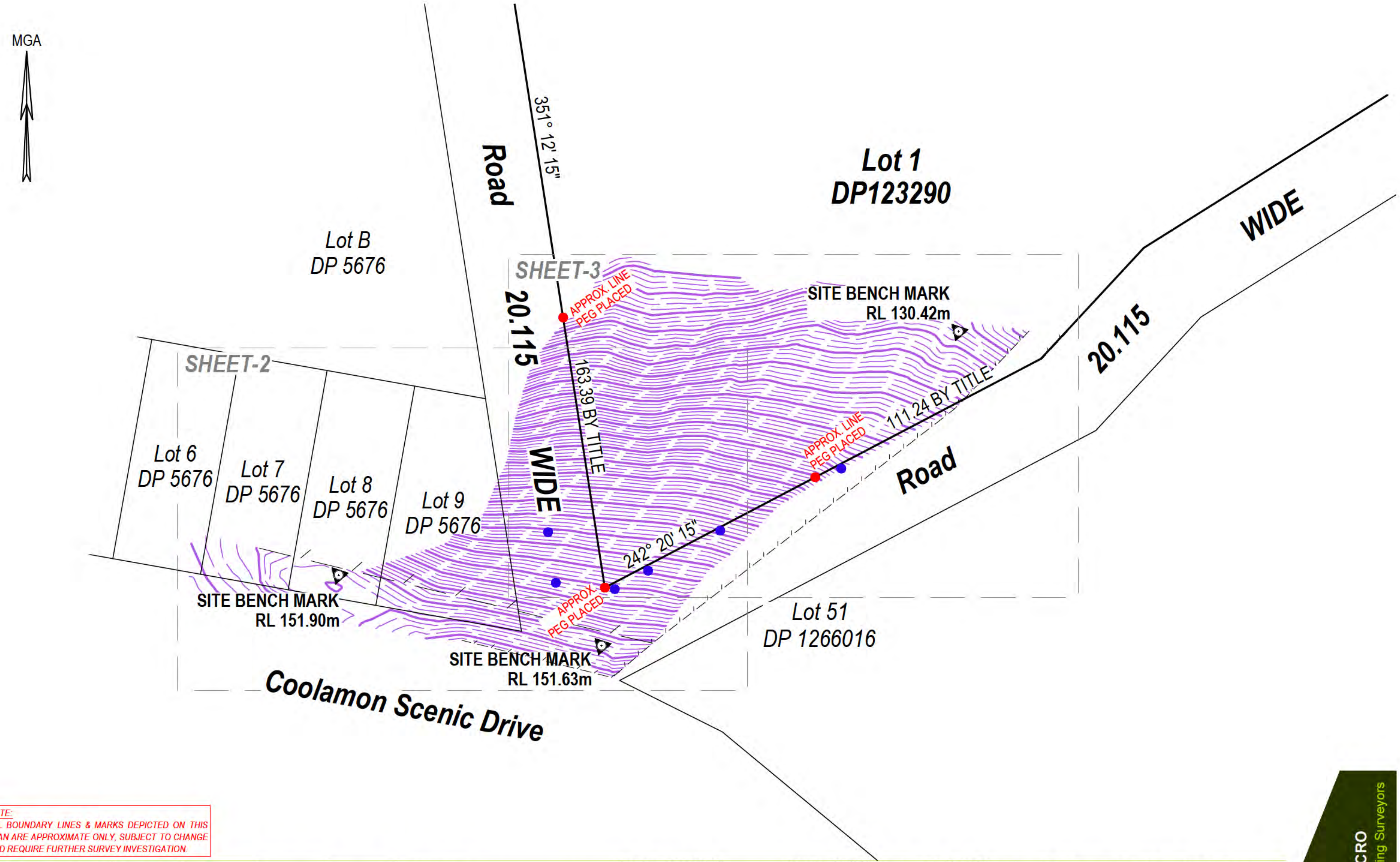
1 : 100



2 SOUTH ELEVATION

1 : 100

DRAFTINGPLANS Mob 0405 183 552 www.draftingplans.com.au jonathon@draftingplans.com.au	Client: Catherine & Geoff Wijnberg	Project Address: 550 Coolamon Scenic Dr, Coorabell NSW 2479	Project Number: J716 Issue Date: 01/02/2023 Drawn By: JP	Project: FARM BUILDING	02 ELEVATIONS 07



NOTE:
ALL BOUNDARY LINES & MARKS DEPICTED ON THIS PLAN ARE APPROXIMATE ONLY, SUBJECT TO CHANGE AND REQUIRE FURTHER SURVEY INVESTIGATION.

Notes:

2m 4m 6m 8m

Boundary - Site (Approx.)
Boundary - Adjoining (Approx.)
FE - Fenceline

- APPROX. BOUNDARY MARK PLACED
- STAKE FOUND

Disclaimer:
- *Services shown hereon have been located by field survey. Prior to any excavation or construction, the relevant authority should be contacted for the possible location of further services and the exact location of **all** services.*
- *Underground services including telecommunication cables have not been located, and have been plotted from the records of the relevant authorities.*
- *All levels are ground levels unless otherwise indicated.*
- *Boundary marks and lines are approximate only.*

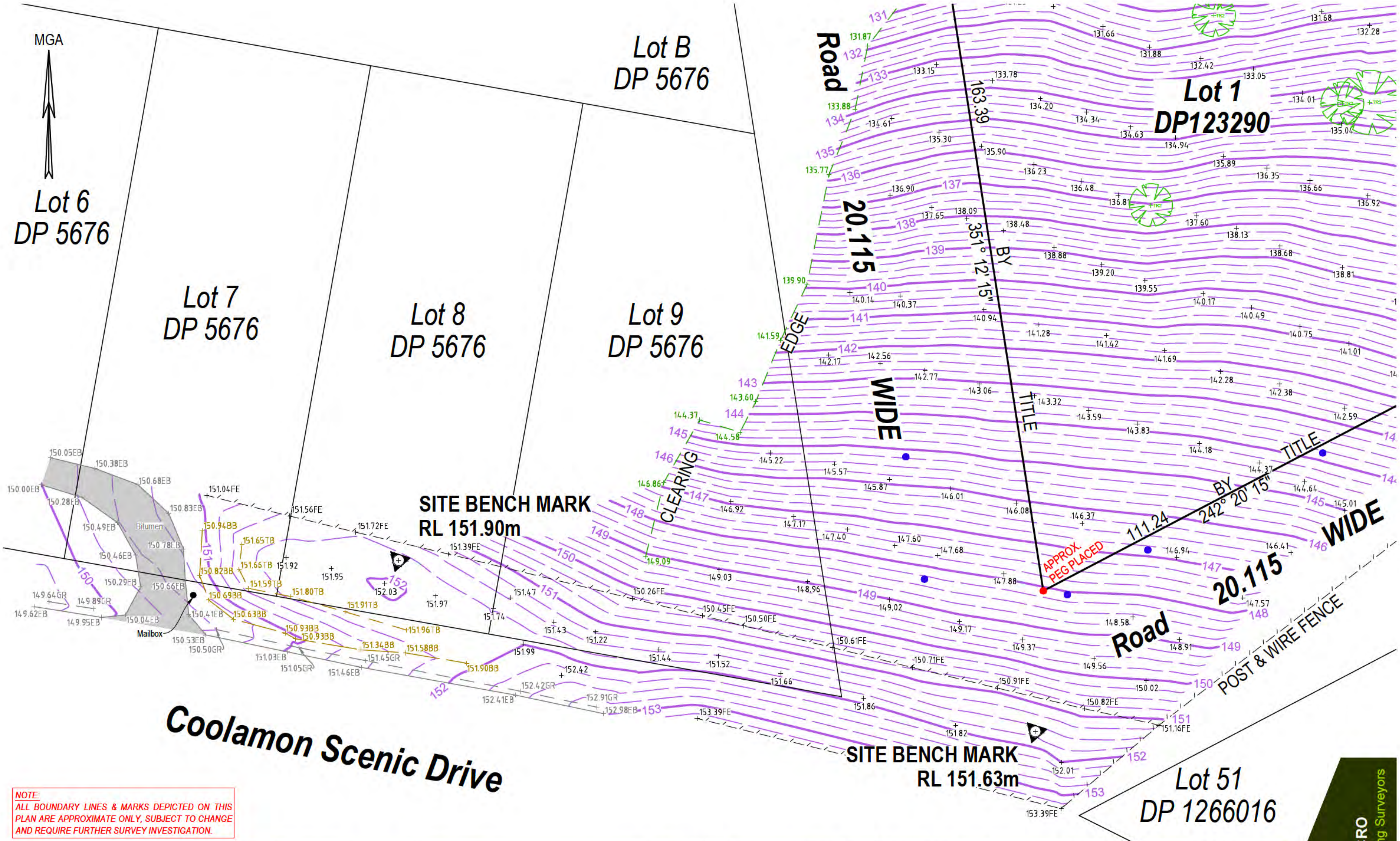
Locality:	**COORABELL**	Coords:	**ASSUMED**	Ref:	**21053-1A**
LGA:	**BYRON**	Datum:	**AHD**	Date:	**30.06.2021**
Parish:	**BRUNSWICK**	Method:	**GNSS \ TRIG**	Survey:	**SC VP**
County:	**ROUS**	Origin:	**PM 70744**	Drawn:	**RRAV**
FB/LB:	**N/A**	RL:	**149.3**	Data:	**B21053 VP01**
RR:	**1:800 @ A3**	Contour:	**0.25m**	Sheet:	**1 of 3**

PLAN SHOWING DETAIL & MARKS PLACED OVER PART OF LOT 1 IN DP123290 COOLAMON SCENIC DRIVE

Client:
GEOFF WINJBERG

33 Martin Street | PO Box 633 | BALLINA NSW 2478 | **T** 02 6686 8939 | **E** office@macrosurveyors.com.au | www.macrosurveyors.com.au
MACRO Consulting Surveyors Pty Ltd ABN 66 149 995 522 | BALLINA | COFFS HARBOUR | MACLEAN | NORFOLK ISLAND

ABBOTT & MACRO
Land and Engineering Surveyors



Notes:

0 2m 4m 6m 8m

- Boundary - Site (Approx.)
- Boundary - Adjoining (Approx.)
- FE - Fenceline
- GR - Guard Rail
- TB - Top of Bank
- BB - Bottom of Bank
- EG - Edge Bitumen
- Mail Box
- TR# - Canopy Radius #
- Approx. Boundary Mark Placed
- Stake Found

Disclaimer:

- Services shown hereon have been located by field survey. Prior to any excavation or construction, the relevant authority should be contacted for the possible location of further services and the exact location of **all** services.
- Underground services including telecommunication cables have not been located, and have been plotted from the records of the relevant authorities.
- All levels are ground levels unless otherwise indicated.
- Boundary marks and lines are approximate only.

Locality:	COORABELL	Coords:	ASSUMED	Ref:	21053-2A
LGA:	BYRON	Datum:	AHD	Date:	30.06.2021
Parish:	BRUNSWICK	Method:	GNSS \ TRIG	Survey:	SC VP
County:	ROUS	Origin:	PM 70744	Drawn:	RRAV
FB/LB:	N/A	RL:	149.3	Data:	B21053 VP01
RR:	1:325 @ A3	Contour:	0.25m	Sheet:	2 of 3

PLAN SHOWING DETAIL & MARKS PLACED OVER PART OF LOT 1 IN DP123290 COOLAMON SCENIC DRIVE

Client:

GEOFF WINJBERG

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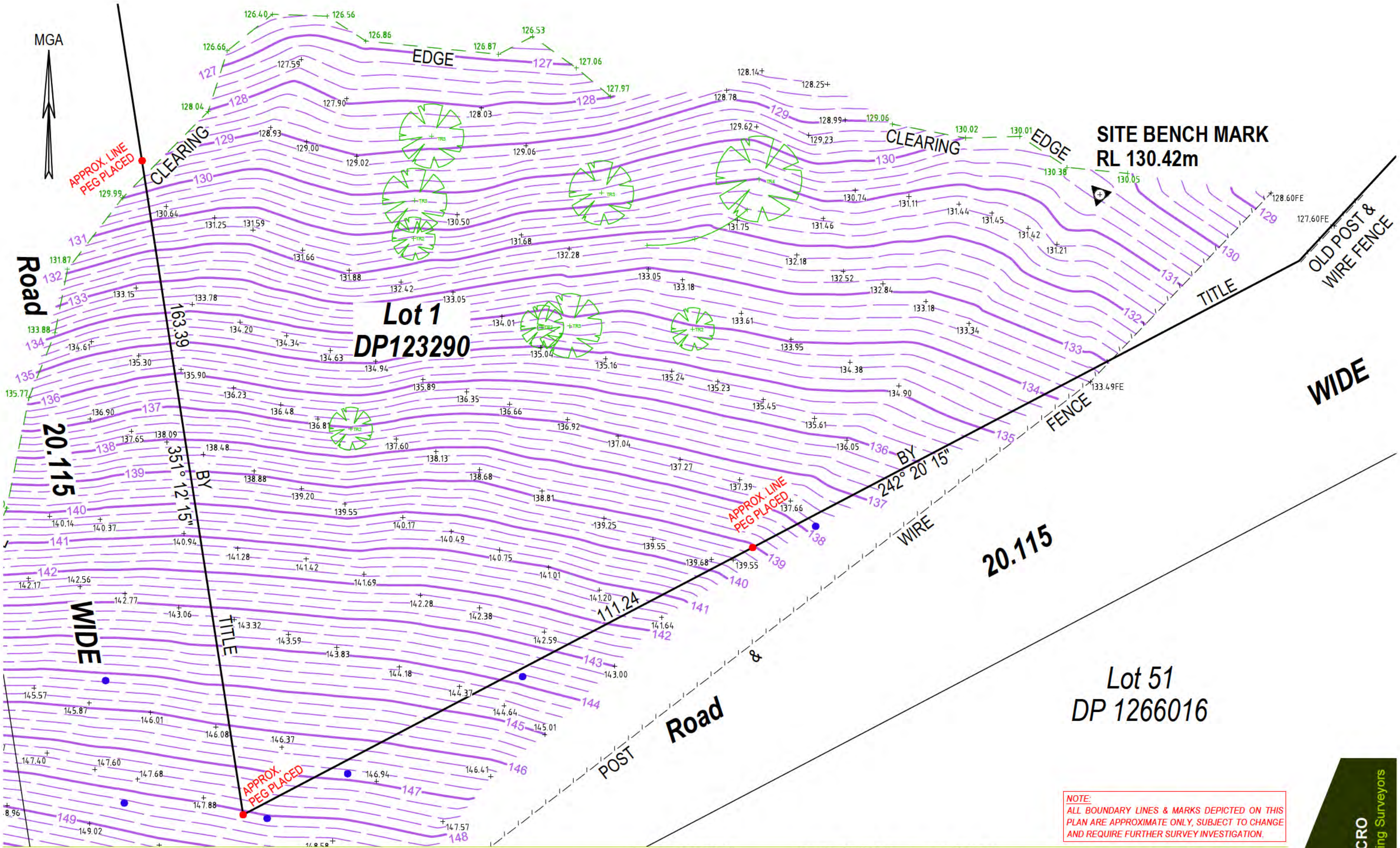

Notes:

- Boundary - Site (Approx.)
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- FE - Fenceline
- Mail Box
- TR# Canopy Radius #
- Approx. Boundary Mark Placed
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Disclaimer:

- *Services shown hereon have been located by field survey. Prior to any excavation or construction, the relevant authority should be contacted for the possible location of further services and the exact location of **all** services.*
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- *All levels are ground levels unless otherwise indicated.*
- *Boundary marks and lines are approximate only.*

Locality:	COORABELL	Coords:	ASSUMED	Ref:	21053-3A
LGA:	BYRON	Datum:	AHD	Date:	30.06.2021
Parish:	BRUNSWICK	Method:	GNSS \ TRIG	Survey:	SC VP
County:	ROUS	Origin:	PM 70744	Drawn:	RRAV
FB/LB:	N/A	RL:	149.3	Data:	B21053 VP01
RR:	1:325 @ A3	Contour:	0.25m	Sheet:	3 of 3

PLAN SHOWING DETAIL & MARKS PLACED OVER PART OF LOT 1 IN DP123290 COOLAMON SCENIC DRIVE

Client:

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APPENDIX B

SITE PLANS S01
ENGINEERING LOGS – BOREHOLE PROFILE BH 1 AND BH 2
GEOTECHNICAL REPORT STANDARD NOTES

Geotech Investigations Pty Ltd
(07) 5523 3979
3/42 Machinery Dr.
Tweed Heads South NSW 2486
admin@geotechinvestigations.com

Map description	Borehole Location Plan		
Site location	550 Coolamon Scenic Drive, Coorabell		
Client	Catherine & Geoff Wijnberg		
Project name	Proposed Farm Building		
Project No	GI 7100	**Scale**	Not to scale

Geotech Investigations Pty Ltd
3/42 Machinery Dr, Tweed Heads South NSW 2486
Phone: (07) 5523 3979

Geotechnical Log - Borehole

BH 1

UTM	: 56J	Drill Rig	: Hilux	Job Number	: GI 7100
Easting (m)	: 548383.620924067	Driller Supplier	: Geotech Investigations	Client	: Catherine & Geoff Wijnberg
Northing (m)	: 6833136.314828718	Logged By	: Phil Walle	Project	: Proposed Farm Building
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: 550 Coolamon Scenic Drive, Coorabell
Total Depth	: 0.8 m BGL	Date	: 09/08/2023	Loc Comment	:

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	DCP graph	Testing
Auger		0.2	Topsoil		CI	Topsoil- Silty CLAY (CI) : firm, medium plasticity, dark brown, with fine to medium sized gravel, trace fine to medium grained sand, (with cobbles).	D	F	1, 2	
		0.6	Residual		CL	Residual- Gravelly CLAY (CL) : very stiff, low plasticity, pale brown, fine to coarse sized gravel, trace fine to medium grained sand, (possible cobbles).		VSt	3, 6, 13, 14	
			Rock		BAS	Rock- BASALT: highly weathered, low strength, pale brown, fine grained, dry, (possibly a basalt boulder / to be confirmed during construction).		LS	20	

BH 1 refusal at 0.8 m

Depth scale: 1, 2

Method
- EX excavator
- BH backhoe bucket
- NE natural exposure
- EE existing xcavation
- RP ripper

Water
- ◄ complete water less
- ► Water inflow
- ▼ water level
- ▽ Level during drilling
- P partial water loss
- N none encountered

USC Classification

GW	well graded gravels	SW	well graded sands
GP	poorly graded gravels	SP	poorly graded sands
GM	silty gravel	SM	silty sands
GC	clayey gravel	SC	clayey sands
ML	inorg silts low plastic	CL	inorg clay low plastic
MH	inorg clay high plastic	CI	inorg clay med plastic
OL	org silts low plastic	CH	inorg clay high plastic
OH	org sills high plastic	Pt	peat of high org soils

Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Moisture
- D Dry
- M Moist
- W Wet
- PL plastic limit
- LL liquid limit

Soil Samples
- B bulk
- D disturbed
- U(63) U(63) push tube
- U(50) U(50) push tube
- WS water

In Situ Testing
- PP pen penetrometer
- VS vane shear
- DCP dynamic cone penetrometer

Laboratory Results
- UC undrained unconsol cohesion
- UF undrained unconsol friction angle
- MC moisture content
- DD dry density
- LL liquid limit
- PL plastic limit
- LS linear shrinkage
- CC undrained console cohesion
- CF undrained console friction angle
- FH falling head permeability
- CH constan head permeablity
- CBR californian bearing ratio

Geotech Investigations Pty Ltd

3/42 Machinery Dr, Tweed Heads South NSW 2486
Phone: (07) 5523 3979

Geotechnical Log - Borehole

BH 2

UTM	: 56J	Drill Rig	: Hilux	Job Number	: GI 7100
Easting (m)	: 548369.5844540225	Driller Supplier	: Geotech Investigations	Client	: Catherine & Geoff Wijnberg
Northing (m)	: 6833133.025425669	Logged By	: James Walle	Project	: Proposed Farm Building
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: 550 Coolamon Scenic Drive, Coorabell
Total Depth	: 3 m BGL	Date	: 09/08/2023	Loc Comment :	

Drilling Method	Water	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Moisture	Consistency/Density	DCP graph	Testing
Auger		0.0–0.3	Residual		CH	Residual- Silty CLAY (CH) : firm, high plasticity, brown, trace fine to medium grained sand, inorganic, (w<wp).	M	F	1, 2, 3	
		0.3–0.8	Residual		CH	As above, but very stiff, brown mottled red.		VSt	4, 4, 4, 6, 6	
		0.8–1.1	Residual		CI	Residual- Silty CLAY (CI) : very stiff, medium plasticity, brown, inorganic.	M-D		6, 6, 8	
		1.1–2.5	Residual		CI	As above, but very stiff to hard, trace fine to medium sized gravel.	D	VSt-H	8, 8	
		2.5–3.0	Residual		CI	As above, but very stiff.	M-D	VSt		

Method
- EX excavator
- BH backhoe bucket
- NE natural exposure
- EE existing xcavation
- RP ripper

Water
- complete water less
- Water inflow
- water level
- Level during drilling
- P partial water loss
- N none encountered

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Consistency
- VS Very soft
- S Soft
- F Firm
- St Stiff
- VSt Very stiff
- H Hard

Density
- VL Very loose
- L Loose
- MD Medium dense
- D Dense
- VD Very dense

Moisture
- D Dry
- M Moist
- W Wet
- PL plastic limit
- LL liquid limit

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- U(50) U(50) push tube
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- PL plastic limit
- LS linear shrinkage
- CC undrained console cohesion
- CF undrained console friction angle
- FH falling head permeability
- CH constan head permeablity
- CBR californian bearing ratio

SCOPE These standard notes may be of assistance when understanding terms and recommendations given in this report. These notes are for general conditions and not all terms given may be of concern to the report attached. The descriptive terms adopted by Geotech Investigations Pty Ltd are given below and are largely consistent with Australian Standards AS1726-1993 'Geotechnical Site Investigations'.

CLIENT can be described and is limited to the financier of this geotechnical investigation.

LEGALITY and privacy of this document is based on communication between Geotech Investigations Pty Ltd and the client. Unless indicated otherwise the report was prepared specifically for the client involved and for the purposes indicated by the client. Use by any other party for any purpose, or by the client for a different purpose, will result in recommendations becoming invalid and Geotech Investigations Pty Ltd will hold no responsibility for problems which may arise.

GEOTECHNICAL REPORTS are predominantly derived using professional estimates determined from the results of fieldwork, in-situ and laboratory testing and experience from previous investigations in the area, from which geotechnical engineers then formulate an opinion about overall subsurface conditions. The client must be made aware that the investigations are undertaken to ensure minimal site impact using test-pits or small diameter boreholes and soil conditions on-site may vary from those encountered during the investigation.

CLIENTS RESPONSIBILITY to notify this office should there be adjustments in proposed structure/location or inconsistencies with material descriptions given in this report and those encountered on site. Geotech Investigations Pty Ltd is able to provide a range of services from on-site inspections to full project supervision to confirm recommendations given in the report.

CSIRO Publication BTF 18 'Foundation Maintenance and Footing Performance: A Homeowner's Guide' explains how to adequately maintain drainage during and post construction which lies as the responsibility of the client. Suitable drainage ensures recommendations given in this report remain valid.

INVESTIGATION METHODS adopted by Geotech Investigations Pty Ltd are designed to incorporate individual project-specific factors to obtain information on the physical properties of soil and rock around a site to design earthworks and foundations for proposed structures. The following methods of investigation currently adopted by this company are summarised below:-

HAND AUGER – investigations enable field work to be undertaken where access is limited. The materials must have sufficient cohesion to stand unsupported in an unlined borehole and there must be no large cobbles boulders or other obstructions which would prevent rotation of the auger.

TEST-PITS – investigations are carried out with an excavator or backhoe, allowing a visual inspection of sub-surface material in-situ and from samples removed. The limit of investigation is restricted by the reach of the excavator or backhoe.

CONTINUOUS SPIRAL FLIGHT AUGERING TECHNIQUES – investigations are advanced by pushing a 100mm diameter spiral into the sub-surface and withdrawing it at regular intervals to allow sampling or testing as it emerges.

WASH BORING – investigations are advanced by removing the loosened soil from the borehole by a stream of water or drilling mud issuing from the lower end of the wash pipe which is worked up and down or rotated by hand in the borehole. The water or mud carries the soil up the borehole where it overflows at ground level where the soil in suspension is allowed to settle in a pond or tank and the fluid is re-circulated or discharged to waste as required.

NON-CORE ROTARY DRILLING – investigations are advanced using a rotary bit with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from feel and rate of penetration.

ROTARY MUD DRILLING – is carried out as above using mud as support and circulating fluid for the borehole drilling. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling.

CONTINUOUS CORE DRILLING – investigations are carried out in rock material, specimens of rock in the form of cylindrical cores are recovered from the drill holes by the means of core barrel. The core barrel is provided at its lower end with a detachable core bit which carries industrial diamond chips in a matrix of metal. Rotation of the barrel by means of the drill rods causes the core bit to cut an annulus in the rock, the cuttings being washed to the surface by a stream of pumped down the hollow drill rods.

TESTING METHODS adopted by Geotech Investigations Pty Ltd to determine soil properties include but not limited to the following:-

U50 – Undisturbed samples are obtained by inserting a 50mm diameter thin-walled steel tube into the material and withdrawing with a sample of the soil in a moderately undisturbed condition.

PP – Pocket Penetrometer tests are commonly used on thin walled tube samples of cohesive soils to evaluate consistency and approximate unconfined compressive strength of saturated cohesive soils. They may also be used for the same purpose in freshly excavated trenches.

VS – Vane Shear test are commonly used in-situ or on thin walled tube samples of cohesive soils by introducing the vane into the material where the measurement of the undrained shear strength is required. Then the vane is rotated and the torsional force required to cause shearing is calculated.

DCP – Dynamic Cone Penetrometer tests are commonly used in-situ to measure the strength attributes of penetrability and compaction of sub-surface materials.

SPT – Standard Penetration Tests are commonly used to determine the density of granular deposits but are occasionally used in cohesive material as a means of determining strength and also of obtaining a relatively unmixed sample. Samples and results are obtained by driving a 50mm diameter split tube through blows from a slide hammer with a weight of 63.5kg falling through a distance of 760mm. Blow counts are recorded for 150mm intervals with the sum of the number of blows required for the second and third 150mm of penetration is termed the "standard penetration resistance" or the "N-value".

GEOLOGICAL ORIGINS of sub-surface material plays a considerable role in the development of engineering parameters and have been summarised as follows:-

FILL – materials are man made deposits, which may be significantly more variable between test locations than naturally occurring soils.

RESIDUAL – soils are present in a region because of weathering over the geological time scale.

COLLUVIAL – soils have been deposited recently, on the geological time scale, as soils being transported slowly down slope due to gravitational creep.

ALLUVIAL – soils have been deposited recently, on the geological time scale, as water borne materials.

AEOLIAN – soils have been deposited recently, on the geological time scale, as wind borne materials.

SOIL DESCRIPTION is based on an assessment of disturbed samples, as recovered from boreholes and excavations, and from undisturbed materials. Soil descriptions adopted by Geotech Investigations Pty Ltd are largely consistent with AS 1726-2017 *'Geotechnical Site Investigation'*. Soil types are described according to the predominating particle size and behaviour, qualified by the grading of other particles present on the following bases detailed in Table 1.

COHESIVE SOILS ability to hold moisture known as its liquid limit is the state of a soil when it goes from a solid state to a liquid state described in Table 2

TABLE 1

Soil Classification	Particle Size
Clay	< 0.002 mm
Silt	0.002 – 0.06 mm
Sand	0.06 – 2.00 mm
Gravel	2.00 – 60.0 mm

TABLE 2

Descriptive Type	Range of Liquid Limit %
Of low plasticity	≤ 35
Of medium plasticity	> 35 ≤ 50
Of high plasticity	> 50

Furthermore to soil description cohesive soils are described on their strength (assessed in conjunction with penetration tests) and liquid limit. Non-cohesive soil strengths are described by their density index. With descriptions for cohesive and non-cohesive soils summarised in Table 3.

TABLE 3

COHESIVE SOILS		NON-COHESIVE SOILS	
Term	**Undrained Shear Strength kPa**	**Term**	**Density Index %**
Very soft	≤ 12	Very Loose	≤15
Soft	> 12 ≤25	Loose	> 15 ≤35
Firm	> 25 ≤50	Medium Dense	> 35 ≤65
Stiff	> 50 ≤100	Dense	> 65 ≤85
Very Stiff	> 100 ≤200	Very Dense	> 85
Hard	> 200		

Description of terms used to describe material portion are summarised in Table 4.

TABLE 4

COARSE GRAINIED SOILS		FINE GRAINED SOILS	
% Fines	**Modifier**	**% Coarse**	**Modifier**
≤ 5	Omit or 'trace'	≤ 15	Omit or 'trace'
> 5 ≤12	Describe as 'with'	> 15 ≤30	Describe as 'with'
> 12	Prefix soil as 'silty/clayey'	> 30	Prefix soil as 'sandy/gravelly'

ROCK DESCRIPTIONS are determined from disturbed samples or specimens collected during field investigations. A rocks presence of defects and the effects of weathering are likely to have a great influence on engineering behaviour.

Rock Material Weathering Classification is summarised in Table 5.

TABLE 5

Term	Symbol	Definition
Residual Soils	-	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported
Extremely Weathered Rock	XW	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded, in water
Distinctly Weathered Rock	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to decomposition of weathering products in pores
Slightly Weathered Rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock
Fresh rock	FR	Rock shows no signs of decomposition or staining

Rock Material Strength Classification is summarised in Table 6.

TABLE 6

Term	Symbol	Point load index (MPa) I_s50	Field guide to strength
Extremely Low	EL	≤0.03	Easily remoulded by hand to a material with soil properties
Very Low	VL	>0.03 ≤0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 3cm thick can be broken by finger pressure
Low	L	>0.1 ≤0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling
Medium	M	>0.3 ≤1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty
High	H	>1.0 ≤3.0	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer
Very High	VH	>3.0 ≤10	Hand specimen breaks with pick after more than one blow; rock rings under hammer
Extremely High	EH	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer

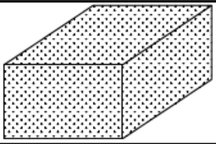
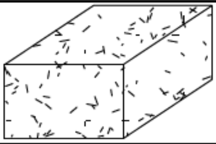
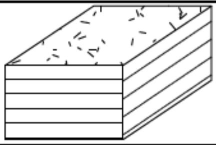
Rock Material Defect Shapes are summarised in Table 7.

TABLE 7

Term	Description
Planar	The defect does not vary in orientation.
Curved	The defect has a gradual change in orientation
Undulating	The defect has a wavy surface
Stepped	The defect has one or more well defined steps.
Irregular	The defect has many sharp changes of orientation
Smooth	The defect has a flat even finish
Rough	The defect has a irregular disoriented finish

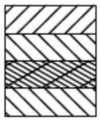
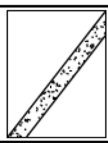
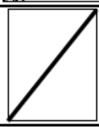
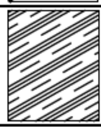
Rock Material Texture and Fabric are summarised in Table 8.

TABLE 8

Geological Description	Massive		Layered (Bedded foliate cleaved)
Diagram			
Fabric Type	Effectively homogenous and isotropic. Bulky or equi-dimensional grains uniformly distributed	Effectively homogeneous and isotropic. Elongated	Effective homogeneous with planar anisotropy. Elongated or tabular grains or pores in a layered arrangement

Rock Material Defect Type is summarised in Table 9

TABLE 9

Term	Definition	Diagram
Bedding	Signifying existence of beds or laminate. Planes dividing sedimentary rocks of the same or different lithology. Structure occurring in granite and similar rocks evident in a tendency to split more or less horizontally to the land surface	
Cross Bedding	Also called cross-lamination or false bedding. The structure commonly present in granular sedimentary rocks, which consists of tabular, irregularly lenticular or wedge-shaped bodies lying essentially parallel to the general stratification and which them selves show pronounced lamination structure in which the laminae are steeply inclined to the general bedding.	
Crushed Seam	A fracture at a more or less acute angle to applied force generally with some pulverized material along its surface	
Joint	A fracture in rock, generally more or less vertical or transverse to bedding, along which no appreciable movement has occurred.	
Parting	A small joint in rock or a layered rock where the tendency of crystals to separate along certain planes that are not true cleavage planes.	
Sheared Zone	A fracture that results from stresses which tend to shear one part of a specimen past the adjacent part	

APPENDIX C

STABILITY RISK MAP S02

GeoTech INVESTIGATIONS PTY LTD
(07) 5523 3979
3/42 Machinery Dr.
Tweed Heads South NSW 2486
admin@geotechinvestigations.com

Map description	SRM S02 Stability Risk Map		
Site location	550 Coolamon Scenic Drive, Coorabell		
Client	Catherine & Geoff Wijnberg		
Project name	Proposed Farm Building		
Project No	GI 7100	**Scale**	Not to scale

APPENDIX D

PRO-FORMA CERTIFICATION

INVESTIGATIONS PTY LTD

STANDARD PRO-FORMA FOR GEOTECHNICAL CERTIFICATION

Property Details	
Lot Number	1
Registered Plan Number	DP 123290
Property Address	No.550 Coolamon Scenic Drive, Coorabell

Proposed Development	
Description	Proposed Residential Development

<table>
<tr><th colspan="4">Declaration</th></tr>
<tr><td>I</td><td>James Daniel Walle</td><td>Registered professional engineer of Queensland (RPEQ) number</td><td>15701</td></tr>
<tr><td>of</td><td colspan="3">Geotech Investigations Pty Ltd</td></tr>
<tr><td colspan="4">being duly authorised on this behalf, do certify that:</td></tr>
<tr><td colspan="4">1. Provided the recommended advice(1) is adhered to and no other developments adversely affect the subject development, the proposed farm building area as shown in Stability Risk Map SRM 02 are considered to be geotechnically suitable and fit for purpose and have a 'low risk' or better in terms of instability in the long term and will not affect the stability and integrity of the adjoining properties.</td></tr>
<tr><td colspan="4">Notes: (1) Recommended advice being the advice outline in the geotechnical report prepared by Geotech Investigations Pty Ltd: Geotechnical Investigation and Landslide Susceptibility Assessment report: Ref: GI 7100-a Dated 11th day of September 2023.</td></tr>
<tr><td>Signature</td><td>[signature]</td><td>Designation</td><td>Senior Geotechnical Engineer</td></tr>
<tr><td>Certified this</td><td colspan="3">11th Day of September 2023</td></tr>
</table>

GEOTECHNICAL ENVIRONMENTAL DRILLING

APPENDIX E

AGS AUSTRALIAN GEOGUIDE LR7 (LANDSLIDE RISK)
GUIDELINES TO GOOD AND BAD HILLSIDE PRACTICES
EXAMPLE OF STANDARD GEOTECHNICAL VERIFICATION FORMS PROVIDED BY AGS

LANDSLIDE RISK

Concept of Risk

Risk is a familiar term, but what does it really mean? It can be defined as *"a measure of the probability and severity of an adverse effect to health, property, or the environment."* This definition may seem a bit complicated. In relation to landslides, geotechnical practitioners (GeoGuide LR1) are required to assess risk in terms of the likelihood that a particular landslide will occur and the possible consequences. This is called landslide risk assessment. The consequences of a landslide are many and varied, but our concerns normally focus on loss of, or damage to, property and loss of life.

Landslide Risk Assessment

Some local councils in Australia are aware of the potential for landslides within their jurisdiction and have responded by designating specific "landslide hazard zones". Development in these areas is often covered by special regulations. If you are contemplating building, or buying an existing house, particularly in a hilly area, or near cliffs, go first for information to your local council.

Landslide risk assessment must be undertaken by a geotechnical practitioner. It may involve visual inspection, geological mapping, geotechnical investigation and monitoring to identify:

- potential landslides (there may be more than one that could impact on your site)
- the likelihood that they will occur
- the damage that could result
- the cost of disruption and repairs and
- the extent to which lives could be lost.

Risk assessment is a predictive exercise, but since the ground and the processes involved are complex, prediction tends to lack precision. If you commission a landslide risk assessment for a particular site you should expect to receive a report prepared in accordance with current professional guidelines and in a form that is acceptable to your local council, or planning authority.

Risk to Property

Table 1 indicates the terms used to describe risk to property. Each risk level depends on an assessment of how likely a landslide is to occur and its consequences in dollar terms. "Likelihood" is the chance of it happening in any one year, as indicated in Table 2. "Consequences" are related to the cost of repairs and temporary loss of use if a landslide occurs. These two factors are combined by the geotechnical practitioner to determine the Qualitative Risk.

TABLE 2: LIKELIHOOD

Likelihood	Annual Probability
Almost Certain	1:10
Likely	1:100
Possible	1:1,000
Unlikely	1:10,000
Rare	1:100,000
Barely credible	1:1,000,000

The terms "unacceptable", "may be tolerated", etc. in Table 1 indicate how most people react to an assessed risk level. However, some people will always be more prepared, or better able, to tolerate a higher risk level than others.

Some local councils and planning authorities stipulate a maximum tolerable level of risk to property for developments within their jurisdictions. In these situations the risk must be assessed by a geotechnical practitioner. If stabilisation works are needed to meet the stipulated requirements these will normally have to be carried out as part of the development, or consent will be withheld.

TABLE 1: RISK TO PROPERTY

Qualitative Risk		Significance - Geotechnical engineering requirements
Very high	VH	**Unacceptable** without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low. May be too expensive and not practical. Work likely to cost more than the value of the property.
High	H	**Unacceptable** without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to acceptable level. Work would cost a substantial sum in relation to the value of the property.
Moderate	M	**May be tolerated** in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as possible.
Low	L	**Usually acceptable** to regulators. Where treatment has been needed to reduce the risk to this level, ongoing maintenance is required.
Very Low	VL	**Acceptable**. Manage by normal slope maintenance procedures.

AUSTRALIAN GEOGUIDE LR7 (LANDSLIDE RISK)

Risk to Life

Most of us have some difficulty grappling with the concept of risk and deciding whether, or not, we are prepared to accept it. However, without doing any sort of analysis, or commissioning a report from an "expert", we all take risks every day. One of them is the risk of being killed in an accident. This is worth thinking about, because it tells us a lot about ourselves and can help to put an assessed risk into a meaningful context. By identifying activities that we either are, or are not, prepared to engage in we can get some indication of the maximum level of risk that we are prepared to take. This knowledge can help us to decide whether we really are able to accept a particular risk, or to tolerate a particular likelihood of loss, or damage, to our property (Table 2).

In Table 3, data from NSW for the years 1998 to 2002, and other sources, is presented. A risk of 1 in 100,000 means that, in any one year, 1 person is killed for every 100,000 people undertaking that particular activity. The NSW data assumes that the whole population undertakes the activity. That is, we are all at risk of being killed in a fire, or of choking on our food, but it is reasonable to assume that only people who go deep sea fishing run a risk of being killed while doing it.

It can be seen that the risks of dying as a result of falling, using a motor vehicle, or engaging in water-related activities (including bathing) are all greater than 1:100,000 and yet few people actively avoid situations where these risks are present. Some people are averse to flying and yet it represents a lower risk than choking to death on food. Importantly, the data also indicate that, even when the risk of dying as a consequence of a particular event is very small, it could still happen to any one of us any day. If this were not so, no one would ever be struck by lightning.

Most local councils and planning authorities that stipulate a tolerable risk to property also stipulate a tolerable risk to life. The AGS Practice Note Guideline recommends that 1:100,000 is tolerable in newly developed areas, where works can be carried out as part of the development to limit risk. The tolerable level is raised to 1:10,000 in established areas, where specific landslide hazards may have existed for many years. The distinction is deliberate and intended to prevent the concept of landslide risk management, for its own sake, becoming an unreasonable financial burden on existing communities. Acceptable risk is usually taken to be one tenth of the tolerable risk (1:1,000,000 for new developments and 1:100,000 for established areas) and efforts should be made to attain these where it is practicable and financially realistic to do so.

TABLE 3: RISK TO LIFE

Risk (deaths per participant per year)	**Activity/Event Leading to Death** (NSW data unless noted)
1:1,000	Deep sea fishing (UK)
1:1,000 to 1:10,000	Motor cycling, horse riding , ultra-light flying (Canada)
1:23,000	Motor vehicle use
1:30,000	Fall
1:70,000	Drowning
1:180,000	Fire/burn
1:660,000	Choking on food
1:1,000,000	Scheduled airlines (Canada)
1:2,300,000	Train travel
1:32,000,000	Lightning strike

More information relevant to your particular situation may be found in other AUSTRALIAN GEOGUIDES:

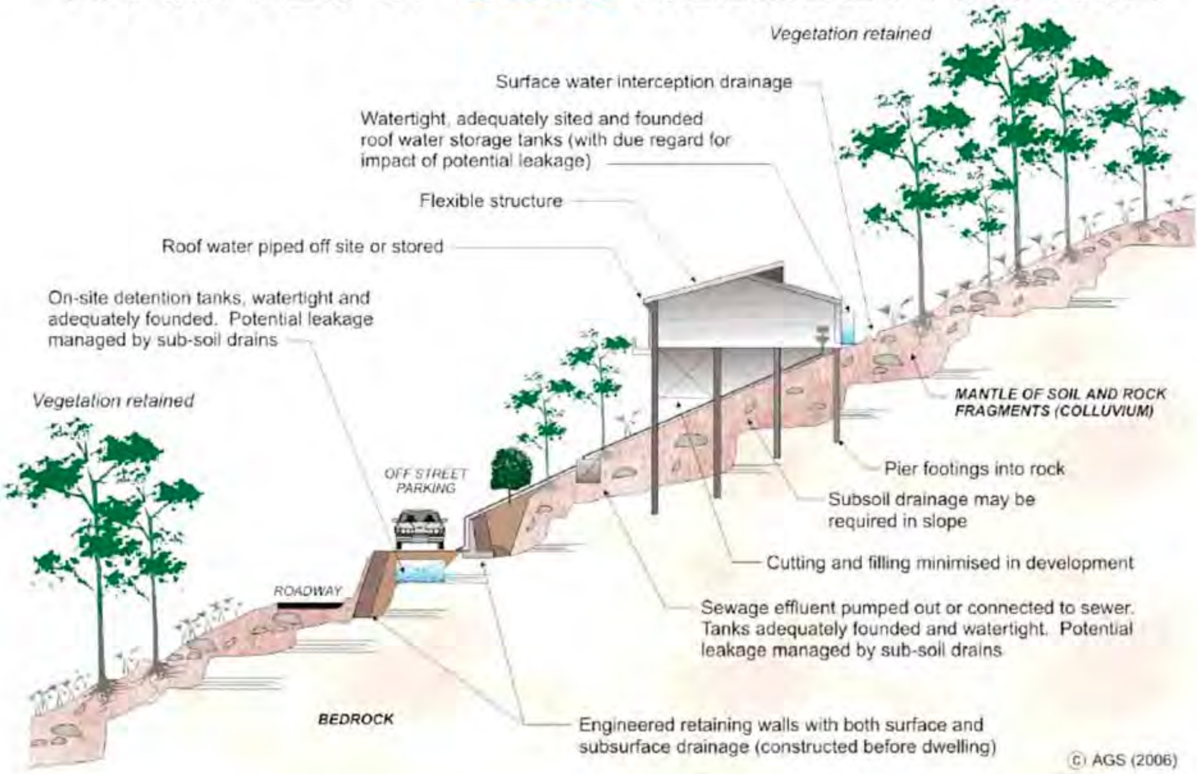
- GeoGuide LR1 - Introduction
- GeoGuide LR2 - Landslides
- GeoGuide LR3 - Landslides in Soil
- GeoGuide LR4 - Landslides in Rock
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR8 - Hillside Construction
- GeoGuide LR9 - Effluent & Surface Water Disposal
  GeoGuide LR10 - Coastal Landslides
- GeoGuide LR11 - Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the Australian Geomechanics Society, a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.

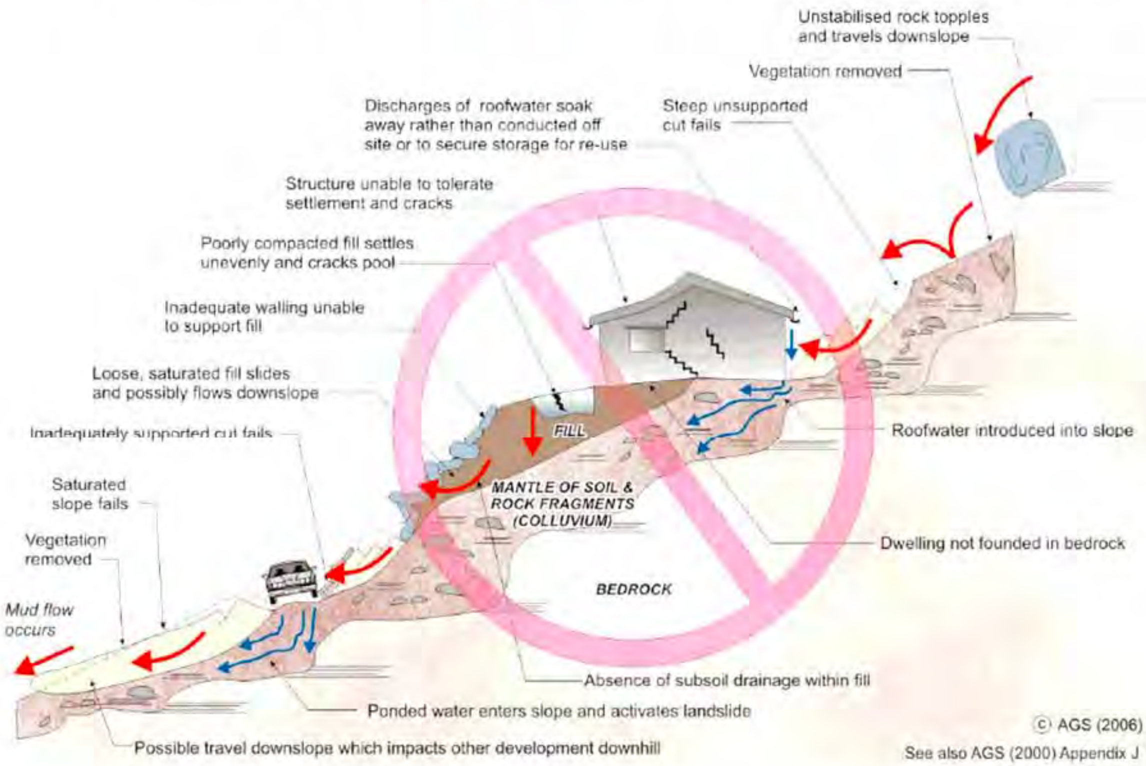
APPENDIX G - SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

	GOOD ENGINEERING PRACTICE	*POOR ENGINEERING PRACTICE*
ADVICE		
GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical practitioner at early stage of planning and before site works.	Prepare detailed plan and start site works before geotechnical advice.
PLANNING		
SITE PLANNING	Having obtained geotechnical advice, plan the development with the risk arising from the identified hazards and consequences in mind.	Plan development without regard for the Risk.
DESIGN AND CONSTRUCTION		
HOUSE DESIGN	Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.	Floor plans which require extensive cutting and filling. Movement intolerant structures.
SITE CLEARING	Retain natural vegetation wherever practicable.	Indiscriminately clear the site.
ACCESS & DRIVEWAYS	Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.	Excavate and fill for site access before geotechnical advice.
EARTHWORKS	Retain natural contours wherever possible.	Indiscriminatory bulk earthworks.
CUTS	Minimise depth. Support with engineered retaining walls or batter to appropriate slope. Provide drainage measures and erosion control.	Large scale cuts and benching. Unsupported cuts. Ignore drainage requirements
FILLS	Minimise height. Strip vegetation and topsoil and key into natural slopes prior to filling. Use clean fill materials and compact to engineering standards. Batter to appropriate slope or support with engineered retaining wall. Provide surface drainage and appropriate subsurface drainage.	Loose or poorly compacted fill, which if it fails, may flow a considerable distance including onto property below. Block natural drainage lines. Fill over existing vegetation and topsoil. Include stumps, trees, vegetation, topsoil, boulders, building rubble etc in fill.
ROCK OUTCROPS & BOULDERS	Remove or stabilise boulders which may have unacceptable risk. Support rock faces where necessary.	Disturb or undercut detached blocks or boulders.
RETAINING WALLS	Engineer design to resist applied soil and water forces. Found on rock where practicable. Provide subsurface drainage within wall backfill and surface drainage on slope above. Construct wall as soon as possible after cut/fill operation.	Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork. Lack of subsurface drains and weepholes.
FOOTINGS	Found within rock where practicable. Use rows of piers or strip footings oriented up and down slope. Design for lateral creep pressures if necessary. Backfill footing excavations to exclude ingress of surface water.	Found on topsoil, loose fill, detached boulders or undercut cliffs.
SWIMMING POOLS	Engineer designed. Support on piers to rock where practicable. Provide with under-drainage and gravity drain outlet where practicable. Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.	
DRAINAGE		
SURFACE	Provide at tops of cut and fill slopes. Discharge to street drainage or natural water courses. Provide general falls to prevent blockage by siltation and incorporate silt traps. Line to minimise infiltration and make flexible where possible. Special structures to dissipate energy at changes of slope and/or direction.	Discharge at top of fills and cuts. Allow water to pond on bench areas.
SUBSURFACE	Provide filter around subsurface drain. Provide drain behind retaining walls. Use flexible pipelines with access for maintenance. Prevent inflow of surface water.	Discharge roof runoff into absorption trenches.
SEPTIC & SULLAGE	Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some areas if risk is acceptable. Storage tanks should be water-tight and adequately founded.	Discharge sullage directly onto and into slopes. Use absorption trenches without consideration of landslide risk.
EROSION CONTROL & LANDSCAPING	Control erosion as this may lead to instability. Revegetate cleared area.	Failure to observe earthworks and drainage recommendations when landscaping.
DRAWINGS AND SITE VISITS DURING CONSTRUCTION		
DRAWINGS	Building Application drawings should be viewed by geotechnical consultant	
SITE VISITS	Site Visits by consultant may be appropriate during construction/	
INSPECTION AND MAINTENANCE BY OWNER		
OWNER'S RESPONSIBILITY	Clean drainage systems; repair broken joints in drains and leaks in supply pipes. Where structural distress is evident see advice. If seepage observed, determine causes or seek advice on consequences.	

EXAMPLES OF GOOD HILLSIDE PRACTICE



EXAMPLES OF POOR HILLSIDE PRACTICE



FORM B Structural/Civil/Geotechnical Engineering Declaration – <*Construction Certificate*> Application

Office Use Only		Regulator: <*Add in or change to appropriate name*>

To be submitted with the structural design forming part of an application for a <*construction certificate*>.
This form must be attached with the submission of the structural documentation required for the determination of a <*construction certificate*> or combined development application and <*construction certificate*> submission.
This form is essential, as it provides evidence to the <*PCA*> determining the <*construction certificate*>, that the structural design has been prepared or verified by a structural engineer or civil engineer as defined by <*Regulator's geotechnical DCP*> and that the structural design has been prepared in accordance with the recommendations given in the geotechnical report for the same development. This form also covers additional design documents required to cover other works not shown on the main structural/civil design drawings. This form is also essential to establish that the recommendations given in the geotechnical report have been interpreted and incorporated into the structural design as originally intended by the geotechnical engineer in preparing the geotechnical report.

Section 1 Related Application

Reference	What is the <*Regulator's*> development application number?
DA Site Address	
DA Applicant	

Section 2 Structural/Civil Design Documents

List of Structural/Civil Design Documents
(More space on page two if required)

Description	Plan or Document No.	Revision or Version No.	Date	Author

Section 3 Geotechnical Report

Details	Title:	
	Author:	Dated: / /
	Author's Company/ Organisation Name:	Report Reference No:

Section 4 Declaration by Structural/Civil Engineer or Designer of Additional Design Documents in Relation to a Geotechnical Report

Declaration
(Tick all that apply)

Yes	No	
☐	☐	I am a structural or civil engineer as defined by the <*Regulator's geotechnical DCP*> and on behalf of the company below.
☐	☐	I have prepared the structural designs listed in Section 2 above and/or Section 6 below, in accordance with the recommendations given in the above geotechnical report.
☐	☐	I am a design engineer and have prepared Additional Design documents listed in Section 7 below in accordance with the recommendations given in the above geotechnical report.
☐	☐	I am aware that the <*PCA*> will rely on this declaration in granting a <*construction certificate*> for works to which the above structural design documents and geotechnical report relate.
☐	☐	I certify that any residential structure designed or erected in accordance with the structural design prepared by the structural engineer or civil engineer achieves the performance requirements of Clause 1.3 of the current version of AS 2870 (this must be ticked when accompanied by minimal impact certification).
☐	☐	I have professional indemnity insurance in accordance with <*Regulator's geotechnical DCP*> of not less than $.... million, being in force for the year in which the report is dated, with retroactive cover under this insurance policy extending back to the engineer's first submission to <*the Regulator*>.

FORM B Structural/Civil/Geotechnical Engineering Declaration – <*Construction Certificate*> Application

Section 5 Structural/Civil/Design Engineer Details

Company/ Organisation Name		
Name (Company Representative)	Surname:	Mr /Mrs /Other:
	Given:	
	Chartered Professional Status:	Registration No:
Signature		Dated: / /

Section 6 Ancillary Structural/Civil Design Required Prior to Completion of Geotechnical Declaration

List of Structural Design Documents Required	Description	Company Responsible	Plan or Document No.	Revision or Version No.	Date of Additional Form B *	Author
	eg. Landscaping retaining walls					
	eg. Anchor design					

Section 7 Additional Design Documents Required Prior to Completion of Geotechnical Declaration

List of Design Documents Required	Description	Company	Plan or Document No.	Revision or Version No.	Date of Additional Form B *	Author
	eg. Surface & subsoil drainage design					
	eg. Infiltration or effluent disposal					

Section 8 and 9 are not to be completed until each relevant ancillary and additional Form B has been completed and forwarded to the geotechnical engineer/engineering geologist

Section 8 Declaration in Relation to Structural/Civil Designs and Additional Design Drawings

Declaration (Tick all that apply)

I am a geotechnical engineer or engineering geologist as defined by the <*Regulator's geotechnical DCP*> and on behalf of the company below:

Yes	No	
☐	☐	I prepared and/or technically verified the above geotechnical report and now declare that I have viewed the above listed design documents prepared for the same development.
☐	☐	I am satisfied that the recommendations given in the above geotechnical report have been incorporated into the design documents as intended.
☐	☐	I consider no additional drawings are required to show all the required works listed in the Geotechnical Report.

Section 9 Geotechnical Engineer or Engineering Geologist Details

Company/ Organisation Name		
Name (Company Representative)	Surname:	Mr /Mrs /Other:
	Given Names:	
	Chartered Professional Status:	Registration No:
Signature		Dated: / /

Note: * A separate Form B is required to be completed by the design engineer for those works listed in each of Sections 6 and 7 of this Form B.

FORM	H	**Geotechnical Declaration** **<*Building Certificate*> or Order**	
Office Use Only			Regulator: <*Add in or change to appropriate name*>

This form is to be submitted with Application for a <*Building Certificate*> or in response to an order.

Section 1 Related Application

Reference	What is the *Regulator's DA / BA / Order* number?
Site Address	
Applicant	

Section 2 Geotechnical Report

Details	Title:	
	Author:	Dated: / /
	Author's Company/ Organisation Name:	Report Reference No:

Section 3 Declaration

Declaration (Tick all that apply)

I am a geotechnical engineer or engineering geologist as defined by the <*Regulator's geotechnical DCP*> and I prepared or verified the geotechnical report as described above on behalf of the company below. I:

Yes	No	
☐	☐	have inspected the site and existing development and am satisfied that both the site and development achieves <*tolerable risk*> level requirement of the <*Regulator's geotechnical DCP*>. The attached report provides details of the assessment in accordance with the <*Regulator's geotechnical DCP*>. The report also contains recommendations as to any reasonable and practical measures that can be undertaken to reduce foreseeable risk.
☐	☐	have inspected the site of the existing development. The attached report details the remedial actions required to be undertaken prior to me being prepared to certify that the site and the development achieves the <*tolerable risk*> criteria required by the <*Regulator's geotechnical DCP*>.
☐	☐	to the best of my knowledge, am satisfied that where changes to the development occurred during construction, those changes were carried out in accordance with all the requirements and recommendations of the above geotechnical report, conditions of development consent relating to geotechnical issues, and any site reports or site instructions issued by me as listed below.
☐	☐	am aware that the <*PCA*> requires this certificate prior to issuing a <*Building Certificate*> for the above development and will rely on this certificate as verification that the development has achieved the necessary level of <*tolerable risk*> as defined by <*Regulator's geotechnical DCP*> and in determining the <*occupation or subdivision certificate*>.
☐	☐	have professional indemnity insurance in accordance with <*Regulator's geotechnical DCP*> of not less than $.... million, being in force for the year in which the report is dated, with retroactive cover under this insurance policy extending back to the engineer's first submission to <*the Regulator*>.