Douglas Partners
Geotechnics · Environment · Groundwater

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AC:ds
Project 34161
6 February 2004

T J & R F Fordham Pty Ltd
PO Box 431
CAMDEN NSW 2570

Attention Mr Glenn Fordham

Dear Sir

REPORT ON GEOTECHNICAL INVESTIGATION
PROPOSED SITE CLEARING
LOT 5 DP 261728 WARRADALE ROAD
SILVERDALE

1. INTRODUCTION

This letter report presents the results of a geotechnical assessment undertaken to assess the geotechnical factors which may influence a proposal to undertake selective clearing of trees and undergrowth at the above site. The work was requested by T J & R F Fordham Pty Ltd, property owners.

It is understood that the site is to be used for cattle grazing and that some site clearing will be required to facilitate this land use. The assessment was undertaken to provide geotechnical comment on the potential impact the works may have on site stability and erosion potential.

The assessment comprised a site inspection and mapping by an experienced geotechnical engineer followed by laboratory testing of selected samples, the results of which are given within this report.

2. SITE DESCRIPTION AND REGIONAL GEOLOGY

The site, which is known as Lot 5 in DP 261728 comprises a roughly trapezoidal shaped area of some 19 ha with maximum north-south and east-west dimensions of 470 m and 580 m, respectively. The site is bounded to the north and west by road easements and to the east and south by existing residential allotments.

Site levels generally fall towards a northerly trending creek (Megarittys Creek) at slopes of 2 – 5° (but locally steeper to 10°) increasing to slopes of 15 - 30° at cliff lines which flank the creek (see Drawing 1).

At the time of the inspection, the eastern third of the site was cleared and heavily grassed, with the remainder of the site being moderately timbered with eucalypts and heavy scrub undergrowth.

Reference to the 1:100 000 Wollongong – Port Hacking Geological Series Sheet (Ref 1) indicates that the site is underlain by Ashfield Shale and Hawkesbury Sandstone, both of Triassic age. The Ashfield Shale comprises dark grey siltstone and laminite, whilst the Hawkesbury Sandstone comprises medium to coarse grained quartz sandstone. The field inspection confirmed the geological mapping with sandstone noted in outcrop over the site.

3. FIELD WORK

The field work comprised a site inspection by an experienced geotechnical engineer and the collection of five near-surface soil samples (Samples X1 – X5). The approximate sampling locations are shown on Drawing 1 attached, together with pertinent features noted during the site walkover.

Various site features are illustrated in Photoplates 1 – 9, attached.

4. SITE INSPECTION

Inspection of the site and adjacent areas indicated the following:

- no signs of deep seated or creep-induced instability on the site;
- generally upright tree growth;
- uniform surface slopes across the site;
- sandstone outcrop at the cliff lines which flank Megarittys Creek with overhangs and dislodged boulders typical of cliff line regression;
- the eastern third of the site is clear-felled and heavily grassed;
- no significant signs of rilling or erosion, particularly in the areas which are currently cleared of trees;
- the site is located outside the Warragamba catchment area.

5. LABORATORY TESTING

Five samples of clayey silt (X1 – X5) from the site were tested in the laboratory for determination of Emerson Class Number (ECN). The detailed test report sheets are attached, with the Emerson Class Number of 7 obtained for all samples.

The results therefore indicate that the soil samples tested are non-dispersive and as such, would have a low erosion potential.

6. STABILITY ASSESSMENT AND EROSION POTENTIAL

Based on the results of the site inspection, most of the site has been classified after the methods of the Australian Geomechanics Society Sub-committee on Landslide Risk Management (AGS, Ref 2) as being of VERY LOW risk to property as a consequence of creep-induced instability. Areas adjacent to the cliff line (say within 10 – 15 m) would be considered to be of LOW risk to property due to the potential for rock falls as the cliff line regresses. Relevant extracts of the AGS paper are attached. It is noted however, that the risk classification is based on the current land-use (ie: rural) and could change should a different land-use (such as residential) be proposed.

The results of the Emerson class dispersion testing indicate that the site soils to be of negligible dispersion potential.

Based on the observed conditions and the results of laboratory testing, it is considered that slope instability or erosion problems are unlikely at the site.

7. COMMENTS

Based on the details provided and observations made during the inspection, the following comments are offered:

- the proposed works on the site comprise clearing up to 12 ha to reduce vegetation levels to a minimum 12 trees per hectare, with the exception of those areas within 50 m of the existing creek lines which will not be cleared;
- In view of the current low risk of site instability, negligible dispersion potential of the site soils and satisfactory performance of areas which have been previously cleared of trees, it is considered that the proposed site works should not have an adverse effect on site stability and erosion;
- It is noted however, that existing the grasses should be maintained to further reduce the potential for scour erosion. Clearing should also be limited to those areas with slopes of less than, say, 10° and no closer than 15 m from existing cliff lines and changes in grade (associated with drainage depressions).

We trust that the above information is in accordance with your present requirements. Please do not hesitate to contact the undersigned should you require additional information at this stage.

DOUGLAS PARTNERS PTY LTD Reviewed by:

A Castrissios
Associate

for **G W McIntosh**
Managing Principal

References:

1. Geology of 1:100 000 Wollongong – Port Hacking Geological Series Sheet No 9029 – 912a, Dept of Mines, (1985).
2. AGS – Landslide Risk Management Concepts and Guidelines, Australian Geomechanics Society, Sub-committee on Landslide Risk Management, 2000.

Attachments: Laboratory Test Results (1 sheet)
AGS Extract (3 sheets)
Photoplates (1 – 9)
Drawing 1

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DETERMINATION OF EMERSON CLASS NUMBER OF SOIL

Client: T J & R F FORDHAM PTY LTD
Project: PROPOSED SITE CLEARING
Location: LOT 5 DP261728 WARRADALE ROAD, SILVERDALE

Project No: 34161
Report No: UL04-112
Report Date: 2 FEB 04
Date Sampled: 22 JAN 04
Date of Test: 29 JAN 04
Page: 1 of 1

SAMPLE NO	DEPTH (m)	DATE SAMPLED	DESCRIPTION	WATER TYPE	WATER TEMP	CLASS NO.
X1	-	22/1/04	Brown Gravelly Sandy Silt	Distilled	17	7
X2	-	22/1/04	Brown Clayey Sandy Silt	Distilled	17	7
X3	-	22/1/04	Brown Sandy Silt	Distilled	17	7
X4	-	22/1/04	Brown Gravelly Sandy Silt	Distilled	17	7
X5	-	22/1/04	Brown Gravelly Sandy Silt	Distilled	17	7

Test Method(s): AS 1289 3.8.1 - 1997
Sampling Method(s): AS 1289.1.2.1-1998, AS 1289.1.1-2001

Remarks:

Form No: HD05 Rev 4 Date of issue February 2003

NATA Accredited Laboratory No 11183
This Laboratory is accredited by the National Association of Testing Authorities, Australia. The test(s) reported herein have been performed in accordance with its terms of accreditation

Tested: AT
Checked: DE

Approved Signatory:

Brett Rippingale
Laboratory Manager

APPENDIX G

LANDSLIDE RISK ASSESSMENT – EXAMPLE OF QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

Qualitative Measures of Likelihood

Level	Descriptor	Description	Indicative Annual Probability
A	ALMOST CERTAIN	The event is expected to occur	$\geq\approx 10^{-1}$
B	LIKELY	The event will probably occur under adverse conditions	$\approx 10^{-2}$
C	POSSIBLE	The event could occur under adverse conditions	$\approx 10^{-3}$
D	UNLIKELY	The event might occur under very adverse circumstances	$\approx 10^{-4}$
E	RARE	The event is conceivable but only under exceptional circumstances.	$\approx 10^{-5}$
F	NOT CREDIBLE	The event is inconceivable or fanciful	$<10^{-6}$

Note: "≈" means that the indicative value may vary by say ½ of an order of magnitude, or more.

Qualitative Measures of Consequences to Property

Level	Descriptor	Description
1	CATASTROPHIC	Structure completely destroyed or large scale damage requiring major engineering works for stabilisation.
2	MAJOR	Extensive damage to most of structure, or extending beyond site boundaries requiring significant stabilisation works.
3	MEDIUM	Moderate damage to some of structure, or significant part of site requiring large stabilisation works.
4	MINOR	Limited damage to part of structure, or part of site requiring some reinstatement/stabilisation works.
5	INSIGNIFICANT	Little damage.

Note: The "Description" may be edited to suit a particular case.

Qualitative Risk Analysis Matrix – Level of Risk to Property

LIKELIHOOD	CONSEQUENCES to PROPERTY				
	1: CATASTROPHIC	2: MAJOR	3: MEDIUM	4: MINOR	5: INSIGNIFICANT
A – ALMOST CERTAIN	VH	VH	H	H	M
B – LIKELY	VH	H	H	M	L-M
C – POSSIBLE	H	H	M	L-M	VL-L
D – UNLIKELY	M-H	M	L-M	VL-L	VL
E – RARE	M-L	L-M	VL-L	VL	VL
F – NOT CREDIBLE	VL	VL	VL	VL	VL

Risk Level Implications

Risk Level		Example Implications(1)
VH	VERY HIGH RISK	Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to acceptable levels; may be too expensive and not practical
H	HIGH RISK	Detailed investigation, planning and implementation of treatment options required to reduce risk to acceptable levels
M	MODERATE RISK	Tolerable provided treatment plan is implemented to maintain or reduce risks. May be accepted. May require investigation and planning of treatment options.
L	LOW RISK	Usually accepted. Treatment requirements and responsibility to be defined to maintain or reduce risk.
VL	VERY LOW RISK	Acceptable. Manage by normal slope maintenance procedures.

Note: (1) The implications for a particular situation are to be determined by all parties to the risk assessment: these are only given as a general guide.

(2) Judicious use of dual descriptors for Likelihood, Consequence and Risk to reflect the uncertainty of the estimate may be appropriate in some cases.

APPENDIX J

SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

	GOOD ENGINEERING PRACTICE	*POOR ENGINEERING PRACTICE*
ADVICE		
GEOTECHNICAL ASSESSMENT	Obtain advice from a qualified, experienced geotechnical consultant 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.	Indiscriminant 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.	

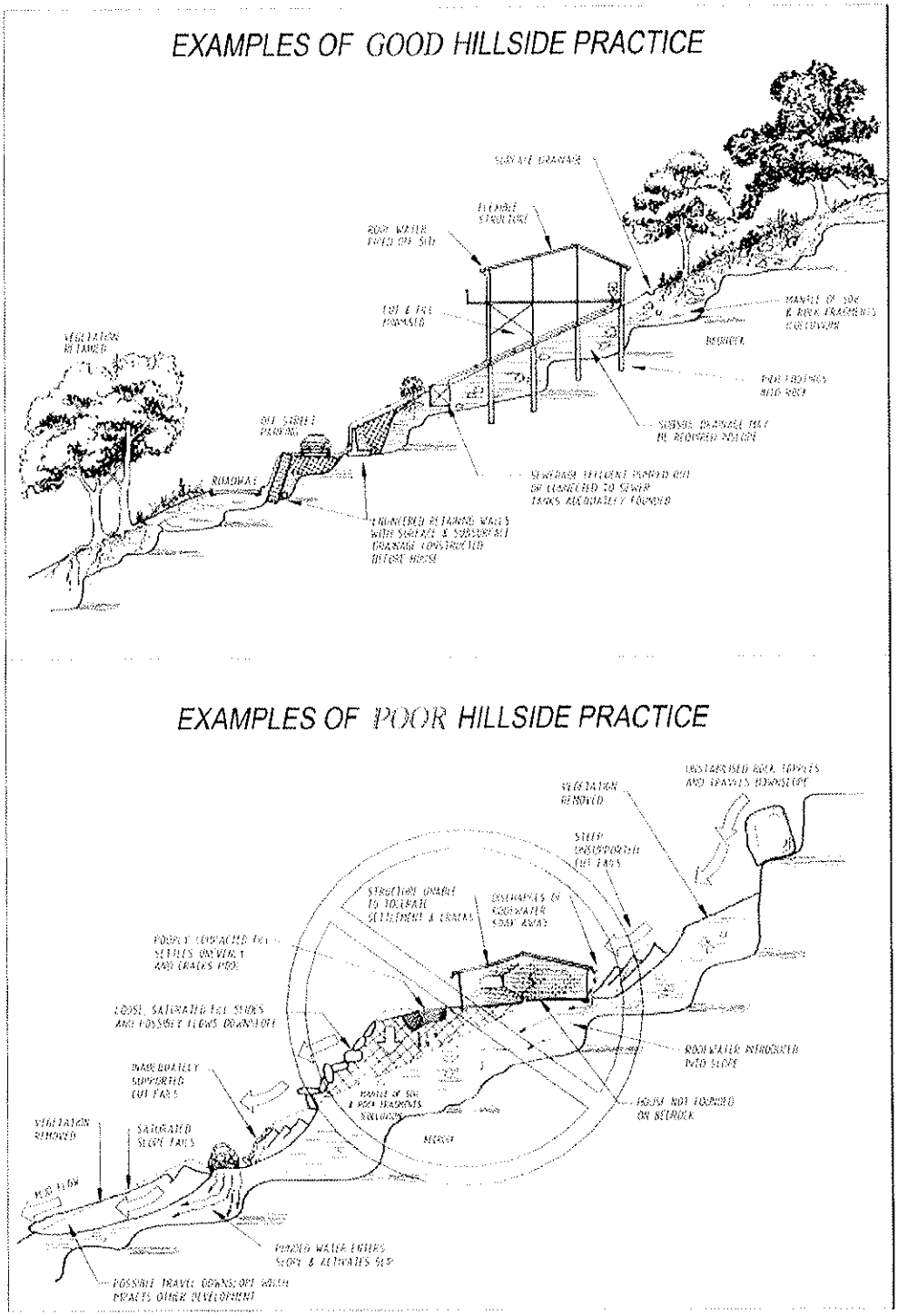

Figure J1 Illustrations of Good and Poor Hillside Practice

View from north-eastern corner of the site
towards cleared section

PROPOSED SITE CLEARING LOT 5 DP 261728 WARRADALE ROAD, SILVERDALE	PROJECT 34161	FEBRUARY 2004	PLATE 1

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View to the west from the eastern boundary

PROPOSED SITE CLEARING LOT 5 DP 261728 WARRADALE ROAD, SILVERDALE	PROJECT 34161	FEBRUARY 2004	PLATE 2

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View to north-west from near the south-eastern corner of the site

PROPOSED SITE CLEARING LOT 5 DP 261728 WARRADALE ROAD, SILVERDALE	PROJECT 34161	FEBRUARY 2004	PLATE 3

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View from top of cliffline toward Megarittys Creek

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View from cliffline towards Megarittys Creek near southern boundary

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Minor rilling adjacent to track in north-east of the site

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View to the east from the western side of Megarittys Creek

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View east from powerline easement (western boundary)

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Sandstone outcrops leading to Megarittys Creek (looking east)

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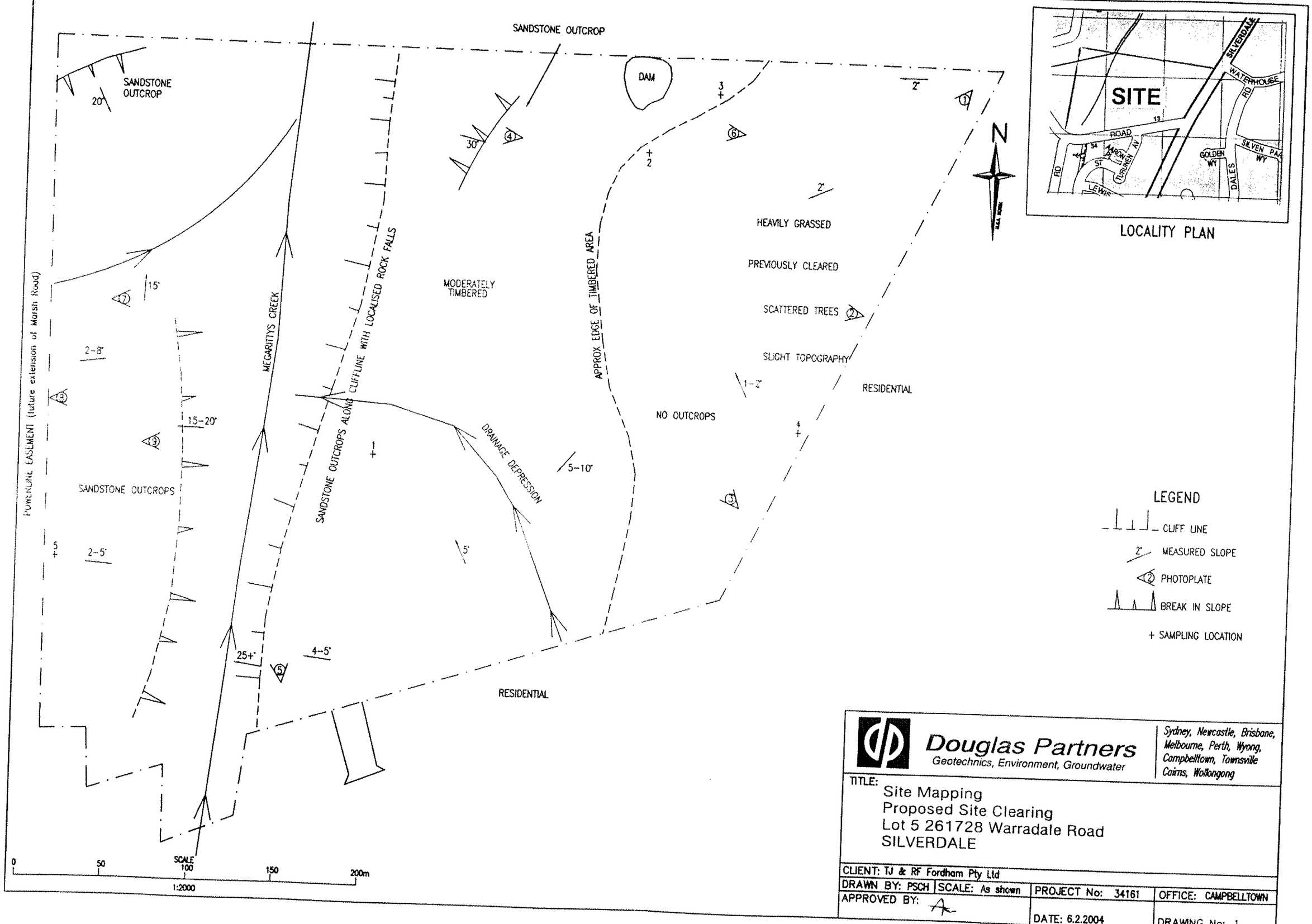

LOCALITY PLAN

LEGEND

- CLIFF LINE
- 2° MEASURED SLOPE
- (2) PHOTOPLATE
- BREAK IN SLOPE
- + SAMPLING LOCATION

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Geotechnics, Environment, Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Campbelltown, Townsville Cairns, Wollongong

TITLE:
Site Mapping
Proposed Site Clearing
Lot 5 261728 Warradale Road
SILVERDALE

CLIENT: TJ & RF Fordham Pty Ltd			
DRAWN BY: PSCH	SCALE: As shown	PROJECT No: 34161	OFFICE: CAMPBELLTOWN
APPROVED BY:		DATE: 6.2.2004	DRAWING No: 1