

PROJECT

**SOIL PRESERVATION
MANAGEMENT PLAN
ALTITUDE ASPIRE
TERRANORA
NEW SOUTH WALES**

PREPARED FOR

NEWLAND DEVELOPERS PTY LTD

DATE

APRIL 2013

**+GILBERT
SUTHERLAND**

DOCUMENT CONTROL

DOCUMENT 10849_SPMP_RMF1F.docx
TITLE Soil Preservation Management Plan, Altitude Aspire, Terranora, New South Wales
PROJECT MANAGER N. Gifford
AUTHOR(S) M. Foster
CLIENT Newland Developers Pty Ltd
CLIENT CONTACT Shaun Nicholson – Regional Manager, North Queensland
CLIENT REFERENCE –

SYNOPSIS This Soil Preservation Management Plan outlines the extent of Class 6 lands and establishes responsibilities and procedures for the management of krasnozem soils within these lands at Altitude Aspire, Terranora.

REVISION HISTORY

REVISION #	DATE	EDITION BY	APPROVED BY
1	04/13	M. Foster	P. Matthew /L. Varcoe

DISTRIBUTION

	REVISION NUMBER									
Distribution	1	2	3	4	5	6	7	8	9	10
Newland Developers Pty Ltd	1									
G&S library + file	2									

SUMMARY

Gilbert & Sutherland Pty Ltd (G&S) was commissioned to prepare a Soil Preservation Management Plan (SPMP) for input into the Revised Preferred Project Report (PPR) for the proposed Altitude Aspire residential development.

Class 6 Agricultural Lands, associated with the Carool soil landscape that features mostly krasnozem soils, are mapped as being present on the site. The Tweed Development Control Plan 2008, Section B24 – Area E Urban Release Development Code, states that landforming plans for the project are to identify Class 6 soils, detail how the soils will be managed throughout the landforming process and placed post landforming in order for these soils to continue to be productive.

Boreholes constructed by G&S and Morrison Geotechnics for previous investigations associated with the Altitude Aspire development provide an overview of the distribution of soils on the site. Soils mapped within the Class 6 lands were described as clays, silty clays and sandy clays ranging in depth from 2.6 to 10 m.

This SPMP commits the proponent to specific strategies and measures for the overall management of Class 6 lands on the site. It establishes procedures to ensure that all krasnozem soils encountered on Class 6 lands during the landforming process are appropriately managed and preserved.

This SPMP establishes a clear management protocol incorporating operational policies, performance criteria, implementation strategies and corrective actions, should they be necessary. The SPMP identifies who is responsible for each specific aspect of soil management using a working tabular format with provision for amendment if required.

CONTENTS

1	Introduction	5
1.1	Background	5
1.2	Agricultural land suitability.....	5
1.3	Geology and soils.....	5
1.4	SPMP structure	5
1.5	General commitments	6
1.6	Definitions	7
2	Management of Class 6 lands	8
2.1	Identification of krasnozem soils	8
2.2	Management of krasnozem soils - landforming process...	9
2.3	Erosion and sediment control.....	11
2.4	Management of krasnozem soils – post landforming.....	13
2.5	Contractor management	14
3	Administration of the SPMP	15
3.1	Amendment of the SPMP.....	15
3.2	Incident management.....	15
4	Appendix 1 – Reference drawing	16
5	Appendix 2 – Borelogs.....	17

1 Introduction

1.1 Background

Gilbert & Sutherland Pty Ltd (G&S) was commissioned to prepare a Soil Preservation Management Plan (SPMP) for input into the Revised Preferred Project Report (PPR) for the proposed Altitude Aspire residential development site (herein referred to as 'the site').

This SPMP aims to identify and describe the management of krasnozem soils within Class 6 agricultural lands in accordance with the following requirements detailed within the Tweed Development Control Plan 2008, Section B24 – Area E Urban Release Development Code (herein referred to as 'Area E Development Code'):¹

'26% (73 ha) of the Shire's mapped Special Use (horticulture) Class 6 land (mostly krasnozem soils) is located within Area E. The Carool soil landscape is the most important agricultural land found within the Terranora area and as such the retention of this soil to viably and actively be used in the future is to be retained. Landforming plans are to identify Class 6 soils, detail how the soils will be managed throughout the landforming process and placed post landforming in order for these soils to continue to be productive. Class 6 soils should preferably be placed within a public space to better facilitate community gardens to be pursued.'

1.2 Agricultural land suitability

NSW Agriculture (1998)² mapped agricultural land suitability within Terranora Area E. Land within the site falls within agricultural land suitability classes 3, 5, 6, 9 and 10 as shown in Drawing No. 10849.6.1 (attached in Appendix 1). The area of Class 6 land within the site is approximately 7.4 ha.

¹ Planning Reforms Unit, Adopted 13 December 2011, Area E Urban Release Development Code, Tweed Development Control Plan – Section B24.

² NSW Agriculture, 1998, *Agricultural Land Classification study – Tweed Shire. Notes to Accompany Agricultural Land Classification Map 1998*, NSW Agriculture, Orange, NSW Govt.

1.3 Geology and soils

The geology of the site is described by the Geological Survey of Queensland Moreton Geology 1:500,000 geology map³, as overlying Tertiary Basalt and sections of the Neranleigh-Fernvale beds. These groups consist of basalt, mudstone, shale, greywacke, chert, jasper, conglomerate, basic metavolcanics and pillow lava.

The soil landscape belongs to the Carool colluvial landscape group (Morand 1996⁴). Boreholes constructed for investigations undertaken by G&S and Morrison Geotechnics give an overview of the distribution of the site's soils. Boreholes MB1, BH4 and BH5 were constructed within Class 6 lands (as shown on Drawing No. 10849.6.1 in Appendix 1). These soils were described as clays, silty clays and sandy clays ranging in depth from 2.6 to 10 m (note: borelogs are included in Appendix 2).

The provisions proposed within this SPMP for the overall management of Class 6 lands on the site establish procedures to ensure that all krasnozem soils encountered on Class 6 lands during the landforming process are appropriately managed, preserved and ultimately placed so as to continue to be productive.

1.4 SPMP structure

This SPMP acknowledges the occurrence of potentially productive agricultural land associated with the Altitude Aspire development at Terranora, NSW and details strategies to preserve the krasnozem soils present on the Class 6 lands.

Each control strategy is based upon proven environmental management methods and is presented as a commitment. The commitments made within this document will form the basis of future assessments, which will be made available to the Tweed Shire Council (TSC) for review.

The SPMP is based on a series of tables for use during the earthworks phase of the proposed development. The person responsible for the

³ Queensland Government (1980) *Geological Survey of Queensland, Moreton Geology, 1:500,000 geology map*.

⁴ Morand D.T. *Soil landscapes of the Murwillumbah – Tweed Heads 1:100000 (Fingal, Pottsville, Green Pidgeon, Tygalum)* NSW Soil Conservation Service pp 30-33.

implementation of the measures detailed is written on the table itself. The tables then detail the issue, the performance criteria, the implementation strategy, monitoring, auditing, reporting, failure

identification and the corrective action. The detachable pages within each section detail the provisions of the SPMP. The format is presented below for reference purposes.

Title

Person responsible	This is the person who has accepted the responsibility of implementing the SPMP provisions detailed on this page.
Issue	The issue with which the table deals.
Operational policy	The operational policy or management objective that applies to the element.
Performance criteria	Performance criteria (outcomes) for each element of the operation.
Implementation strategy	The strategies or tasks (to nominated operational design standards) that will be implemented to achieve the performance criteria.
Monitoring	The monitoring requirements that will measure actual performance (i.e. specified limits to pre-selected indicators of change).
Auditing	The auditing requirements, which will verify implementation of, agreed construction and operation phase environmental management strategies and compliance with agreed performance criteria.
Reporting	Content, timing and responsibility for reporting and auditing of monitoring results.
Identification of incident or failure	The circumstances under which the agreed performance criteria are unlikely to be met and environmental harm is likely to result.
Corrective action	The action to be implemented in case a performance requirement is not reached and the company(s) responsible for action.

Commitment #

What the Proponent or its nominated project manager has committed to.

An objective of the tabular format is to allow the SPMP to be a working document. If items need altering, changes may be made to the individual tables after appropriate consultation with the statutory authorities.

1.5 General commitments

Commitment 1

The Proponent undertakes to comply with the strategy as described within the approved Soil Preservation Management Plan (SPMP).

Commitment 2

The Proponent undertakes to fulfil all commitments made in this SPMP and to carry out its activities on the project site in accordance with relevant current statutory requirements and approved amendments.

1.6 Definitions

In this SPMP the terms have the following meanings;

- **SPMP** means the approved Soil Preservation Management Plan and includes any amendments that may be approved from time to time.
- **TSC** means Tweed Shire Council.
- **Proponent** means the person undertaking the development of the land and includes the person nominated as having the responsibility for implementing the provisions of the SPMP.

2 Management of Class 6 lands

2.1 Identification of krasnozem soils and soil horizons suitable for salvage

Person responsible	Site Manager
Issue	Identification of krasnozem soils and soil horizons suitable for salvage within Class 6 land as depicted on Drawing No. 10864.6.1 (Appendix 1).
Operational policy	To identify the location and volume of krasnozem soils within Class 6 land prior to bulk earthworks.
Performance criteria	The depth of krasnozem soils and soil horizons suitable for salvage within Class 6 land is identified prior to the commencement of bulk earthworks.
Implementation strategy	- A series of boreholes will be constructed to determine the depth of krasnozem soil horizons within the Class 6 land. - The total volume of krasnozem soils suitable for salvage within the Class 6 land will be estimated. - A maximum stripping depth of 2 m will be implemented. - Rejection criteria will be based on the following critical acidity and aluminium levels for tolerant plants:⁵ - pH (CaCl₂) – <4.0. - Extractable Al in CaCl₂ solution – >1.6 ppm. - Exchangeable Al as a percentage of CEC: If EC <0.07 dS/m – >32 If EC 0.07 to 0.23 dS/m – >21 If EC >0.23 dS/m – >10
Monitoring	The location of boreholes and the depth of the krasnozem soil horizons will be recorded.
Auditing	- Auditing will be undertaken by the site manager and/or the proponent's nominated representative. - Alternatively, auditing may be carried out by an independent consultant. The audit should include an inspection of site activities and reporting to assess compliance with the provisions outlined within the SPMP.
Reporting	Records shall be kept of the location and depth of krasnozem soil horizons within Class 6 lands.
Identification of incident or failure	Failure to correctly identify the extent of krasnozem soils with Class 6 lands as depicted on Drawing No. 10864.6.1 (Appendix 1).
Corrective action	Construct addition boreholes to correctly delineate the extent of krasnozem soils within Class 6 lands.

Commitment 3

The extent of krasnozem soils suitable for salvage within Class 6 lands will be identified prior to the commencement of bulk earthworks.

⁵ NSW Department of Natural Resources 2007, *Interpreting soil test results, What do all the numbers mean?* Hazelton, P. and Murphy, B., Table 5.3 - column labeled Tolerant plants, p 60.

2.2 Management of krasnozem soils – landforming process

Person responsible	Site Manager
Issue	Removal and storage of krasnozem soils within Class 6 lands throughout the landforming process.
Operational policy	Krasnozem soils within Class 6 lands will be excavated and stockpiled on site during the landforming process.
Performance criteria	All krasnozem soils within Class 6 lands are excavated and stockpiled.
Implementation strategy	The krasnozem soils within the Class 6 land (as shown on Drawing No. 10864.6.1, Appendix 1) will be excavated to the depths identified in the borehole investigation conducted prior to the commencement of bulk earthworks. Excavated material will be stockpiled within bunded holding areas. Erosion and sediment control measures should be installed in accordance with Table 2.3 – Erosion and sediment control, and the International Erosion Control Association (IECA) <i>Best Practice Erosion and Sediment Control</i> (November, 2008). Stockpiles will be managed in accordance with the DECC guidelines⁶ and take into account the following considerations: • Locate stockpiles away from hazards e.g. flow paths, steep slopes. • Stockpiles are to be protected from upslope surface flows. • Sediment fences should be installed downslope of holding areas. • All stockpiles should be covered to protect them from wind and rain erosion. Alternatively, stockpiles should be seeded within a fortnight of final forming with an appropriate seed mix. Topsoil shall be stripped and stockpiled separately to subsoils. Where necessary, stockpiles will be separately established for each soil horizon identified as suitable for salvage. Topsoil stockpiles shall be: • a maximum height of 2 m; and • maintained to prevent weed growth; and • used within 12 months of stripping or protected and sown (and periodically re-sown) with sterile pasture grasses or legumes to maintain organic matter and biological function. Krasnozem soils identified and preserved in accordance with the procedure detailed above will be placed, post-landforming, in accordance with the guidance provided in Table 2.4.
Monitoring	The volume of soil removed and the location of stockpiles will be recorded.
Auditing	• Auditing will be undertaken by the site manager and/or the proponent's nominated representative. • Alternatively, auditing may be carried out by an independent consultant. The audit should include an inspection of site activities, complaints, corrective

⁶ NSW Department of Environment and Climate Change 2008, *Managing Urban Stormwater, Soils and construction, Volume 2A, Installation of services*, Table 6.2, p 31.

	actions and reporting to assess compliance with the provisions outlined within the SPMP.
Reporting	- Records are to be kept on site and should be available for inspection at all times. - Records are to be sent to TSC as required.
Identification of incident or failure	- Failure to excavate all krasnozems soils identified within Class 6 lands. - Failure to correctly stockpile excavated material for future re-use.
Corrective action	- Excavate any krasnozems soils that were missed during initial works. - Maintain stockpiles to ensure soils are appropriately preserved for re-use.

Commitment 4

All krasnozems soils with Class 6 lands shall be managed in accordance with the above provisions.

2.3 Erosion and sediment control

Person Responsible	Consulting Engineer, Site Manager
Issue	Sediment and erosion control during excavation and storage of krasnozem soils.
Operational policy	To prevent the displacement of sediment across the site, particularly during rainfall events.
Performance criteria	- All excavated material shall be stockpiled in such a manner so as to prevent the displacement of this material across the site. - Erosion resulting from on-site activities shall be minimised. - The transport and accumulation of sediment offsite and should be prevented.
Implementation strategy	- Erosion and sediment control devices such as (but not limited to) silt fences, bunds and contour drains should be installed prior to commencement of site activities to the reasonable satisfaction of TSC and should be maintained throughout the life of site operations. - All exposed areas should have a negative grade toward the onsite excavations (water feature basins). - Upslope runoff shall be diverted around bunded holding areas or any cleared or disturbed regions of the site in a way that minimises erosion, the size of the upslope catchment and diverts waters to the onsite water feature basins. - Sediment control fences should be constructed at the downslope perimeter of holding areas and any cleared or disturbed regions of the site. - Where possible, the excavation/construction programme shall be scheduled to minimise the potential for soil loss to occur. Where excavation/construction activities cannot be altered, additional controls shall be implemented in the areas of high erosion potential. - All erosion and sediment control measures should be maintained at operational capacity until disturbed land is effectively rehabilitated.
Monitoring	Visual inspections will be undertaken fortnightly and following rainfall events to ensure adequate erosion and sedimentation control devices are installed.
Auditing	- Auditing will be undertaken by the site manager and/or the proponent's nominated representative. - Alternatively, auditing may be carried out by an independent consultant during the construction phase of the development. The audit should include an inspection of site activities, complaints, corrective actions and reporting to assess compliance with the SPMP.
Reporting	- Reporting is required if excessive sedimentation and/or erosion is identified. - Full details to be available to the contractor together with suggested corrective actions if required.
Identification of incident or failure	- Displacement of soil across the site. - Inadequate bunding of holding areas. - Damaged or failed erosion and sediment control devices.

Corrective action	Identify the source of any displaced material and take the necessary steps required to prevent a recurrence. This may include: • the installation of additional erosion and sediment control measures • maintenance of existing controls • a review of work practices to minimise exposed areas and the duration of exposure
-------------------	---

Commitment 5

The Proponent will ensure that appropriate and adequate erosion and sediment control measures are installed prior to the commencement of works and are maintained for the duration of the construction works.

2.4 Management of krasnozem soils – post landforming

Person Responsible	Site Manager
Issue	Post-landforming placement/reinstatement of krasnozem soils.
Operational policy	To ensure the excavated krasnozems are placed/reinstated in a manner that allows these soils to continue to be productive, post landforming.
Performance criteria	All excavated krasnozem soils are reinstated post landforming.
Implementation strategy	The preserved krasnozems will be reinstated in the appropriate order (sub-soils overlain by top soil). The priority for reinstating the soils will consider the following options, in order: 1. Where community gardens are proposed, the preserved krasnozems would be reinstated in these locations. 2. Preserved krasnozems in excess of the requirements for option 1 would be reinstated for landscaping throughout the development. 3. Preserved krasnozems in excess of the requirements for Option 2 would be reinstated as top dressing of lots at final grade (outside of the building envelope), allowing landholders to benefit from productive soils in their own gardens. 4. Preserved krasnozems in excess of the requirements for Option 3 would be made available to landscaping suppliers to ensure the soils are actively used in the future.
Monitoring	The method of reinstatement and the volume of soil taken from each stockpile will be recorded.
Auditing	• Auditing will be undertaken by the site manager and/or the proponent's nominated representative. • Alternatively, auditing may be carried out by an independent consultant during the construction phase of the development. The audit should include an inspection of site activities, complaints, corrective actions and reporting to assess compliance with the SPMP.
Reporting	• Records are to be kept on site and should be available for inspection at all times. • Records are to be sent to TSC as required.
Identification of incident or failure	• Failure to reinstate all stockpiled material. • Stockpiled material is not reinstated in a manner that allows the soil to be actively productive in the future.
Corrective action	• Reinstall all stockpiled material in accordance with the options detailed above.

Commitment 6

The Proponent will ensure that appropriate methods of reinstatement are adopted for the preservation of the krasnozem soils.

2.5 Contractor management

Person Responsible	Consulting Engineer
Issue	Contractor management.
Operational policy	To ensure the Proponent's Duty of Care is met by ensuring the Contractor is aware of their responsibilities under the terms of the SPMP.
Performance criteria	Each contractor shall be fully aware of its responsibilities under the terms of the SPMP and their obligation to respond to environmental issues arising from construction activities.
Implementation strategy	- Monitoring and verifying that the SPMP is adhered to at all times and taking action if the specifications are not followed. - The provision of advice, information and training to contractors and staff with regard to the implementation of the SPMP.
Monitoring	Weekly site inspections are to be carried out by the site manager or Proponent's representative to ensure the provisions of the SPMP are being adequately implemented.
Auditing	- Auditing will be undertaken by the site manager and/or the proponent's nominated representative. - Alternatively, auditing may be carried out by an independent consultant. The audit should include an inspection of site activities, complaints, corrective actions and reporting to assess compliance with the provisions outlined within the SPMP.
Reporting	Full details shall be available to the contractor together with suggested corrective actions (if required).
Identification of incident or failure	Failure to comply with the conditions set out in the SPMP resulting in environmental harm or unnecessary disturbance to neighbouring land users.
Corrective action	The Proponent has the right to call a halt to any activity being undertaken which is deemed in conflict with the SPMP.

Commitment 7

All contractors will be managed to ensure compliance with the SPMP for the duration of the site works.

3 Administration of the SPMP

3.1 Amendment of the SPMP

The Proponent may make an application to TSC to amend the provisions of this SPMP. The application shall:

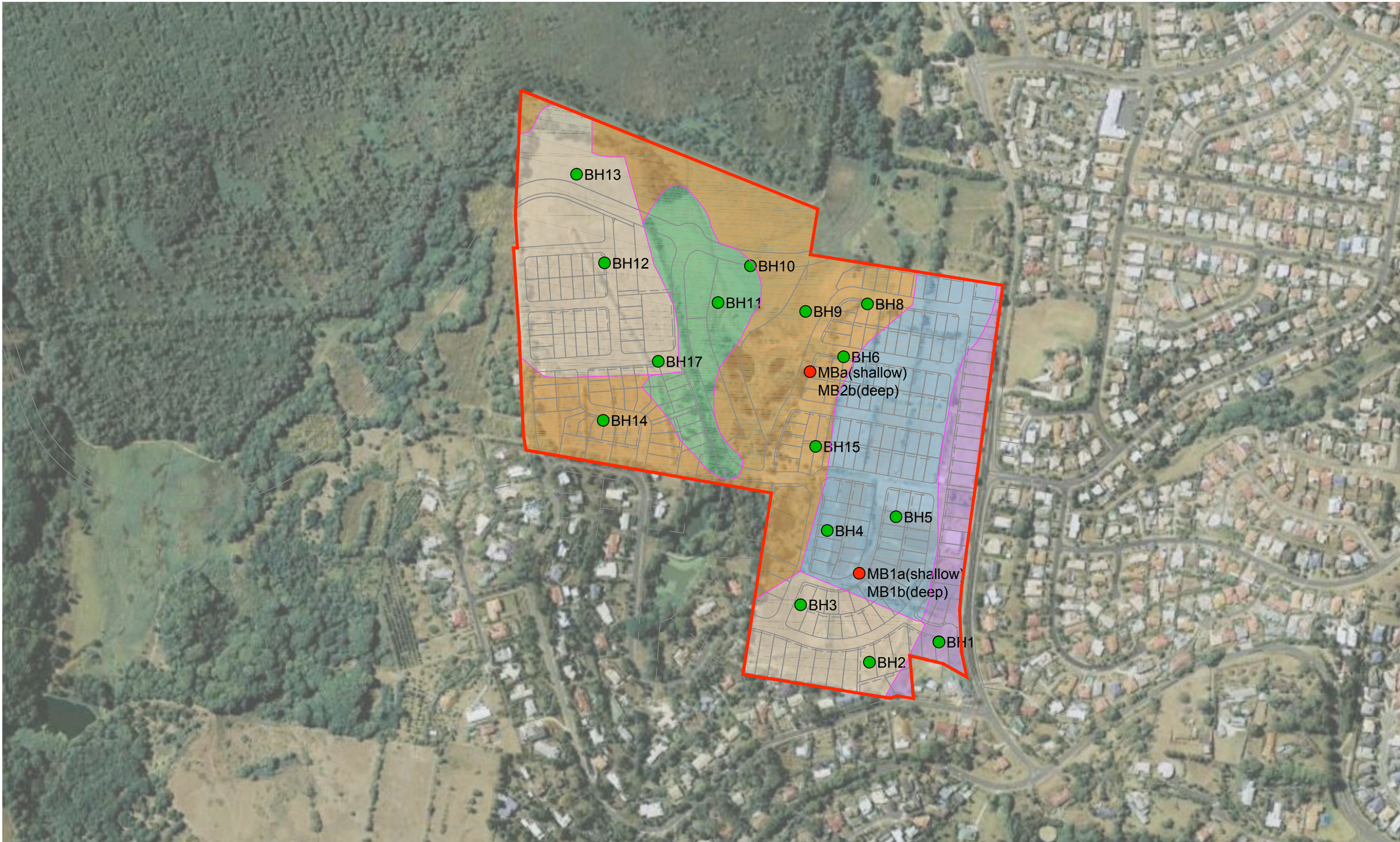
- be in writing; and
- specify the provisions of the SPMP to which the application relates; and
- state how the proposed amendments achieve the objectives of the provisions to which the amendments relate.

Tweed Shire Council shall approve the amendment where TSC is satisfied, acting reasonably, that the proposed amendments achieve the objective of the provisions to which the amendment relates.

3.2 Incident management

The Proponent and any person appointed by the Proponent as having responsibility for a control strategy set out in this SPMP have clearly defined responsibilities under the NSW *Protection of the Environment Operations Act* (1997) to report any incidents likely to cause material or serious environmental harm.

4 Appendix 1 – Reference drawing



ORIENTATION
NORTH

SCALE
50 100 150 200 250
metres

ROBINA
PO Box 4115 Robina QLD4230
Email robina@access.gs

07 5578 9944
www.access.gs

LEGEND	
	Site Boundary
	Gilbert & Sutherland Borehole
	Morrison Geotechnics Borehole
	Class 3- Grazing land or land well suited to pasture improvement
	Class 5 - Land unsuitable for agriculture
	Class 6 - Horticulture
	Class 9 - Urban
	Class 10 - Bananas

SOURCES
Image base: Google Earth Pro 2012
Agricultural Land Suitability: Area E Urban Release
Development Code- Supplementary Site Analysis 2011 V.2.0

PROJECT
TERRANORA
ALTITUDE ASPIRE

CLIENT
NEWLAND
DEVELOPERS PTY
LTD

DRAWING
AGRICULTURAL LAND
SUITABILITY CLASSES
AND BOREHOLE
LOCATIONS

SCALE 1:5 000@A3	DATE 09/04/2013	DRAWN AJS	CHECKED MLF	PROJECT NO 10849	DRAWING NO 6.1
----------------------------	---------------------------	---------------------	-----------------------	----------------------------	--------------------------

Brisbane Sydney Melbourne and regions

**+GILBERT
SUTHERLAND**

Agriculture. Water. Environment.

5 Appendix 2 – Borelogs

Borehole: MB1

Project: GJ0901

Client: Metricon Developments

Northing: 3877251

Easting: 551308

RL(m): _____

GILBERT+SUTHERLAND
agriculture - water - environment

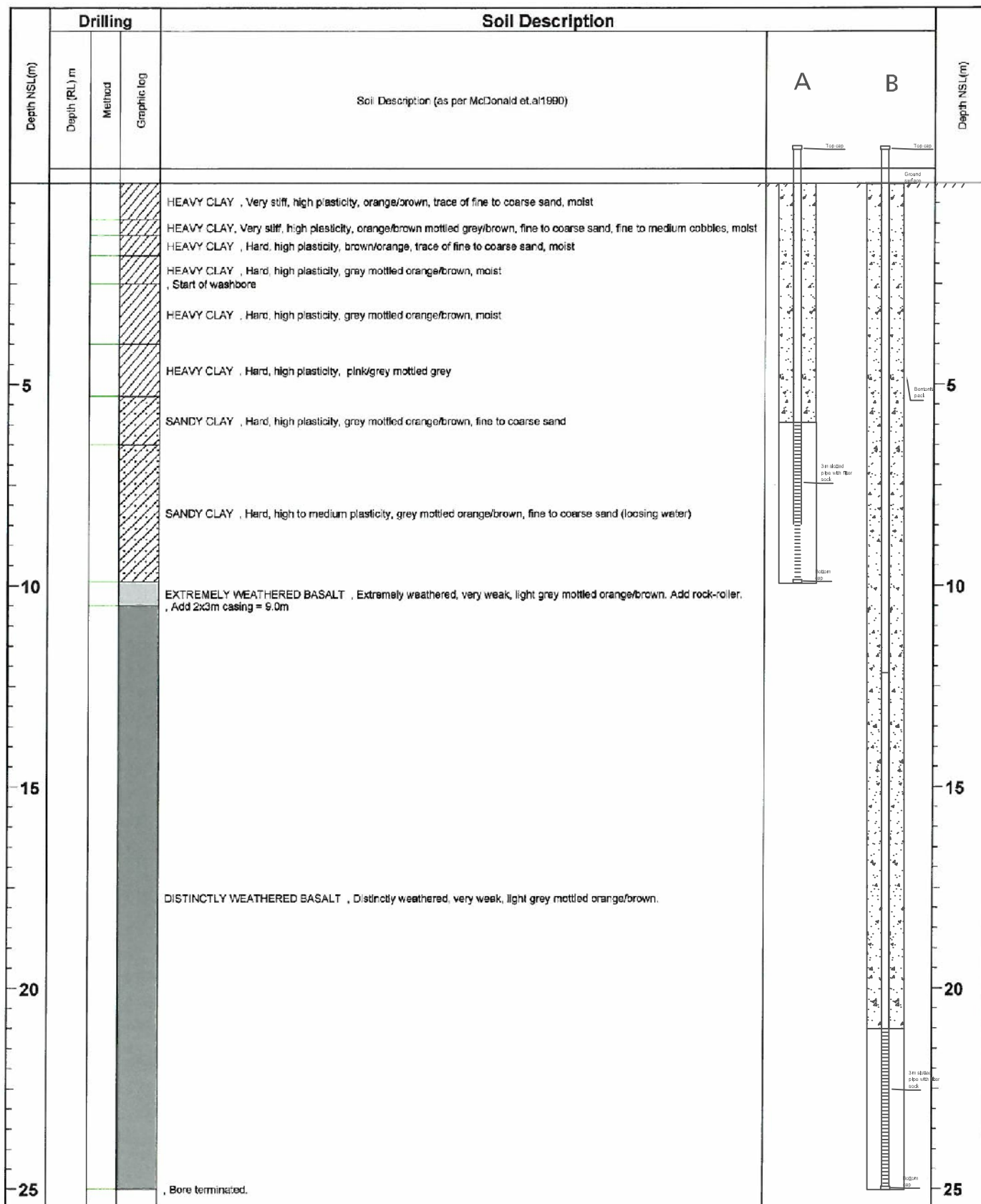
Depth (m): 25.00

Logged by: JT

Drilled by: Altitude 1

Start date: _____

Completion date: _____





Morrison Geotechnic Pty Ltd

A.B.N. 051 009 878 899
PO Box 3063, Darra, QLD 4076
Phone: (07) 3279 0900 Fax: (07) 3279 0955

Engineering Log - Borehole

Borehole No.: **BH4**

Page: 1 of 1

Job Number: GE10/001

Client: Metricon Pty Ltd

Project: Broadscale Geotechnical Investigation

Location: Altitude 1, Fraser Drive, Tweed Heads

Easting: 551431.00

Drilling Rig: Jacro 200

Northing: 6877214.00

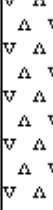
Driller: Morrison Geotechnic

RL:

Logged By: L. Bexley

Total Depth: 3.60

Date: 11/01/2010

Drilling Information				Material Description						Test Samples				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
TC bit with 100mm Dia. Auger			0.3	Slopewash		CI	Sandy CLAY: Hard, medium plasticity, red brown mottled orange brown with a trace of grey, fine to medium grained sand, moist		M	H		0.5 –	PP	>600kPa
			1.0			CI	Sandy CLAY: As above but with a trace of fine to coarse gravel		M	H				
			1.7			CL	Sandy CLAY (CL/CI)/ Clayey SAND (SC): Firm to stiff, low to medium plasticity fines, orange brown mottled grey and purple and red brown, fine to medium grained sand, moist to wet		M-W	F-St				
			2.0	Residual		/ CL CI	Sandy CLAY (CL/CI)/ Clayey SAND (SC): As above but grey mottled orange brown and res brown		M-W	F-St		1.8 –	PP	100kPa
			2.1											
			2.6			SC	Clayey SAND: Medium dense, fine to medium grained sand, grey mottled orange brown and red brown, low to medium plasticity fines, moist		M	MD				
			2.8	Bedrock		BAS	BASALT: Extremely weathered, very low strength, grey with some orange brown mottling	XW		VLS				
		3.0												
			3.6											
			4.0				3.60m: BOREHOLE TERMINATED AT MAX. TC BIT REFUSAL							

Comments:						Authorised by:	
						Date:	
Water	Weathering	Consistency	Density	Rock Strength	Tests & Results		
Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.		
Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	D Disturbed sample.		
Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.		
	SW Slightly weathered	St Stiff	D Dense	MS Medium	PP Hand penetrometer estimate of unconfined compressive strength, kPa.		
	FR Fresh	VSt Very stiff	VD Very dense	HS High	S Vane shear value kPa		
		H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.		
				EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes		
		Moisture					
		D Dry M Moist W Wet					



Morrison Geotechnic Pty Ltd

A.B.N. 051 009 878 899
PO Box 3063, Darra, QLD 4076
Phone: (07) 3279 0900 Fax: (07) 3279 0955

Engineering Log - Borehole

Borehole No.: **BH5**

Page: 1 of 2

Job Number: GE10/001

Client: Metricon Pty Ltd

Project: Broadscale Geotechnical Investigation

Location: Altitude 1, Fraser Drive, Tweed Heads

Easting: 551532.00

Drilling Rig: Jacro 200

Northing: 6877235.00

Driller: Morrison Geotechnic

RL:

Logged By: L. Bexley

Total Depth: 7.60

Date: 11/01/2010

Drilling Information				Material Description				Test Samples			
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results
TC bit with 100mm Dia. Auger			1.0	Residual		CH	Silty CLAY: Very stiff to hard, red brown, high plasticity moist		M	VSt-H	
			1.1			CH	Silty CLAY: As above but very stiff		M	VSt	
			2.0								
			2.2			CH	Silty CLAY: As above but dark grey mottled orange brown, and very stiff to hard		M	VSt-H	
			2.4			CH	Silty CLAY: As above but dark grey mottled blue grey with some orange brown mottling, and very stiff		M	VSt	
			3.0								
			3.1			CH	Silty CLAY: As above but red brown with some blue grey and orange brown mottling, and stiff		M	St	
			3.7			CH	Silty CLAY: As above but firm and wet		M	F	
			4.0								

Comments:					Authorised by:	
					Date:	
Water	Weathering	Consistency	Density	Rock Strength	Tests & Results	
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.	
► Water inflow	XW Extremely weathered	S Soft	L Loose	VLS Very low	D Disturbed sample.	
► Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	LS Low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.	
	SW Slightly weathered	VSt Very stiff	D Dense	MS Medium High	PP Hand penetrometer estimate of unconfined compressive strength, kPa.	
	FR Fresh	H Hard	VD Very dense	VHS Very high	S Vane shear value kPa	
				EHS Extremely high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.	
		Moisture			From AS1289-1993 Methods of Testing Soils for Engineering Purposes	
		D Dry M Moist W Wet				



Morrison Geotechnic Pty Ltd

A.B.N. 051 009 878 899
PO Box 3063, Darra, QLD 4076
Phone: (07) 3279 0900 Fax: (07) 3279 0955

Engineering Log - Borehole

Borehole No.: **BH5**

Page: 2 of 2

Job Number: GE10/001

Client: Metricon Pty Ltd

Project: Broadscale Geotechnical Investigation

Location: Altitude 1, Fraser Drive, Tweed Heads

Easting: 551532.00

Drilling Rig: Jacro 200

Northing: 6877235.00

Driller: Morrison Geotechnic

RL:

Logged By: L. Bexley

Total Depth: 7.60

Date: 11/01/2010

Drilling Information				Material Description						Test Samples				
Drill Method	Water	RL	Hole Depth (m)	Soil Origin	Graphic Log	Classification Code	Description	Weathering	Moisture	Consistency - Density - Strength	DC Test Results	Test Depth	Tests	Sample/Result
TC bit with 100mm Dia. Auger						CH	Silty CLAY: As above but firm and wet		M	F		4 /	PP	60kPa
			4.5			CH	Silty CLAY: As above but moist to wet		M-W	F		4.6 -	PP	75-100kPa
			5.0											
			5.1			CH	Silty CLAY: As above but soft to firm, and wet		W	S-F				
			6.0									6 -	PP	40-60kPa
			7.0											
			7.5											
			7.6											

Comments:						Authorised by:					
						Date:					
Water	Weathering	Consistency	Density	Rock Strength	Tests & Results						
▼ Water level on date shown	RS Residual soil	VS Very soft	VL Very loose	ELS Extremely low	U50 Undisturbed 50mm diam tube.						
► Water inflow	XW Extremely weathered	S Soft	L Loose	LS Low	D Disturbed sample.						
► Water outflow	DW Distinctly weathered	F Firm	MD Medium dense	VLS Very low	SPT Standard Penetration Test, N = number of blows to drive 50mm sampler 300mm with a 63.6kg hammer falling 762mm.						
	SW Slightly weathered	St Stiff	D Dense	LS Low	PP Hand penetrometer estimate of unconfined compressive strength, kPa.						
	FR Fresh	VSt Very stiff	VD Very dense	HS High	S Vane shear value kPa						
		H Hard		VHS Very high	DC Dynamic Cone test, 9.09kg hammer, fall 508mm, driving 20mm, 30 deg taper cone fitted to rods of smaller section.						
				EHS Extremely high	From AS1289-1993 Methods of Testing Soils for Engineering Purposes						
		Moisture									
		D Dry M Moist W Wet									