



Hunter Geotechnics

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HGM 004-1RR
27th May 2010

GP: gp

McCloy Group
PO Box 2214
DANGAR NSW 2309

Attention: Shane Boslem

Dear Sir,

Re: Northlakes Estate Stage 23, Cameron Park: AS2870 Classifications.

1.0 INTRODUCTION

As requested, we have carried out geotechnical studies at the above residential subdivision site in order to provide Classifications for Stage 23 Lots 2301 to 2323 in accordance with AS2870-1996 "Residential Slabs and Footings - Construction". Our studies were carried out near the completion of subdivision earthworks.

This Company was not engaged to carry out pavement testing or other Geotechnical services during subdivision earthworks on Stage 23 and we were advised by the McCloy Group that filling has not been carried out on residential Lots.

A plan of the site is shown on the attached Drawing HGM 004-01. This report should be read in conjunction with the attached General Notes.

2.0 FIELDWORK

Fieldwork carried out on 13th May 2010 included fourteen test pits (TP01 to TP14) by backhoe to depths ranging from 0.35m to 2.1m. Dynamic Cone Penetrometer (DCP) testing was carried out at some of the test pit locations to aid assessment of in-situ consistency/relative density.

The fieldwork was carried out by one of our Senior Geotechnicians who selected the test pit locations, performed in-situ testing and sampling and prepared field logs of the profiles encountered.

Test Pit Logs are attached and approximate test pit locations are shown on the above Drawing.

3.0 LABORATORY TESTING

Laboratory Shrink-Swell Index tests were carried out on eight samples of varying clay content to aid assessment of soil volume change characteristics with variations in soil moisture content (soil reactivity).

The laboratory test result are attached and discussed in Section 5.0.

4.0 SITE CONDITIONS

4.1 Surface

Stage 23 is situated within regionally undulating terrain and in particular occupies north-east and south-east facing slopes of about 5° to 10°. The site is located to the north of Constitution Avenue and the Lots front Nithsdlle Street, Meander Grove and Raleigh Street. The site is bound by recently completed Stage 22 to the west, future Stage 24 to the east and undeveloped land to the north and south.

Road embankment fill appears to extend into the front of Lots 2307, 2310 and 2318 to 2320 however the depth of fill within possible building areas is expected to be shallow. SANDSTONE rock is locally exposed within the front of Lot 2306.

Vegetation at the time of investigation comprised a scattering of medium sized trees which are situated within or near the boundary of each Lot. Surface soils generally comprise Silty SAND topsoil. The Lots were being dressed with mulch at the time of investigation.

4.2 Subsurface

Newcastle Soil Landscape Series Sheet 9232 (Department of Land and Water Conservation) indicates the site to be situated near the boundary of *Warners Bay (Wa) Residual Landscape* to the south-west and *Killingworth (Ki) Erosional Landscape* to the north-east.

The Warners Bay Residual Landscape and Killingworth Erosional Landscape are both characterised by undulating to rolling hills and low hills on fine grained sediments of the Newcastle Coal Measures in the Awaba Hills. Soils of each landscape typically comprise shallow to moderately deep Yellow Podzolic Soils, Yellow Soloths, Gleyed Podzolic Soils and Structured Loams. Development limitations of both Landscapes are reported to include moderate to high shrink-swell potential, water erosion and position within a mine subsidence district.

Subsurface conditions encountered within **the uphill eastern portion of the site at TP1 to TP7, TP12 and TP13** are generalised as follows:

<u>Layer/Description</u>	<u>Depth to Base of Layer (m)</u>
TOPSOIL: Silty SAND, brown, some organics	0.05 to 0.5
RESIDUAL: Clayey GRAVEL & Clayey Sandy GRAVEL, fine to medium gravel, brown, low to medium plasticity, dry/moist (except TP7, TP12, TP13)	0.3 to >1.8
ROCK: SANDSTONE & SILTSTONE, highly weathered, yellow-brown/orange brown/pale grey (except TP1): bucket refusal (R)	0.35R to 1.7

Subsurface conditions encountered **within the downhill western portion of the site at TP8 to TP11 and TP14** are generalised as follows:

<u>Layer/Description</u>	<u>Depth to Base of Layer (m)</u>
TOPSOIL: Silty SAND, brown, some organics	0.2
RESIDUAL: CLAY & Gravelly CLAY, medium to high and low to medium plasticity, grey-brown, M>Wp, stiff/very stiff to hard	0.55 to 1.8
ROCK: SANDSTONE & SILTSTONE, highly weathered, yellow-brown/orange brown/pale grey (except TP10): bucket refusal (R)	1.1R to 1.8R

Groundwater was not encountered within the test pits at the time of investigation however it is pointed out that groundwater levels and seepages may fluctuate with variations in rainfall, site drainage and other factors.

5.0 DISCUSSION & RECOMMENDATIONS

Laboratory testing indicates the medium to high plasticity residual CLAY to be of moderate to high reactivity with Shrink Swell Index (Iss) values of 2.3%, 2.9% and 3.1% (3 tests), the low to medium plasticity residual Gravelly CLAY to be of moderate reactivity with Iss values of 1.4% and 1.8% (2 tests), the residual Clayey GRAVEL and Clayey Sandy GRAVEL to be of low reactivity with Iss values of 0.6% (2 tests) and the highly weathered ROCK to be of low reactivity with an Iss value of 0.4% (1 test).

Based on the above, we have adopted the following design Iss values for calculation of characteristic surface movements:

- Residual: CLAY Iss 3%
- Residual Gravelly CLAY Iss 2.0%
- Residual: Clayey GRAVEL Iss 1.0%
- Rock: highly weathered SANDSTONE & SILTSTONE Iss 0.5%

Characteristic surface movement (y_s) is assessed to range from about 0mm to 25mm for existing site conditions across the Stage 23 site. This assessment is based on a change in suction at the soil surface (Δu) of 1.5pF, a 1.8m depth of seasonal moisture variation (H_s) and the presence of a 0.9m deep soil cracked zone.

Based on the above, Lots are currently assessed in accordance AS2870-1996 "Residential Slabs and Footings - Construction" as follows:

Class S (Slightly Reactive): Lots 2305 to 2312, and 2318 to 2323 inclusive.

Class P (Problem): Lots 2301 to 2304 and 2313 to 2317 inclusive.

A summary table of the above lot classifications is attached.

Lots 2301 to 2304 and 2313 to 2317 are assessed to have y_s values in the Class M (Moderately Reactive) range of AS2870-1996 however are assessed as Class P (Problem) in accordance with Clause 2.4.4 (e) of the same Standard due to potential abnormal soil moisture conditions associated with the presence of trees within or near a future footing.

High level footing systems may be considered for the Lots classified as Class S and should be designed and constructed in accordance with the recommendations and advice in AS2870-1996. In particular, all footings should be founded on suitable natural soil beneath any shallow (<0.4m depth) topsoil, uncontrolled fill or other deleterious material. Notwithstanding the above, if rock is encountered in part of a footing system then the balance of the footing system on that lot should be extended or pierced to strata of similar stiffness to reduce the potential effects of differential movement.

High level footing designs presented in AS2870-1996 do not cover Class P sites therefore the footing systems for such Lots will need to be designed by a Civil/Structural Engineering Consultant.

The above AS2870 Classifications and related advice are provided on the basis that the performance expectations set out in Appendix B of AS2870-1996 are acceptable and that future site maintenance is in accordance with the recommendations and advice contained in CSIRO BTF-18, a copy of which is attached. Appendix B of AS2870-1996 includes restrictions on trees and shrubs, and indicates that tree planting should be restricted to a distance from the building of not less than 0.75 x mature tree height for Class M sites in order to reduce the possibility of drying related damage.

Further geotechnical advice should be sought if there is to be substantial future cut/fill earthworks (>0.4m depth) on any of the Lots during possible benching in order to verify that the above Classifications remain valid. We would be pleased to provide additional geotechnical guidance on a site specific basis if required when house design details are available.

This Company has not made an enquiry with the Mine Subsidence Board regarding residential construction on Stage 23 Lots. Please contact our Morisset Laboratory Manager Steve Waugh or the undersigned if you require further assistance.

For and on behalf of
Hunter Geotechnics Pty Ltd



Gary Peake *BE (Civil), GCE, MIE Aust*
Principal Geotechnical Engineer

*Encl: Summary Table of Current AS2870 Classifications
Test Pit Logs (TP01 to TP14)
General Notes, Terms and Symbols
Laboratory Shrink-Swell Test Report Nos: S2026-01 to S2026-03
Drawing HGM 004-01 Site Plan
CSIRO Sheet BTF-18 "Foundation Maintenance & Footing Performance: A Homeowner's Guide"*

McCloy Group

Northlakes Estate Stage 23
Cameron Park, NSW 2285

SUMMARY TABLE OF CURRENT AS2870 CLASSIFICATIONS

<i>Lot</i>	<i>Class</i>
2301	P
2302	P
2303	P
2304	P
2305	S
2306	S
2307	S
2308	S
2309	S
2310	S
2311	S
2312	S
2313	P
2314	P
2315	P
2316	P
2317	P
2318	S
2319	S
2320	S
2321	S
2322	S
2323	S

Notes:

- *Class S denotes Slightly Reactive.*
- *Class P denotes Problem Site.*
- *The above Lots classified as Class P are assessed to have characteristic surface movement (ys) values in the Class M (Moderately Reactive) range of AS2870-1996 however are assessed as Class P in accordance with Clause 2.4.4 (e) of the same Standard due to potential abnormal soil moisture conditions associated with the presence of trees within or near a future footing.*



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TEST PIT NUMBER TP01

CLIENT McClroy Group PROJECT NAME Northlakes Estate Stage 23
 PROJECT NUMBER HGM 004 PROJECT LOCATION Cameron Park

DATE STARTED 13/5/10 COMPLETED 13/5/10 R.L. SURFACE _____ DATUM _____
 EXCAVATION CONTRACTOR _____ SLOPE --- BEARING ---
 EQUIPMENT Backhoe TEST PIT LOCATION Refer to Site Plan Drawing M004-01
 TEST PIT SIZE 600mm wide LOGGED BY S.W. CHECKED BY G.P.

NOTES Rear of Lots 2317/2318/2319

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
BH			0.5		SM	Silty SAND, brown, some organic matter, dry		TOPSOIL
					SM	Silty SAND, brown, dry		
					GC/CL	Clayey GRAVEL, fine to medium gravel, brown, inclusions of medium plasticity sandy clay, dry to moist		
			1.0				Iss = 1.8%	RESIDUAL
			1.5					
			2.0			Borehole TP01 terminated at 1.8m		
			2.5					

BOREHOLE / TEST PIT HGM 004.GPJ GINT STD AUSTRALIA.GDT 27/5/10



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TEST PIT NUMBER TP02

CLIENT McCloy Group PROJECT NAME Northlakes Estate Stage 23
 PROJECT NUMBER HGM 004 PROJECT LOCATION Cameron Park

DATE STARTED 13/5/10 COMPLETED 13/5/10 R.L. SURFACE _____ DATUM _____
 EXCAVATION CONTRACTOR _____ SLOPE --- BEARING ---
 EQUIPMENT Backhoe TEST PIT LOCATION Refer to Site Plan Drawing M004-01
 TEST PIT SIZE 600mm wide LOGGED BY S.W. CHECKED BY G.P.

NOTES Front of Lots 2319/2320

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
BH			0.5		SM	Silty SAND, brown, some organic matter, dry		TOPSOIL
					GC-GP	Clayey Sandy GRAVEL, fine to medium gravel, brown, medium plasticity clay, some cobbles, moist	DCP from 0.0m depth: 10, 17, 6, 20R (Blows/150mm)	RESIDUAL
			1.0				Iss = 0.6%	
			1.5			Borehole TP02 terminated at 1.5m		Bucket Refusal on Rock
			2.0					
			2.5					

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TEST PIT NUMBER TP03

CLIENT McClroy Group **PROJECT NAME** Northlakes Estate Stage 23
PROJECT NUMBER HGM 004 **PROJECT LOCATION** Cameron Park

DATE STARTED 13/5/10 **COMPLETED** 13/5/10 **R.L. SURFACE** _____ **DATUM** _____
EXCAVATION CONTRACTOR _____ **SLOPE** --- **BEARING** ---
EQUIPMENT Backhoe **TEST PIT LOCATION** Refer to Site Plan Drawing M004-01
TEST PIT SIZE 600mm wide **LOGGED BY** S.W. **CHECKED BY** G.P.

NOTES Front of Lots 2321/2322

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
BH			0.5		ML	Sandy SILT, brown, some organic matter, dry		TOPSOIL RESIDUAL
					GP-GC	Clayey Sandy GRAVEL, fine to medium gravel, brown, low plasticity, moist		
					SANDSTONE, highly weathered, fine to medium grained, yellow-brown/pale grey, dry	ROCK		
						Borehole TP03 terminated at 0.6m		Bucket Refusal on Rock
			1.0					
			1.5					
			2.0					
			2.5					

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TEST PIT NUMBER TP04

CLIENT McCloy Group **PROJECT NAME** Northlakes Estate Stage 23
PROJECT NUMBER HGM 004 **PROJECT LOCATION** Cameron Park

DATE STARTED 13/5/10 **COMPLETED** 13/5/10 **R.L. SURFACE** _____ **DATUM** _____
EXCAVATION CONTRACTOR _____ **SLOPE** --- **BEARING** ---
EQUIPMENT Backhoe **TEST PIT LOCATION** Refer to Site Plan Drawing M004-01
TEST PIT SIZE 600mm wide **LOGGED BY** S.W. **CHECKED BY** G.P.

NOTES Lots 2322/2323

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
BH			0.5		SM	Silty SAND, brown, some organic matter, dry		TOPSOIL
					GP	Sandy GRAVEL, fine gravel, orange-brown, fine to medium sand, dry		RESIDUAL
						SANDSTONE, highly weathered, fine to medium grained, yellow-brown/pale grey, dry		ROCK
			1.0			Borehole TP04 terminated at 0.8m		Bucket Refusal on Rock
			1.5					
			2.0					
			2.5					

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TEST PIT NUMBER TP05

CLIENT McCloy Group PROJECT NAME Northlakes Estate Stage 23
 PROJECT NUMBER HGM 004 PROJECT LOCATION Cameron Park

DATE STARTED 13/5/10 COMPLETED 13/5/10 R.L. SURFACE _____ DATUM _____
 EXCAVATION CONTRACTOR _____ SLOPE --- BEARING ---
 EQUIPMENT Backhoe TEST PIT LOCATION Refer to Site Plan Drawing M004-01
 TEST PIT SIZE 600mm wide LOGGED BY S.W. CHECKED BY G.P.

NOTES Lots 2308/2309

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
BH			0.5		SM	Silty SAND, brown, dry		TOPSOIL
					GP-GC	Clayey Sandy GRAVEL, fine to medium grained, brown, low plasticity, dry		RESIDUAL
						SILTSTONE, highly weathered, pale grey, dry		ROCK
						Borehole TP05 terminated at 0.6m		Bucket Refusal on Rock

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TEST PIT NUMBER TP06

CLIENT McCloy Group PROJECT NAME Northlakes Estate Stage 23
 PROJECT NUMBER HGM 004 PROJECT LOCATION Cameron Park

DATE STARTED 13/5/10 COMPLETED 13/5/10 R.L. SURFACE _____ DATUM _____
 EXCAVATION CONTRACTOR _____ SLOPE --- BEARING ---
 EQUIPMENT Backhoe TEST PIT LOCATION Refer to Site Plan Drawing M004-01
 TEST PIT SIZE 600mm wide LOGGED BY S.W. CHECKED BY G.P.

NOTES Lots 2307/2310

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
BH			0.5		SM	Silty SAND, brown, dry		TOPSOIL
					GP-GC	Clayey Sandy GRAVEL, fine to medium gravel, brown, low plasticity, dry to moist		FILL (Road Embankment)
					GP-GC	Gravelly Sandy CLAY/Clayey Sandy GRAVEL, fine to medium, brown, low plasticity, dry to moist	Iss = 0.6%	RESIDUAL
						SANDSTONE, highly weathered, fine to medium gravel, orange-brown, dry		ROCK
			1.0			Borehole TP06 terminated at 0.9m		Bucket Refusal on Rock
			1.5					
			2.0					
			2.5					

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TEST PIT NUMBER TP07

CLIENT McCloy Group **PROJECT NAME** Northlakes Estate Stage 23
PROJECT NUMBER HGM 004 **PROJECT LOCATION** Cameron Park

DATE STARTED 13/5/10 **COMPLETED** 13/5/10 **R.L. SURFACE** _____ **DATUM** _____
EXCAVATION CONTRACTOR _____ **SLOPE** --- **BEARING** ---
EQUIPMENT Backhoe **TEST PIT LOCATION** Refer to Site Plan Drawing M004-01
TEST PIT SIZE 600mm wide **LOGGED BY** S.W. **CHECKED BY** G.P.

NOTES Front of Lots 2311/2312

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
BH			0.5		SM	Silty SAND, brown, some organic matter, moist		TOPSOIL
						SANDSTONE, highly weathered, fine to medium gravel, orange-brown, dry		ROCK
						Borehole TP07 terminated at 0.6m		Bucket Refusal on Rock
			1.0					
			1.5					
			2.0					
			2.5					

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TEST PIT NUMBER TP08

CLIENT McCloy Group PROJECT NAME Northlakes Estate Stage 23
 PROJECT NUMBER HGM 004 PROJECT LOCATION Cameron Park

DATE STARTED 13/5/10 COMPLETED 13/5/10 R.L. SURFACE _____ DATUM _____
 EXCAVATION CONTRACTOR _____ SLOPE --- BEARING ---
 EQUIPMENT Backhoe TEST PIT LOCATION Refer to Site Plan Drawing M004-01
 TEST PIT SIZE 600mm wide LOGGED BY S.W. CHECKED BY G.P.

NOTES Rear of Lots 2316/2317

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
BH			0.0		SM	Silty SAND, brown, dry to moist		TOPSOIL
			0.5		CL/CH	CLAY, medium to high plasticity, grey-brown, M>Wp, stiff/very stiff		RESIDUAL
			1.0			SANDSTONE, highly weathered, fine to medium grained, brown, some low plasticity clay		ROCK
			1.5			Borehole TP08 terminated at 1.5m		Bucket Refusal on Rock
			2.0					
			2.5					

BOREHOLE / TEST PIT HGM 004.GPJ GINT STD AUSTRALIA.GDT 27/5/10

DCP from 0.0m
 depth: 2, 2, 4, 7,
 9, 9
 (Blows/150mm)



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TEST PIT NUMBER TP09

CLIENT McCloy Group PROJECT NAME Northlakes Estate Stage 23
 PROJECT NUMBER HGM 004 PROJECT LOCATION Cameron Park

DATE STARTED 13/5/10 COMPLETED 13/5/10 R.L. SURFACE _____ DATUM _____
 EXCAVATION CONTRACTOR _____ SLOPE --- BEARING ---
 EQUIPMENT Backhoe TEST PIT LOCATION Refer to Site Plan Drawing M004-01
 TEST PIT SIZE 600mm wide LOGGED BY S.W. CHECKED BY G.P.

NOTES Front of Lot 2316

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations	
BH			0.0 - 0.1		SM	Silty SAND, brown, dry to moist		TOPSOIL	
			0.1 - 0.5		CL/CH	CLAY, medium to high plasticity, brown, moist to wet		Iss = 3.1% DCP from 0.0m depth: 14, 10, 10, 12, 25R (Blows/150mm)	RESIDUAL
			0.5 - 1.1			SILTSTONE, highly weathered, brown, some low to medium plasticity clay		Iss = 0.4%	ROCK
			1.1 - 2.5			Borehole TP09 terminated at 1.1m			

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TEST PIT NUMBER TP10

CLIENT McCloy Group **PROJECT NAME** Northlakes Estate Stage 23
PROJECT NUMBER HGM 004 **PROJECT LOCATION** Cameron Park

DATE STARTED 13/5/10 **COMPLETED** 13/5/10 **R.L. SURFACE** _____ **DATUM** _____
EXCAVATION CONTRACTOR _____ **SLOPE** --- **BEARING** ---
EQUIPMENT Backhoe **TEST PIT LOCATION** Refer to Site Plan Drawing M004-01
TEST PIT SIZE 600mm wide **LOGGED BY** S.W. **CHECKED BY** G.P.

NOTES Rear of Lots 2313/2314

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
BH			0.0		SM	Silty SAND, brown, dry to moist		TOPSOIL
			0.5		CL	Gravelly CLAY, low to medium plasticity, brown, gravel increasing with depth, M-Wp, hard	DCP from 0.0m depth: 10, 14, 35R (Blows/150mm)	RESIDUAL
			1.0		ML	Sandy SILT, low plasticity, black-brown, M-Wp	Iss = 1.4%	
			2.0		ML	Sandy SILT, low plasticity, black-brown, M-Wp		
			2.5			Borehole TP10 terminated at 2.1m		

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TEST PIT NUMBER TP11

CLIENT McCloy Group PROJECT NAME Northlakes Estate Stage 23
 PROJECT NUMBER HGM 004 PROJECT LOCATION Cameron Park

DATE STARTED 13/5/10 COMPLETED 13/5/10 R.L. SURFACE _____ DATUM _____
 EXCAVATION CONTRACTOR _____ SLOPE --- BEARING ---
 EQUIPMENT Backhoe TEST PIT LOCATION Refer to Site Plan Drawing M004-01
 TEST PIT SIZE 600mm wide LOGGED BY S.W. CHECKED BY G.P.

NOTES Front of Lot 2315

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
BH			0.0		SM	Silty SAND, brown, some organic matter, dry to moist		TOPSOIL
			0.5		CL/CH	CLAY, medium to high plasticity, grey, moist, with tree roots		RESIDUAL
			1.0			SANDSTONE, highly weathered, fine to medium grained, brown, some low plasticity clay	Iss = 2.9%	ROCK
			1.5					
			2.0			Borehole TP11 terminated at 1.8m		Bucket Refusal on Rock
			2.5					

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TEST PIT NUMBER TP12

CLIENT McCloy Group PROJECT NAME Northlakes Estate Stage 23
 PROJECT NUMBER HGM 004 PROJECT LOCATION Cameron Park

DATE STARTED 13/5/10 COMPLETED 13/5/10 R.L. SURFACE _____ DATUM _____
 EXCAVATION CONTRACTOR _____ SLOPE --- BEARING ---
 EQUIPMENT Backhoe TEST PIT LOCATION Refer to Site Plan Drawing M004-01
 TEST PIT SIZE 600mm wide LOGGED BY S.W. CHECKED BY G.P.

NOTES Rear of Lots 2305/2306

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
BH			0.5		SM	Silty SAND, brown, dry		TOPSOIL
						SANDSTONE, highly weathered, fine to medium grained, brown		ROCK
						Borehole TP12 terminated at 0.35m		Bucket Refusal on Rock
			1.0					
			1.5					
			2.0					
			2.5					

BOREHOLE / TEST PIT HGM 004.GPJ GINT STD AUSTRALIA.GDT 27/5/10



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TEST PIT NUMBER TP13

CLIENT McCloy Group PROJECT NAME Northlakes Estate Stage 23
 PROJECT NUMBER HGM 004 PROJECT LOCATION Cameron Park

DATE STARTED 13/5/10 COMPLETED 13/5/10 R.L. SURFACE _____ DATUM _____
 EXCAVATION CONTRACTOR _____ SLOPE --- BEARING ---
 EQUIPMENT Backhoe TEST PIT LOCATION Refer to Site Plan Drawing M004-01
 TEST PIT SIZE 600mm wide LOGGED BY S.W. CHECKED BY G.P.

NOTES Front of Lots 2303/2304

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
BH					SM	Silty SAND, brown, dry		TOPSOIL
						SILTSTONE, extremely to highly weathered, orange-brown/grey, dry		ROCK

BOREHOLE / TEST PIT HGM 004.GPJ GINT STD AUSTRALIA.GDT 27/5/10



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TEST PIT NUMBER TP14

CLIENT McCloy Group PROJECT NAME Northlakes Estate Stage 23
 PROJECT NUMBER HGM 004 PROJECT LOCATION Cameron Park

DATE STARTED 13/5/10 COMPLETED 13/5/10 R.L. SURFACE _____ DATUM _____
 EXCAVATION CONTRACTOR _____ SLOPE --- BEARING ---
 EQUIPMENT Backhoe TEST PIT LOCATION Refer to Site Plan Drawing M004-01
 TEST PIT SIZE 600mm wide LOGGED BY S.W. CHECKED BY G.P.

NOTES Rear of Lots 2301/2302

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Additional Observations
BH			0.0		SM	Silty SAND, brown, dry	DCP from 0.0m depth: 9, 10, 13, 15, 20R (Blows/150mm) Iss = 2.3%	TOPSOIL
			0.5		CL/CH	CLAY, medium to high plasticity, orange-brown, M-Wp, hard		RESIDUAL
			1.0			SILTSTONE, highly weathered, orange-brown/grey, dry		ROCK
			1.5					
			2.0					
			2.5					
						Borehole TP14 terminated at 1.8m		Bucket Refusal on Rock

BOREHOLE / TEST PIT HGM 004.GPJ GINT STD AUSTRALIA.GDT 27/5/10



General Notes Terms and Symbols

GENERAL

Geotechnical reports present the results of investigations carried out for a specific project and usually for a specific phase of the project (e.g. preliminary design). The report may not be relevant for other phases of the project (e.g. construction), or where projects details change.

SOIL AND ROCK DESCRIPTIONS

Soil and rock descriptions are based on AS 1726-1993, using visual and tactile assessment except at discrete locations where field and / or laboratory tests have been carried out. Refer opposite for term and symbol definitions.

GROUNDWATER

The water levels indicated on the logs are taken at the time of measurement and depending on material permeability may not reflect the actual groundwater level at those specific locations. Also, groundwater levels can vary with time due to seasonal or tidal fluctuations and construction activities.

INTERPRETATION OF RESULTS

The discussion and recommendations in the accompanying report are based on extrapolation / interpolation from data obtained at discrete locations. The actual interface between the materials may be far more gradual or abrupt than indicated. Also, actual conditions in areas not sampled may differ from those predicted.

CHANGE IN CONDITIONS

Subsurface conditions can change with time and can vary between test locations. Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations can also affect subsurface conditions.

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FURTHER ADVICE

We would be pleased to further discuss how any of the above issues could affect your specific project. We would also be please to provide further advice or assistance including.

- Assessment of suitability of design and construction techniques;
- Contract documentation and specification;
- Construction control testing (earthworks, pavement materials, concrete);
- Construction advice (foundation assessments, excavation support).

SOIL DESCRIPTIONS

Consistency		Qu (kPa)	Density Index		I _D (%)
VS	Very Soft	<25	VL	Very Loose	< 15
S	Soft	25 – 50	L	Loose	15 – 35
F	Firm	50 – 100	MD	Medium Dense	35 – 65
St	Stiff	100 – 200	D	Dense	65 – 85
VSt	Very Stiff	200 – 400	VD	Very Dense	> 85
H	Hard	>400			
Fb	Friable	- -			

Moisture Condition					
D	Dry	M	Moist	W	Wet
W _p	Plastic Limit	WL	Liquid Limit		

ROCK DESCRIPTIONS

Weathering		Structure	Spacing
RS	Residual Soil	Thinly laminated	< 6 mm
XW	Extremely Weathered	Laminated	6 – 20 mm
HW	Highly Weathered	Very Thinly bedded	20 – 60 mm
MW	Moderately Weathered	Thinly bedded	60 – 200 mm
DW	Distinctly Weathered*	Medium bedded	0.2 – 0.6 m
SW	Slightly Weathered	Thickly bedded	0.6 – 2m
FR	Fresh	Very thickly bedded	> 2 m

*DW covers HW & MW

Strength	I _{s(50)} Mpa	
EL	Extremely Low	< 0.03
VL	Very Low	0.03 – 0.1
L	Low	0.1 – 0.3
M	Medium	0.3 – 1
H	High	1 – 3
VH	Very High	3 – 10
EH	Extremely High	> 10

X = diametral test
O = axial test

Natural Fractures			
Type	Shape	Infill / Coating	Roughness
JT	Joint	pl planar	pol polished
BP	Bedding plane	cu curved	slk slickensided
SM	Seam	un undulose	smo smooth
FZ	fractured zone	st stepped	rou rough
SZ	Shear zone	ir irregular	vro very rough
VN	Vein	dis discontinuous	
		mi micaceous	
		qz quartz	

Note: Soil and rock descriptions are based on AS 1726 – 1993.

EXCAVATION / DRILLING

METHOD & CASING		SAMPLES / TESTS & WATER MEASUREMENTS	
BH	Backhoe / excavator bucket	B	Bulk sample
NE	Natural exposure	D	Disturbed sample
HE	Hand excavation	U50	Undisturbed sample ϕ 50mm
AS	Auger screwing*	PP	Pocket penetrometer (kPa)
AD	Auger drilling*	SV	Shear vane test (kPa)
	* bit type shown by suffix	SPT	Standard penetration test
	V = 'V' shaped Bit	N*	SPT value (blows/300mm)
	T = Tungsten carbide Bit		* Denotes sample taken
	B = Blank Bit	Nc	SPT value with solid cone
R	Roller / Tricone	DCP	Dynamic cone penetrometer (blows/150mm)
W	Washbore	R	Refusal of SPT or DCP
NMLC	NMLC size core drilling	▼	Water Level during drilling
NQ/HQ	Wireline core drilling	▽	Water Level after drilling
C	Casing	▲-	Water Inflow
M	Mud	-▲	Water Outflow

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Singleton NSW 2330

SHRINK SWELL INDEX TEST REPORT**(Australian Standard 1289.7.1.1)**

CLIENT: McCloy Group
CLIENT ADDRESS: PO Box 2214, Dangar NSW 2309
PROJECT: Site Classifications
DATE OF TESTING: 14/05/2010
LOCATION: Northlakes Estate, Stage 23, Cameron Park

REPORT No: S2026-01
PROJECT No: HGS 2026
DATE OF REPORT: 25/05/2010
TECHNICIAN: T.C.

Sample Number:	1	2	3
Sample Location	TP1	TP2	TP6
Date Sampled	13/05/2010	13/05/2010	13/05/2010
Date Tested	14/05/2010	14/05/2010	14/05/2010
Sample Description	Brown Clayey Gravel	Brown Clayey Sandy Gravel	Brown Gravely Sandy Clay
Depth	0.9 - 1.2m	0.4 - 0.7m	0.4 - 0.6m
Test Procedure			
Shrink Specimen			
Moisture Content (Field) %	20.1	14.4	15.6
AS1289.2.1.1			
Swell Specimen			
Moisture Content (Before & After) %	19.8 / 25.6	14.9 / 16.3	15.9 / 17.7
AS1289.2.1.1			
Maximum Swell (Esw) %	2.5	0.0	0.0
AS1289.7.1.1			
Maximum Shrink (Esh) %	1.9	1.0	1.0
As1289.7.1.1			
Shrink Swell Index (Iss) %	1.8	0.6	0.6
Cracking :	Moderate - High	Moderate	Minor
Crumbling:	Minor	Moderate - High	Moderate - High
% Inert Inclusions:	<10	<20	<20
Sampled By:	Hunter Geotechnics	Hunter Geotechnics	Hunter Geotechnics

Remarks

Samples Remoulded

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Signed: 

Approved Signatory

R Thompson

Document ID: R-T12

Issue No: 5

Date of Issue: 30-Jul-09



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Signatory Name:

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Date of Issue:

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SHRINK SWELL INDEX TEST REPORT**(Australian Standard 1289.7.1.1)**

CLIENT: McCloy Group
CLIENT ADDRESS: PO Box 2214, Dangar NSW 2309
PROJECT: Site Classifications
DATE OF TESTING: 14 & 18/05/2010
LOCATION: Northlakes Estate, Stage 23, Cameron Park

REPORT No: S2026-02
PROJECT No: HGS 2026
DATE OF REPORT: 25/05/2010
TECHNICIAN: T.C.

Sample Number:	4	5	6
Sample Location	TP9	TP9	TP10
Date Sampled	13/05/2010	13/05/2010	13/05/2010
Date Tested	14/05/2010	18/05/2010	18/05/2010
Sample Description	Brown Silty Clay	Grey Sandy Gravel	Grey Sandy Gravely Clay
Depth	0.2 - 0.5m	0.6 - 0.9m	0.5 - 0.7m
Test Procedure			
Shrink Specimen			
Moisture Content (Field) %	23.1	11.9	16.6
AS1289.2.1.1			
Swell Specimen			
Moisture Content (Before & After) %	23.5 / 25.8	11.6 / 19.0	16.9 / 21.3
AS1289.2.1.1			
Maximum Swell (Esw) %	1.7	0.0	0.7
AS1289.7.1.1			
Maximum Shrink (Esh) %	4.7	0.8	2.1
As1289.7.1.1			
Shrink Swell Index (Iss) %	3.1	0.4	1.4
Cracking :	None	Moderate - High	High
Crumbling:	None	Moderate	Moderate
% Inert Inclusions:	<5	<15	<20
Sampled By:	Hunter Geotechnics	Hunter Geotechnics	Hunter Geotechnics

Remarks

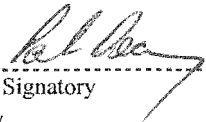
Samples Remoulded

Sample 5 - +3% Moisture Added

Sample 6 - +2% Moisture Added

HGM 004

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Issue No:

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Date of Issue:

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SHRINK SWELL INDEX TEST REPORT**(Australian Standard 1289.7.1.1)**

CLIENT: McCloy Group
CLIENT ADDRESS: PO Box 2214, Dangar NSW 2309
PROJECT: Site Classifications
DATE OF TESTING: 14/05/2010
LOCATION: Northlakes Estate, Stage 23, Cameron Park

REPORT No: S2026-03
PROJECT No: HGS 2026
DATE OF REPORT: 25/05/2010
TECHNICIAN: T.C.

Sample Number:	7	8	
Sample Location	TP11	TP14	
Date Sampled	13/05/2010	13/05/2010	
Date Tested	14/05/2010	14/05/2010	
Sample Description	Grey Silty Clay	Orange Brown Silty Clay	
Depth	0.3 - 0.6m	0.4 - 0.75m	
Test Procedure			
Shrink Specimen			
Moisture Content (Field) % AS1289.2.1.1	22.6	17.2	
Swell Specimen			
Moisture Content (Before & After) % AS1289.2.1.1	23.1 / 25.0	17.0 / 23.8	
Maximum Swell (Esw) % AS1289.7.1.1	1.1	4.2	
Maximum Shrink (Esh) % As1289.7.1.1	4.7	2.1	
Shrink Swell Index (Iss) %	2.9	2.3	
Cracking :	Moderate	Moderate	
Crumbling:	None	Minor	
% Inert Inclusions:	<10	<5	
Sampled By:	Hunter Geotechnics	Hunter Geotechnics	

Remarks

Samples Remoulded

HGM 004

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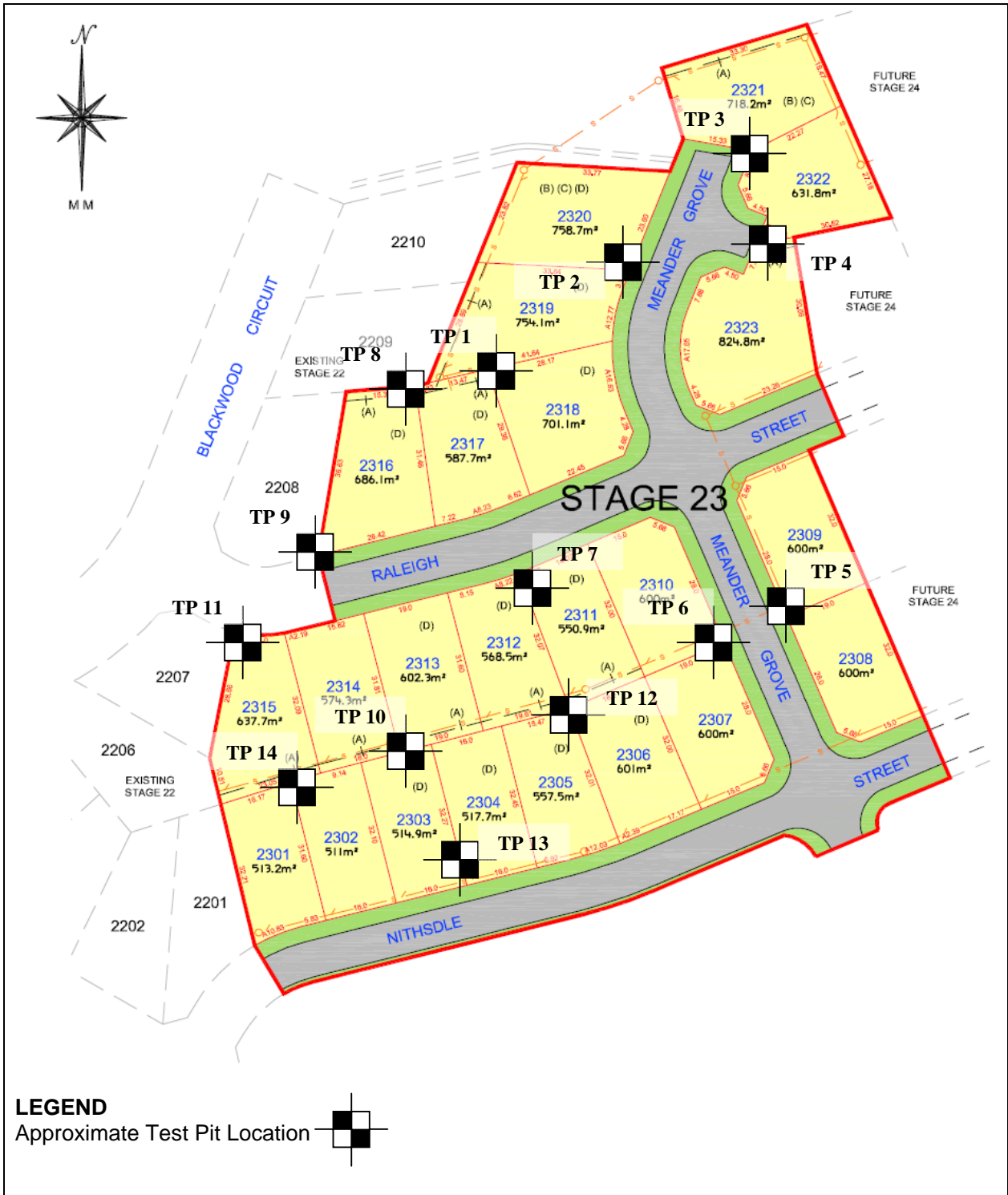
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30-Jul-09



LEGEND

Approximate Test Pit Location

<p>Hunter Geotechnics ABN: 80 088 399 124</p> <p>Unit 5/34 Alliance Avenue MORISSET NSW 2264 (PO Box 4) Ph 02 4973 1242 Fax 02 4973 1243</p>	<p>Drawing No: HGM 004-01</p>	<p>McCloy Group</p> <p>Northlakes Estate Stage 23</p> <p>Cameron Park NSW 2285</p> <p>SITE PLAN</p>
	<p>Scale: As Shown</p>	
	<p>Drawn By: A.C.</p>	
	<p>Date: May 2010</p>	