Sheet Project No:

Excavation No.

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

4.4.2007 4.4.2007

TP26

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

M	
Surface:	1.709

equ	equipment type and model: 4WD Bates excavation dimensions: 1.5m lor						e		Pit Orientation:	Easting:	m			۶	≀.L.	Surface:	1.709	
exc	avation	dim	ensid	ons:	1.5m l	ong (	0.4m w	ide		Northing:	m			d	atui	m:	AHD	
ех	cavati	on	info	rmation			mat	erial s	ubstance									
method	5 penetration	support	water	notes samples, tests, etc	RL I	depth metres	graphic log	classification symbol	material soil type: plasticity or particle of colour, secondary and minor	components.		moisture condition	consistency/ density index	100 pocket 200 d penetro- 300 m penetro-	400	additi	tructure and onal observa	
В		Z		D	_1.5	0.5		SP	TOPSOIL: Silty Sandy CLAY, medidark grey-black, sand fine to medic some rootlets to 100mm.  SAND: fine to coarse grained, pale Becoming pale brown / grey.	ım grained, with	- —	М	D			TOPSOIL		
				D	0.0	2.0			Pit collapsing due to groundwater. Test pit TP26 terminated at 1.5m									

Sketch

GEO 5.2 Issue 3 Rev.2

-	method		support	notes,	samples, tests	class	sification symbols and	consisten	cy/density index
-	N	natural exposure	S shoring N nil	U <sub>so</sub>	undisturbed sample 50mm diameter	soil	description	vs	very soft
-	Х	existing excavation		U <sub>83</sub>	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
ű.	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
é	В	bulldozer blade	1234	V	vane shear (kPa)			St	stiff
6	R	ripper	no resistance	Bs	bulk sample	mois	sture	VSt	very stiff
sne	ε	excavator	ranging to refusal	E	environmental sample	D	dry	Н	hard
S			water	R	refusal	M	maist	Fb	friable
5.2			water level	l		W	wet	٧L	very loose
			on date shown	l		Wp	plastic límit	L	loose
GEO				I		WL	fiquid limit	MD	medium dense
			water inflow	l				D	dense
Ē			→ water outflow	I		l		VD	very dense

Sheet

TP27

1 of 1

Project No:

GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Excavation No.

4.4.2007 4.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS ogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

Surface: 1.536

equ	ipment	type	and	model:	4WD I	Backho	e		Pit Orientation:	Easting:	m			R.L.	. Surface: 1.536	
exc	avation	dim	ensid	ons:	1.5m l	ong (	0.4m w	ide		Northing:	m			datu	um: AHD	
ex	cavati	ion	into	rmation			mat	erial s	ubstance							
method	t penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or partic colour, secondary and mi	de characteristics, nor components.		moisture condition	consistency/ density index	100 pocket 200 pocket 300 popenetro- 400 meter	structure and additional observations	
НВ	AND AND THE STREET AND AND THE STREET, AND ADDRESS OF THE STREET, AND ADDRE	N			_1.0	0. <u>5</u>			TOPSOIL: Silty (Clayey) SAND, grained, dark grey-black, with so 200mm.	fine to medium ome rootlets to		D			TOPSOIL	- - -
				D	1	_		SM	Silty SAND: fine to medium gra with some cemented sand nodu	ined, dark brown, ules.		М	VD			
				****	_0.5	1. <u>0</u>		SP	SAND: fine to coarse grained, b small percent of fines approxim- clay lenses or nodules.	prown / grey, with ately 20-30% poss	ibly					- - 
			04-04-07 3:46pm	D		-      -			Becoming pale grey-white.			M/W				-
			₹ 04-04-(	D	_0.0	1. <u>5</u> - -			Becoming pale grey / brown.			,,,,,,,				-
					0.5	2.0			Pit collapsing due to groundwat Test pit TP27 terminated at 1.8r	er inflow. m						-
						2.5										- -

ł	method		support	notes, s	amples, tests	class	ification symbols and	consisten	cy/density index
1		natural exposure	S shoring N nil	Uso	undisturbed sample 50mm diameter	soil	description	vs	very soft
	Х	existing excavation		U <sub>63</sub>	undisturbed sample 63mm diameter	base	d on unified classification	s	soft
1		backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
į	в	bulldozer blade	1234	٧	vane shear (kPa)			St	stiff
5	R	ripper	no resistance ranging to	Bs	bulk sample	mois	ture	VSt	very stiff
3	Ε .	excavator	refusal	E	environmental sample	D	dry	Н	hard
3			water	R	refusal	М	moist	Fb	friable
اب			water level	į .		W	wet	VL	very loose
i			on date shown			Wp	plastic limit	L	loose
,				I	•	W <sub>L</sub>	liquid limit	MD	medium dense
-	l		water inflow	1				Ð	dense

Excavation No.

TP28

## **Engineering Log - Excavation**

Sheet

1 of 1 GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Date completed:

4.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS Logged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

4.4.2007

equipment	type	and	model: 4	4WD	Backho	е		Pit Orientation: Easting: m	ı		R.L	. Surface: 2.012
excavation	dime	ensic	ons:	1.5m l	long (	0.4m w	ride	Northing: m	ı		datı	ım; AHD
excavati	ion i	nfo	rmation			mat	erial s	ubstance				
method method method method method method mother mothers samples, tests, etc depth RL metres and a graphic logicalization.							classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	100 pocket 200 penetro- 300 m meter	structure and additional observations
ВН	N			_1.5	0. <u>5</u>	***************************************		TOPSOIL: Silty SAND, fine to medium grained, dark grey-black, with some rootlets.	D			TOPSOIL - - - - -
			D D	_1.0	1.0		SM	Silty SAND: fine to medium grained, dark brown-black / red, cemented sand nodules.	M	D		-
		V 04-04-07 3:31pm	D	_0.5	1.5		SP	SAND: fine to coarse grained, pale brown / grey.  Becoming brown / grey mottled orange.	W			
				0.0	2.0 - - - 2.5			Test pit TP28 terminated at 1.8m				-

method N X BH B	natural exposure existing excavation backhoe bucket bulldozer blade ripper	support S shoring N nil  penetration 1 2 3 4  ranging to	notes, samples, tests  U <sub>50</sub> undisturbed sample 50mm diameter U <sub>63</sub> undisturbed sample 63mm diameter D disturbed sample V vane shear (kPa) Bs bulk sample	system moisture	consistency/density index VS very soft S soft F firm St stiff VSt very stiff
E	excavator	water water level on date shown water inflow	E environmental sample R refusal	D dry M moist W wet Wp plastic limit W <sub>L</sub> liquid limit	H hard Fb friable VL very loose L loose MD medium dense D dense
1		water outflow			VD year dense

TP29

Sheet Project No:

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Excavation No.

5.4.2007

5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

Ckeu by.

equipment type and model:	4WD Backho	e	Pit Orientation:	Easting:	m		R.L	. Surface: 2.170
excavation dimensions:	1.5m long	0.4m wide		Northing:	m		datı	ım; AHD
excavation information		material s	ubstance					
notes samples, tests, etc	depth RL metres		material soil type: plasticity or particle colour, secondary and mind	or components.	moisture	consistency/ density index	100 x pocket 200 x penetro- 300 w meter	structure and additional observations
N D	2.0 - - 0.5 - - 1.5 - - 1.0 -	sc	TOPSOIL: Silty SAND, fine to me brown-black, with some rootlets.  Silty SAND: fine to medium grian brown.  Clayey SAND: fine to medium gralow plasticity fines.	ed, pale grey / pal	e	D		TOPSOIL
D	1. <u>5</u>	SP	SAND: fine to medium grained, p	ale grey-white.	w			-
05-04-07 3:12pm	2.0		Pit collapsing. Test pit TP29 terminated at 1.7m					;
1	2.5							

I	method		support	notes,	samples, tests	class	sification symbols and	consisten	cy/density Index
ı	N	natural exposure	S shoring N nil	U <sub>50</sub>	undisturbed sample 50mm diameter	soil	description	VS	very soft
i	Х	existing excavation		U <sub>63</sub>	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
٠l	8H	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
ì	В	bulldozer blade	1234	٧	vane shear (kPa)			St	stiff
5	R	ripper	no resistance ranging to	Bs	bulk sample	mois	ture	VSt	very stiff
9	E	excavator	refusal	Е	environmental sample	D	dry	Н	hard
21			water	R	refusal	М	moist	Fb	friable
ı١			water level			W	wet	VL	very loose
1			on date shown			Wp	plastic limit	Ł	loose
Ú						W,	liquid limit	MD	medium dense
≟l			water inflow	1		_		D	dense
5			→ water outflow	}				VD	very dense

Excavation No.

**TP30** 

Sheet

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Date completed:

5.4.2007

consistency/density index

very soft soft firm

very stiff

friable

very loose loose

medium dense dense very dense

stiff

٧S

St

VSt

Fb

VL

MD

Principal:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

5.4.2007

Project:

Test pit location:

REFER TO FIGURE 1

Checked by:

CKED DY:

equi	pment	type	and	model; 4	4WD E	3ackho	е		Pit Orientation: Easting: m			R.L	, Surface: 1.159
exca	vation	dim	ensid	ons: 1	1.5m ld	ong (	0.4m w	ide	Northing: m			date	am: AHD
exc	cavati	ion	info	rmation			mat	erial s	ubstance				
123							graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.	moisture condition	consistency/ density index	100 pocket 200 pocket 300 popenetro- 400 meter	structure and additional observations
ВН		N			_1.0	<b>-</b>	***		TOPSOIL: Silty Clayey SAND, fine to medium grained, dark grey-black mottled white, low plasticity fines, some rootlets 300mm and roots to 300mm.	D			TOPSOIL -
	AL MANUFACTURE OF THE PARTY OF		05-04-07			0. <u>5</u>		SP	SAND: fine to coarse grained, pale grey-white.	W	MD		Some inflow of groundwater to pit at 0.3m, 8:05am, pit slowly collapsing from sides, organic
				D	_0.5				Becoming pale brown-grey.		Đ		odour.
				D	_0.0	1. <u>0</u>							· -
						- - 1.5							- - -
				D	0.5	_			Becoming dark brown-red, with some cemented sand nodules.				_
						2. <u>0</u>			Pit collapsing. Test pit TP30 terminated at 1.7m				- -
					1.0	_ _							- -
						2.5						200 200 200 200 200 200 200 200 200 200	

Sketch

method N X BH B	natural exposure existing excavation backhoe bucket bulldozer blade	support S shoring N nil penetration 1 2 3 4	notes, s U <sub>50</sub> U <sub>63</sub> D V	samples, tests undisturbed sample 50mm diameter undisturbed sample 63mm diameter disturbed sample vane shear (kPa)	soil	sification symbols and description Id on unified classification em
R E	ripper excavator	no resistance ranging to refusal	Bs E R	bulk sample environmental sample refusal	mois D M	dry moist
		water level on date shown water inflow			W Wp W <sub>L</sub>	wet plastic limit liquid limit
		water outflow				

Form GEO 5.2 Issue 3 Rev.2

Sheet

TP31

Project No:

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Excavation No.

5.4.2007

5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS Logged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

4WD Backhoe R.L. Surface: 0.732 equipment type and model: Pit Orientation: Easting: m AHD excavation dimensions: 1.5m long Northing m datum: material substance excavation information pocket penetro-meter classification symbol penetratio consistency/ density index material notes moisture condition structure and samples. graphic additional observations tests, etc soil type: plasticity or particle characteristics, colour, secondary and minor components. kPa depth RL metres 8888 123 TOPSOIL: Silty Clayey SAND, fine to medium TOPSOIL (swampy area) organic grained, dark grey-black mottled white, low to medium plasticity fines, with layer of mulch and rootlets to odour, MD 0.5 Clayey SAND: fine to medium grained, pale grey / pale brown, low plasticity fines. 0.<u>5</u> D D 0.0 W Very slow inflow of groundwater. Becoming grey / brown. 1.0 D SAND: fine to medium grained, dark brown-red, indurated cemented sand nodules. Rapid inflow of groundwater. 05-04-07 8;29am -0.5 1.5 Sifty Gravelly SAND: fine to coarse grained, dark grey-black, gravel fine to medium grained, rounded-subrounded. D Pit collapsing due to inflow of groundwater. Test pit TP31 terminated at 1.8m 2.0

ı	method		support	notes, s	samples, tests	clas	sification symbols and	consisten	cy/density index
1	N	natural exposure	S shoring N nii	U <sub>so</sub>	undisturbed sample 50mm diameter	soil	description	VS	very soft
	X	existing excavation		U <sub>63</sub>	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
Ŋ	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	អ៊ីហា
ő	В	buildozer blade	1234	V	vane shear (kPa)			St	stiff
3	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff
9	E	excavator	refusal	Ε	environmental sample	D	dry	н	hard
<u>ss</u>			water	R	refusal	M	moist	Fb	friable
Ŋ				ł		W	wet	VL	very loose
ő			on date shown			Wρ	plastic limit	L	loose
OEO				•		W <sub>L</sub>	liquid limit	MD	medium dense
			water inflow			-		D	dense
ē								VD	very dense

Excavation No.

TP32

1 of 1

Sheet Project No:

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

5.4.2007

5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS ogged by:

CW

	st pit le					TO F Backho		RE 1	Pit Orientation:	Easting:	m	(	Checke		Surface:	0.004
i .	avation				1.5m		0 0.4m w	ida	, a Otternation.	•						0.994
_				rmation	1.5111	iong (			ubstance	Northing:	m			dat	um:	AHD
method	5 penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle o colour, secondary and minor	haracteristics, components.		moisture condition	consistency/ density index	100 x pocket 200 x penetro- 300 w meter	addi	structure and tional observations
ВН		Z	05-04-07 8:47am	D D	_0.5	0.5		SC	TOPSOIL: Silty Clayey SAND, fine grained, dark grey-black mottled wi fines, with some rootlets and roots  Clayey SAND: fine to coarse graine brown, low plasticity fines maybe to fines approximately 30-40%.  Becoming grey-brown, some presesand nodules.	nite, low plastici (10mm). ed, pale grey-pa w percentage d	ale of	M	D		Some inflo	(swampy area) w of water. nflow of groundwater
				D	0.5	1. <u>5</u>			Becoming grey mottled brown / ora of subrounded to rounded gravel (fi grained) less than 10mm size. Pit continually collapsed due to wate Test pit TP32 terminated at 1.7m	ne to medium	ıce					

Sketch

	method	
	N	natural exposure
	Х	existing excavation
ı	ВH	backhoe bucket
	8	bulldozer blade
	Ŕ	ripper
	E	excavator
ı		
ı		

support	
S shoring	N nil
penetration	
1234	
	resistance
	iging to
ooooooooo = ref	usal
water	
water lev	rel
pn date s	
	310011

notes,	samples, tests
U <sub>so</sub>	undisturbed sample 50mm diameter
U <sub>63</sub>	undisturbed sample 63mm diameter
D	disturbed sample
٧	vane shear (kPa)
8s	bulk sample
E	environmental sample
R	refusal

soil	sification symbols and description ed on unified classification em	•
moi	sture	
D	dry	
M	moist	

wet plastic limit

liquid limit

Wp

consiste	ncy/density Index
VS	very soft
s	soft
F	ត្ <b>ពា</b>
St	stiff
VSt	very stiff
Н	hard
Fb	friable
VL	very loose
L	loose
MD	medium dense
D	dense

very dense

TP33

Sheet Project No:

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Excavation No.

5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

5.4.2007 CW

Test pit location:

REFER TO FIGURE 1

Checked by:

equipment typ	e and	model: 4	4WD B	Backho	е		Pit Orientation: Easting:	m			R.L	. Surface: 0,923
excavation dir	nensi	ons:	1.5m l	ong (	0.4m wi	de	Northing:	m			dati	um: AHD
excavation	info	rmation			mate	erial s	ubstance					
method 1 0 penetration support	water	notes samples, tests, etc	RL :	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characteristics, colour, secondary and minor components.		moisture condition	consistency/ density index	100 pocket 200 uppocket 300 uppocket 400 meter	
BH			_0.5	0. <u>5</u>		SC	TOPSOIL: Silty Clayey SAND, fine to medium grained, dark grey-black mottled white, low plasticit fines, with some rootlets to 250mm.  Clayey SAND: fine to coarse grained, pale grey-pa brown.		D/M M	D		TOPSOIL (swampy area)
	05-04-07 8:56am	D D	0.0	1. <u>0</u>			Becoming grey / brown.		w			Very slow inflow of groundwater 8:56am, organic odour.
			0.5	1. <u>5</u>								
		D	1.5	2.0		SP	SAND: fine to medium grained, dark brown-black, some cemented nodules of sand. Pit collapsing due to water table. Test pit TP33 terminated at 2m					

method		support	notes,	samples, tests	clas	sification symbols and	consister	cy/density index
N	natural exposure	Sishoring Ninil	U <sub>so</sub>	undisturbed sample 50mm diameter	lioz	description	VS	very soft
Х	existing excavation		Ues	undisturbed sample 63mm diameter	base	ed on unified classification	S	soft
BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
В	bulldozer blade	1234	V	vane shear (kPa)			St	stiff
R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff
E	excavator	refusal	Ε	environmental sample	D	dry	н	hard
		water	R	refusal	М	moist	Fb	friable
1		w water level	1		W	wet	VL	very loose
		on date shown	1		Wp	plastic limit	L	loose
1			1		W,	liquid limit	MD	medium dense
		water inflow	1		•		D	dense
i I		→ water outflow	1		ı		VD	verv dense



Excavation No.

TP34

1 of 1

Sheet

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Date completed:

5.4.2007

5.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

CW

Test pit location:

REFER TO FIGURE 1

Checked by:

equipment	type	and	model; 4	4WD	Backho	е		Pit Orientation:	Easting:	m				R.L	. Surface:	0.893	
excavation	dim	ensid	ons:	1.5m l	long (	).4m w	ide		Northing:	m				datı	um:	AHD	
excavat	ion	info	rmation			mat	erial s	ubstance							· · · · · · · · · · · · · · · · · · ·		
method 1 2 penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or partic colour, secondary and mir	nor components.	,	moisture condition	consistency/ density index	100 A pocket	a a	addit	structure and ional observati	ons
H8	Z	05-04-07 9:13am	D	0.5	1.5		SC SP	TOPSOIL: Silty Clayey SAND, figrained, dark grey-black mottled plasticity fines.  Clayey SAND: fine to coarse griggrey-white, low plasticity fines.  Becoming pale grey-pale brown SAND: with some clayey lenses grained, low plasticity fines.  Clayey SAND: fine to coarse grillow to medium plasticity fines.  Pit slowly collapsing due to water strength of the coarse grillow to medium plasticity fines.  Silty SAND: fine to medium grained.  Pit collapsing due to groundwater test pit TP34 terminated at 2m	ained, pale  ined, grey / brower table.	<u>го,</u>	M/w	MD L			Very slow	inflow of water, \$	):13am.

5.2 Issue 3 Rev.2	method N X BH B R R	natural exposure existing excavation backhoe bucket buildozer blade ripper excavator	support S shoring N nil  penetration 1 2 3 4 no resistance ranging to refusel  water  water level	notes, s U <sub>50</sub> U <sub>63</sub> D V Bs E R	samples, tests undisturbed sample 50mm diameter undisturbed sample 63mm diameter disturbed sample vane shear (kPa) bulk sample environmental sample refusal	soil base syste	sification symbols and description ad on unified classification erm sture dry moist wet	consistend VS S F St VSt H Fb VL	cy/density index very soft soft firm stiff very stiff hard friable very loose
Form GEO 5.2 Is:				R	refusal			,	



Borehole No.

BH35

Sheet

1 of 1 GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

11.4.2007

11.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

JJT

Date completed:

Pro Bor	-		Lo	catio	on: <b>REF</b>					PROJECT APPLICATION, TE	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	-	-	d by:		131 []]][	
drill	mo	del	and	mou	nting: I	MD20				Easting: stope	: -90°			ſ	R.L. Surf	ace: 1.0	006
hole						100 m	m			Northing beari	ng;			(	datum:	AH	ID .
dri			nfo	rma	tion		T	mat	,	ubstance		-		í			
method		N penetration ω	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle charact colour, secondary and minor compo	eristics, nents.		density index	200 x pocket	₹		ture and observations
보	36536555		С	<u>*</u>			_		SP	SAND: fine to medium grained, grey.		W N	GN				
	300000000000000000000000000000000000000				SPT 2,2,3		_										
	88088888				N*=5	_0	1_										
							<u>-</u>						D				
						-1	2										
					SPT 2,3,11 N*=14												
						_	3										
						2	,										
					SPT 6,4,12												
		4	L		N*=16	3	4			Borehole BH35 terminated at 4m							
							-			Borettole Di 199 terminated at 4111							
							-										
						4	<u>5</u>										
							-										
						5	6										
						6	<u>7</u>										
							-										
							8	:									
meth AS AD RR W CT HA DT B	hod	<u>. l</u>	ro w ca ha di bl		re ool uger	M C per	mud casing netration 2 3 4 ter 10/1/98		ievel	notes, samples, tests  U <sub>50</sub> undisturbed sample 50mm diameter U <sub>53</sub> undisturbed sample 63mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample		ption Inified class			V S F S V H F V L	t 'St I b	ensity index very soft soft firm stiff very stiff hard friable very loose loose medium dense
	shov	wn b	y sul				water in water o			R refusal	vvi ndar	~ 011HL			D	)	dense very dense



Borehole No.

BH36

Sheet

Project No:

1 of 1 GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

11.4.2007

11.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

JJT

mod	lei a	nd	mou	nting: I	MD20				Easting:	lope: -90°				R.L. Su	ırface: 2.361
e diar					100 m	ım			_	earing:				datum:	AHD
rillin	-	ıfo	rma	tion			mate		ubstance						
12 penetration		support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle cha colour, secondary and minor co	mponents.	moisture condition	consistency/ density index	100 pocket 200 y penetro-	a	structure and additional observation
		С			_2	_		SC	Clayey SAND: fine to medium grained low plasticity.	, black, clay	М				
			<u>v</u>	SPT 4,4,5 N*=9		- - 1		SP	SAND: fine grained, white.		w	D			
					1	<u>'</u>		SP	SAND: fine to medium grained, black	coffee rock).					
	•			SPT 2,9,11 N*=20	_0	2		SP	SAND: fine grained, white.						
						3			Becoming grey.			VĎ			
				SPT 6,13,24 N*=37	<u>_</u> -1	- 4		SP	SAND: fine to medium grained, black	coffee rock).					
					2				Becoming softer.						
				SPT 6,9,23 N*=32	3	<u>5</u> - -								:	
					4	6									·
				SPT 8,16,14 N*=30		- 7			Borehole BH36 terminated at 7m						
					5	1									
hod	11	roll wa cal hai dia	ger di er/tric shboi ole to nd au tube nk bii	re ol iger	M C per	ter 10/1/98			notes, samples, tests U <sub>50</sub> undisturbed sample 50mm dian U <sub>51</sub> undisturbed sample 63mm dian D disturbed sample N standard penetration test (SPT) N' SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample	moisture D dry M moi W wet Wp plas	ription unified c				consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium densi



Borehole No.

BH37

Sheet

1 of 1 GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Date completed:

11.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

JJT

11.4.2007

Borehole Location: REFER TO FIGURE 1

Checked by:

AM

	Borehole Location: REFER TO					EK	10 F	IGUI						d by:				
drill	l mo	del a	and	mou	nting: I	MD20				Easting:	slope: -90°	pe: -90° R.					Not Measured	
	e dis					100 m	m			Northing	bearing:			(	datum:		AHD	
dr	_	_	nfo	rma	tion		1	mate		ıbstance		1			-			
method	1	ာ penetration င	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle c colour, secondary and minor	haracteristics, components.	moisture condition	consistency/ density index	200 A pocket	a		ructure and nal observations	
生		П	C					/:	sc	Clayey SAND: fine to medium grain low plasticity.	ed, black, clay	М						
				▼	SPT 4,6,10		_		SP	SAND: fine to medium grained, whit	e.		D					
					N*=16		1 - 1 - 1			Becoming dark brown, with some o	ganic material.	W						-
					SPT 1,7,8 N*=15		3											-
					SPT 6,18,R N*=R		4		SP	SAND: fine to medium grained, blace	k (coffee rock).		VD		ĪNĪ	DURATED	SAND	
					SPT 5,7,R N*=R		5 1 1 1 1			Becoming brown.								
					SPT 6,7,R N*=R		6 - - - 7			Borehole BH37 terminated at 7m								
							8									******************************		
AS AD RR W CT HA DT B V	t show		au roi wa ca ha dia bla Vi	ger d ler/trid ashbo ble to and au atube ank bi bit bit fix	re ol ger	M C pe 1	ter 10/1/9	n no resista ranging to refusal 9 water l e shown	level		sturbed sample 50mm diameter sturbed sample 63mm diameter dribed sample 63mm diameter dribed sample system  - sample recovered with solid cone where the sample system  - sample with solid sone where the sample wet sample where the sample where					consistend VS S F St VSt H Fb VL L MD D VD	y/density index very soft soft firm stiff very stiff hard friable very loose loose medium dense dense very dense	



Sheet

BH38

Project No:

Borehole No.

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started: Date completed:

11.4.2007 11.4.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS..ogged by:

JJT

Bor	orehole Location: REFER TO FIGUR						IGUI	RE 1			Check	ed by:	M
drill	mode	l and	d mo	unting:	MD20				Easting: slope:	-90°		R.	L. Surface: 2.303
	e diam				100 m	ım			Northing bearing:			da	itum: AHD
dri	illing	inf	orma	ation	_		mate		ıbstance		_		
method	12 penetration	tionais	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characterist colour, secondary and minor componen	nts. E පි	consistency/ density index	200 % pocket 300 % penetro-	3
HF		C		0.07	2			CL.	TOPSOIL: Clayey SAND, fine grained, dark grained low plasticity.  Sandy CLAY: medium to high plasticity, grey, fine grained.	J >Wp			TOPSOIL
				SPT 2,2,3 N*=5		1_		CL	Sandy CLAY: low to medium plasticity, dark b	ILOJAND			-
			<u> </u>	-	_1			OL.	sand fine grained.	W	_		
				SPT 4,5,5 N*=10	_0	<u>2</u> -		sw	SAND: fine to medium grained, grey.		D		- -
		:				3							_
				SPT 12,18,23	1 	-			Becoming black.				
				N*=41	2	<u>4</u> -							-
				SPT 4,8,11		5							-
				N*=19		- 6							
				SPT	4						MD		-
			-	4,8,8 N*=16		7			Borehole BH38 terminated at 7m				
					5								
met AS AD RR W CT HA DT B V T	shown	i i i by se	auger coller/t vashb cable f hand a diatub blank l / bit	ool auger e	M C pe 1	ter 10/1/9	n no resista ranging to refusal 8 water l e shown	evel	notes, samples, tests  U <sub>50</sub> undisturbed sample 50mm diameter U <sub>63</sub> undisturbed sample 63mm diameter D disturbed sample 63mm diameter D standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample R refusal	classification sysoil description based on unified system  moisture D dry M moist W wet Wp plastic lim Wt liquid limit	classifica		consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense

Excavation No.

TP39

Sheet

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

1.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS Logged by:

1.6.2007 RJP

Test pit location:

REFER TO FIGURE 1

Checked by:

Date completed:

consistency/density index

very soft soft

firm stiff very stiff

hard friable

loose

very loose

medium dense dense very dense

VS

s F St

VSt

٧L

MD

equ	ipment	nent type and model: 4WD Backhoe							Pit Orientation:	Easting:	m				R.L	Surface:	2.77					
exc	avation	dim	ensid	ons: 2	2m lor	ng 0.4	45m wi	de		Northing:	m				dat	um:	AHD					
ex	cavati	ion	info	rmation			mat	erial s	ubstance													
method	υ ν penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	soil type: plasticity or colour, secondary a	aterial  particle characteristics, and minor components.		moisture condition	consistency/ density index	100 pocket 200 pocket 300 poenetro- 400 meter		kPa 800 00 800 00 800 00		kPa		additi	structure and onal observation	າຣ
ВН		N							TOPSOIL: Sandy Silty CL dark grey, sand fine to me	AY, medium plasticity, edium grained.		М				TOPSOIL F	Root affected.					
					_2.5	0.5		СН	CLAY: high plasticity, green mottled, some sand.			>Wp	St	***************************************								
			Ì	D	]									~								
					2.0			СН	CLAY: high plasticity, grey		- —							-				
						1.0			grained.	ce of sand fille to friedigh	'											
				D	_1.5													- -				
						1. <u>5</u>		SP	SAND: fine to medium gra grey-brown.	ained, white / light		W				Pit collapsir odour.	ig below 1.4m, or	ganic				
				D	-	_			•							oddar.						
					_1.0	-			Moderate groundwater inf Test pit TP39 terminated	low below 1.4m, at 1.7m					***************************************			_				
						2. <u>0</u>									***************************************			_				
					0.5													-				
						2.5												-				
_																						

3 Rev.2	method N X BH B	natural exposure existing excavation backhoe bucket bulldozer blade	support S shoring N nil  penetration 1 2 3 4	notes, samples, tests  U <sub>50</sub> undisturbed sample 50mm diameter  U <sub>83</sub> undisturbed sample 63mm diameter  D disturbed sample  V vane shear (kPa)	classification symbols and soil description based on unified classification system
orm GEO 5.2 Issue 3 Re	R E	ripper excavator	water water level on date shown water inflow water outflow	Bs bulk sample E environmental sample R refusal	moisture D dry M moist W wet Wp plastic limit W <sub>L</sub> liquid limit

Sheet

TP40

1 of 1

Project No:

Excavation No.

GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

1.6.2007 1.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS.ogged by:

RJP

Test pit location:

REFER TO FIGURE 1

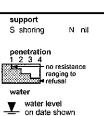
Checked by:

edn	equipment type and model: 4WD Back						е		Pit Orientation:	Easting:	m				R.L.	Surface: 2.59
exca	avation	dim	ensid	ons:	2m lo.	ng 0.4	45m wi	de		Northing:	m				datu	ım: AHD
ex	cavati	on	info	rmation			mat	erial s	ubstance							
method	າ ຮ penetration ພ	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or partic colour, secondary and mi	ele characteristics, nor components.		moisture condition	consistency/ density index	100 pocket 200 Topenetro-	a	structure and additional observations
HB		N		D	_2.5	0. <u>5</u>		CI	TOPSOIL: Silty Sandy CLAY, m dark grey, sand fine to medium  Sandy CLAY: medium plasticity orange mottled, sand fine to medium grey-brown and sand Sandy CLAY / Clayey SAND.  SAND: fine to medium grained, some clay.	grained.  , grey-brown and dium grained.  I content increasin	g to	>Wp	St			TOPSOIL Root affected.
				D	_1.0	2.0		SP	SAND: fine to medium grained, Pit collapsing below 1.1m. Test pit TP40 terminated at 1.7r							Rapid groundwater inflow below 1.4m. Organic odour.

Sketch

IT 20248AA LOGS.GPJ COFFEY.GDT 23.10.07	
A LOGS.GPJ COFF	
TESTPIT 20248A/	
	m GEO 5.2 Issue 3 Rev.2
	Form (

:
on



water inflowwater outflow

notes, s	samples, tests
J <sub>50</sub>	undisturbed sample 50mm diameter
J <sub>63</sub>	undisturbed sample 63mm diameter
)	disturbed sample
√	vane shear (kPa)
3\$	bulk sample
=	environmental sample
₹	refusal

clas	sification symbols and
soil	description
base	ed on unified classification
syst	em
moi	sture
D	dry
М	moist

wet

Wp

plastic limit

liquid limit

consisten	cy/density inde
VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
Н	hard
Fb	friable
VL	very loose

MD

loose

medium dense

very dense

Sheet

TP41

1 of 1

Project No:

GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Date started:

Date completed:

Excavation No.

1.6.2007 1.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS..ogged by:

RJP

Test pit location:

REFER TO FIGURE 1

Checked by:

////

equip	oment i	type	and	model:	4WD	Backho	е		Pit Orientation:	Easting:	m			R.I	Surface:	3.63	
exca	vation	dim	ensic	ons:	2m lo	ng 0,4	45m wi	de		Northing:	m			da	tum:	AHD	
exc	avati	on	info	rmation			mat	erial s	ubstance								
method	ν penetration ε	support	water	пotes samples, tests, etc	RL	depth metres:	graphic log	classification symbol	materia soil type: plasticity or parti colour, secondary and m	cle characteristics, inor components.		moisture condition	consistency/ density index	100 x pocket 200 x penetro- 300 m meter		structure and tional observations	;
HB		Z		D		1.5		CI SP	TOPSOIL: Sandy CLAY, media grey-brown, sand fine to media grey-brown, sand fine to media and orange mottled, sand fine Becoming light grey-light grey-mottled.  Sand content increasing light gmottled.  SAND: fine to medium grained some orange mottled, cements	y, light grey-brown to medium grained. brown and orange rey-brown and orange.		M >Wp	St	X		Root affected.	
				D		 - 2.5		υ.	grey-brown.			••				anic odour.	
	7.1.7	_							Test pit TP41 terminated at 2.5	m							

Sketch

est pit TP41 terminated at 2.5m

Form GEO 5.2 Issue 3 Rev.2

method N natural exposure N notes, samples, tests U <sub>so</sub> undisturbed sample 50mm diameter N vales hear (kPa) N system N moist N moist N wet N moist N wet N wet N p plastic limit N liquid limit	consistency/density index VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense

### Excavation No.

TP42

Sheet

1 of 1 GEOTSGTE20248AA

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Date completed:

1.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

1.6.2007 RJP

Test pit location:

REFER TO FIGURE 1

Checked by:

123	equipr	ment t	ype	and	model:	4WD	Backho	е		Pit Orientation:	Easting:	m			R.L	Surface:	2.82
notes samples, lests, etc depth RL metres so tests, etc notes samples, lests, etc depth RL metres so tests, etc depth RL metres so tests, etc depth RL metres so tests, etc notes samples, lests, etc depth RL metres so tests, etc notes samples, lests, etc depth RL metres so tests, etc notes samples, lests, etc depth RL metres so tests, etc notes samples, lests, etc notes samples, l	excava	ation o	dim	ensid	ons: 2	2m lo	ng 0.4	45m wi	de		Northing:	m			datı	ım:	AHD
RL metres 8 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0 5 0	exca	vatio	าก	info	rmation			mat	erial s	ubstance							
plasticity, sand fine to medium grained, dark grey-brown and orange mottled, sand fine to medium grained.  CI Sandy CLAY: medium plasticity, grey-brown and orange mottled, sand fine to medium grained.  CI Sandy CLAY: medium plasticity, grey-grey-brown some orange mottled, sand fine to medium grained.  SP SAND: fine to medium grained, white.  Werry slow water inflow below 1:1r  Becoming grey-grey-brown, with a trace to some clay.  Test pit TP42 terminated at 1.7m  2.0  Test pit TP42 terminated at 1.7m	_	ĺ		water	samples,	RL	depth metres	graphic log	classification symbol	soil type: plasticity or partic colour, secondary and mi	le characteristics, nor components.			consistency/ density index	kPa	addit	ional observations
D  2.0  CI Sandy ČLAY: medium plasticity, grey-grey-brown some orange mottled, sand fine to medium grained, sand content increasing.  SP SAND: fine to medium grained, white.  Wery slow water inflow below 1.1r  Becoming grey-grey-brown, with a trace to some clay.  Test pit TP42 terminated at 1.7m  2.0  -0.5	ВН		N			2.5	-		CI	plasticity, sand fine to medium of grey-brown.  Sandy CLAY: medium plasticity	grained, dark			St		TOPSOIL	Root affected.
SP SAND: fine to medium grained, sand fine to medium grained, sand content increasing.  SP SAND: fine to medium grained, white.  Becoming grey-grey-brown, with a trace to some clay.  1.5  D Test pit TP42 terminated at 1.7m  2.0					D	_2.0	0. <u>5</u>		CI	Sandy CLAV, medium planticih					X		-
D Test pit TP42 terminated at 1.7m  L0.5 - L				<b>-</b>	D		1. <u>0</u>			some orange mottled, sand fine sand content increasing.	to medium grained	i, 	w		X	Very slow	- water inflow below 1.1m.
					-	_1.5	1. <u>5</u>			Becoming grey-grey-brown, witl	n a trace to some c	lay.			AN DESCRIPTION OF STREET		-
2.0							_										
		***************************************				1.0	-			Test pit TP42 terminated at 1.7	n						
2.5	MARKET LANGUAGE MARKET					_0.5	2.0						***************************************				-
							2.5										

Sketch

٥.	
ev.2	
8	
sue	
2.5	
0.5	ı
ij	
Ē	
.0	1

TESTPIT 20248AA LOGS.GPJ COFFEY.GDT 23.10.07

method	
N	natural exposure
Х	existing excavation
BH	backhoe bucket
В	buildozer blade
R	ripper
E	excavator

support			
S shoring	j N	ı	nil
penetrati	οπ		
1234			
::::::::::::::::::::::::::::::::::::::	no resista		ce
	ranging t Trefusal	0	
	retusai		
water			
w water	level		
In an air	to obour	_	

notes,	samples, tests
U <sub>so</sub>	undisturbed sample 50mm diamete
U <sub>63</sub>	undisturbed sample 63mm diamete
D	disturbed sample
V	vane shear (kPa)
Bs	bulk sample
E	environmental sample
R	refusal

		٠
clas	sification symbols and	
soil	description	
base	ed on unified classification	
syst	em,	
moi	sture	
O	dry	
M	moist	

wet

plastic limit

liquid limit

consistency/	density inde
VS	very soft
S	soft
F	firm
St	stiff
VSt	very stiff
H	hard
Fb	friable
VL	very loose

medium dense

dense very dense

L MD

Excavation No.

TP43

Sheet

1 of 1 GEOTSGTE20248AA

Client

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

1.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS ogged by:

RJP

Test pit location:

REFER TO FIGURE 1

Checked by:

Date completed:

1.6.2007

equipment type and model:	4WD Backho	oe .	Pit Orientation:	Easting:	m		R,L	. Surface:	4.75
excavation dimensions:	2m long 0.	.45m wide		Northing:	m		dat	um:	AHD
excavation informatio	1	material	substance						
note sample tests, and a sample test test tests, and a sample test tests, and a sample test test tests test	s,	P 232		article characteristics, minor components.		moisture condition consistency/ density index	100 x pocket 200 v penetro- 300 w meter		structure and tional observations
N N N N N N N N N N N N N N N N N N N	_4.5 -	SP	SAND: fine to medium grains  Becoming light grey-brown.	ed, grey-brown.		М		AEOLIAN	Root affected to 0.15m
D	4.0	SP	SAND: fine to medium grains	ed grev-brown and					
D	3.5		orange mottled, trace to som	e clay.					
<b>▶</b>	1.5	SP	SAND: fine to medium grains some weakly cemented node	ed, light grey-brown, ules, grey-brown.		w		Very slow	
	<u> </u>					.,		10., 0.0	-
	2.0 - _2.5		Test pit TP43 terminated at 1	.85m					-
	2.5	1					***************************************		

1									
	method		support	notes, s	samples, tests	clas	sification symbols and	consisten	cy/density index
	N	natural exposure	S shoring N nil	$U_{50}$	undisturbed sample 50mm diameter	soil	description	VS	very soft
	Х	existing excavation		Ues	undisturbed sample 63mm diameter	base	ed on unified classification	S	soft
į	BH	backhoe bucket	penetration	D	disturbed sample	syste	em .	F	firm
١	В	bulldozer blade	1234	V	vane shear (kPa)	├		St	stiff
5	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff
3	E	excavator	ranging to	Ε	environmental sample	D	dry	Н	hard
ŝ			water	R	refusal	М	moist	Fb	friable
١			water level			w	wet	VL	very loose
í			on date shown	•		Wp	plastic limit	L	loose
3			l.	l		W <sub>L</sub>	liquid limit	MD	medium dense
:			water inflow	l		ŀ		D	dense
5			→ water outflow	l .		ı		VD	verv dense

## Excavation No.

**TP44** 

Sheet

1 of 1

Client:

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

1.6.2007

GEOTSGTE20248AA

Principal:

Date completed: 1.6.2007

Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS Logged by:

RJP

Tes	st pit l	ocat	tion:	REF	ER	TO F	IGUI	RE 1				(	Checke	ed by:		
equ	ipment	type	and	model: 4	4WD I	Backho	е		Pit Orientation:	Easting:	m			R.L	. Surface;	4.46
exc	avation	ı dim	ensid	ons: 2	2m lor	ng 0.4	45m wi	de		Northing:	m			dat	um:	AHD
ex	cavat	ion	info	rmation			mat	erial s	ubstance							
method	5 penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	materia soil type: plasticity or part colour, secondary and n	licie characteristics, ninor components.		molsture condition	consistency/ density index	100 pocket 200 pocket 300 popenetro- 400 meter		structure and tional observations
ВН		Z	served	D	_4.0	0.5		SP	SAND: fine to medium grained  Becoming light grey-brown.  SAND: fine to medium grained silt / Silty SAND.			М			AEOLIAN INDURAT	Root affected to 0.3m.
			None Observed	D	_3.5	1. <u>0</u>										
				D	_3.0	1. <u>5</u>			Becoming cleaner and less ce							-
					_2.5	2.0			Test pit TP44 terminated at 1.	8m						-
					_2.0	2.5										

- 1									
1	method		support	notes, s	amples, tests	class	sification symbols and	consiste	ncy/density index
- 1	N	natural exposure	S shoring N nil	U <sub>50</sub>	undisturbed sample 50mm diameter		description	VS	very soft
- 1	Х	existing excavation		$U_{63}$	undisturbed sample 63mm diameter	base	d on unified classification	S	soft
N	BH	backhoe bucket	penetration	D	disturbed sample	syste	em	F	firm
Rev.2	В	bulldozer blade	1234	٧	vane shear (kPa)			St	stiff
က	R	ripper	no resistance ranging to	Bs	bulk sample	mois	sture	VSt	very stiff
9	E	excavator	ranging to	E	environmental sample	D	dry	Н	hard
ssne			water	R	refusal	M	moist	Fb	friable
25			water level			W	wet	VL	very loose
പ്			on date shown			Wp	plastic limit	L	loose
띪						W,	liquid limit	MD	medium dense
			water inflow			_ `		D	dense
Form			→ water outflow					VD	very dense



Borehole No.

BH45

Sheet

1 of 2 GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Date completed:

5.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS Logged by:

RJP

5.6.2007

Also

Bo	rehole	Loc	atio	n: <i>REF</i>	ER	TO F	IGUF	RE 1			C	Checke	ed by:	
drili	model	and	mour	nting:					Easting: slope	: -90°			R.	L. Surface: 3,20
	e diame				mm				Northing bearing	ng:			da	tum; AHD
dr	illing i	nfo	rmai	ion			mate		ibstance					
method	2 penetration	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characte colour, secondary and minor compo		moisture condition	consistency/ density index	100 pocket 200 to penetro- 300 m meter	
Η		C			_3			SP	SAND: fine to medium grained, grey-brown	1.	M	D		AEOLIAN SAND
			_	SPT 2,5,7 N*=12	_2	1 2			Becoming light grey-brown.					
			<u>▼</u>	SPT 5,6,8	_1	_ 					w			-
				N*=14	_0	3			Becoming dark grey-brown.					
				SPT 3,15,21 N*=36	1	- 4 - -		SP	SAND: fine to coarse grained, dark brown, gravel fine grained and silt.	trace of		VD		
				SPT 9,21,20 N*=41	2	5 - 6			With a trace fine grained gravel.					20 blows for 100mm penetration.
				SPT 8,18,21 N*=39	3	- - - 7_			Becoming fine to medium grained, light bro brown.	wn and				21 blows for 100mm penetration.
meti	hod					8 pport			notes, samples, tests		ation syn	nbols an	d	consistency/density index
AS AD RR W CT HA DT B V T *bit s e.g.	shown by	roll wa: cat hai dia bla V to	ger dri er/tric shbor ole too nd aug tube nk bit it bit x	one e I	C per 1 2 wat	ter	o resistan enging to efusal d water le e shown		U <sub>50</sub> undisturbed sample 50mm diameter U <sub>53</sub> undisturbed sample 63mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone V vane shear (kPa) P pressuremeter Bs bulk sample E environmental sample R	moisture D dr M mo W we	unified c	lassificati	ion	VS very soft S soft F firm St stiff VSt very stiff H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense



Borehole No.

**BH45** 

Sheet

2 of 2 GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Project No: Date started:

Date completed:

5.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENSLogged by:

RJP

1/11

5.6.2007

Вс	reho	le l	Loc	atio	on: <b>REF</b>	ER	TO F	IGUI	RE 1			(	Checke	d by:				
qui	mod	el a	nd :	mou	nting:					Easting: slope:	: -90°	•			R.L. Su	face:	3.20	
	e dian					mm				Northing bearin	ıg:			(	datum:		AHD	
dı	rilling		ifo	rma	tion	1	Т	mate		ubstance		1	i					
method	1 penetration	- 1	support	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle character colour, secondary and minor compon	nents.	moisture condition	consistency/ density index	100 pocket 200 penetro-	a		ructure and nal observations	
HE			С		SPT 5,13,17 N*=30	5	- I - I σ]		SP	SAND: fine to coarse grained, dark brown, gravel fine grained and silt, (continued)	trace of	W	D					- - -
					SPT 1,6,15 N*=21	6 7	10											-
-		+	1		iv ∺ZT					Borehole BH45 terminated at 10.45m		<del> </del>			+			<del></del>
			-	2.3ml <b>∕</b>		8	1 <u>1</u>											-
				Collapsed back to 2.3		9	1 <u>2</u>	-										
				ပိ		10	1 <u>3</u>											-
						11	1 <u>4</u> - -											-
						12	1 <u>5</u>											-
AS AD RR W CT HA DT B V T	shown	by by	roll- wa: cat har dia bla V b	ger di er/tric shboi de to nd au tube nk bii nit bit	re ol iger	M C per 1	ter	n resista anging to efusal 3 water l e shown	evel	notes, samples, tests  U <sub>20</sub> undisturbed sample 50mm diameter  U <sub>63</sub> undisturbed sample 63mm diameter  D disturbed sample  N standard penetration test (SPT)  N* SPT - sample recovered  Nc SPT with solid cone  V vane shear (kPa)  P pressuremeter  Bs bulk sample  E environmental sample  R	soil des based o system moistur D de M m W w	cation syr cription on unified of re re lry noist yet lastic limit quid limit	classifical			consistenc VS S F St VSt H H VVL L MD D VVD	y/density index very soft soft firm stiff very stiff hard friable very loose loose medium dense dense very dense	



Borehole No. **BH46** 

Sheet Project No: 1 of 1 GEOTSGTE20248AA

TATTERSALL SURVEYORS PTY LTD

Date started: Date completed: 6.6.2007

Principal: Project:

RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS Logged by:

6.6.2007 RJP

Bo	rehole	e Lo	catio	n: <b>REF</b>	ER	TO F	IGUI	RE 1			(	Checke	ed by	:	II P		
l	model		mou	nting:					Easting: slope					R.L.	. Surface:	1.07	
	e diam				mm		<del></del>		Northing bearing	ıg:				datu	am:	AHD	
ar	illing	into	rma	tion		1	mate		ubstance			1	,		<u> </u>		
method	5 penetration	poddns	water	notes samples, tests, etc	RL	depth metres	graphic log	classification symbol	material soil type: plasticity or particle characte colour, secondary and minor compor	ents.	moisture condition	consistency/ density index	100 pocket 200 pocket	а	additio	ructure and nal observations	
生		С				_			TOPSOIL: Sandy CLAY / Clayey SAND, lo plasticity, dark grey, sand fine to medium g some silt.	w rained,	M				TOPSOIL		
						-	1.4.1.4.	SP	SAND: fine to medium grained, grey-brown	<del></del>		MD					
			_			1					W						
				SPT 3,2,2	Lº	_			Becoming light grey-brown.								-
Į				N*=4		-											
						-											
					1	2											_
					<u> </u> -'	-											
						-			CAND ELT. TO THE TOTAL TO THE	<del></del>		\					
				SPT 7,12,14				SP	SAND: fine to medium grained, dark brown silt.	, trace		VD					
				N*=26	2	3_											
			ĺ			-											
						-											
						_											
			-	SPT	3	4		ŠP	SAND: fine to medium grained, some clay,	hrown —							
				5,16,23 N*=39		-		Oi.	and dark brown, trace fine grained gravel.	DIOWII			.				
			ŀ	14 -39													
									•								
					4	<u>5</u>											-
			ŀ														
				SPT		_		SP	SAND: fine to medium grained, light brown.								
				2,9,18 N*=27		_											
					5	6_											
						_											
			Ì			-											
						 7											
			ļ	SPT	6				Becoming fine to coarse grained, trace fine gravel, light grey-brown.	grained							-
				3,10,18 N*=28													
						-			Borehole BH46 terminated at 7.45m								
			_			- 8											
mett AS AD RR W CT HA DT B V T *bit s e.g.	hod shown b	au roi wa ca ha dia bla V	ger driler/triceshbore ble too atube ank bit bit bit	cone re ol ger	M C per	casing netration 3 4 n	n resistar anging to efusal 3 water l a shown		notes, samples, tests  U <sub>50</sub> undisturbed sample 50mm diameter U <sub>61</sub> undisturbed sample 63mm diameter D disturbed sample N standard penetration test (SPT) N* SPT - sample recovered NC SPT with solid cone V vane shear (KPa) P pressuremeter Bs bulk sample E environmental sample R refusal	soil des based o system moistur D di M m W w Wp pi	n unified o				consistence VS S F St VSt H Fb VL L MD D VD	y/density index very soft soft firm stiff very stiff hard friable very loose loose medium dense dense very dense	

Appendix B

**Results of Laboratory Testing** 



### **ALS Environmental**

### **CERTIFICATE OF ANALYSIS**

Client : COFFEY GEOTECHNICS Laboratory : Environmental Division Brisbane Page : 1 of 10

Contact : MR ROB PEARCE Contact : Tim KilmIster Work Order : EB0704186

Address : 13 MANGROVE ROAD SANDGATE NSW Address : 32 Shand Street Stafford OLD Australia 4053

13 MANGROVE ROAD SANDGATE NSW Address 32 Shand Street Stafford QLD Australia 4053 AUSTRALIA 2304

 Telephone
 : 49676377
 Telephone
 : 61-7-3243 7222

 Facsimile
 : 49675402
 Facsimile
 : 61-7-3243 7259

 Project
 : GEOTSGTE 20248AA
 Quote number
 : EN/007/07
 Date received
 : 17 Apr 2007

 Order number
 : 2524
 Date issued
 : 8 May 2007

 C-O-C number
 : 0361-0362
 No. of samples
 - Received
 : 19

 Site
 : Not provided Analysed
 : 19

### ALSE - Excellence in Analytical Testing



NATA Accredited Laboratory 825

This document is issued in accordance with NATA's accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

This document has been electronically signed by those names that appear on this report end are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory Position Department

Lea-Ellen Catt Laboratory Technician - Acid Sulphate Inorganics - NATA 825 (818 - Brisbane)
Soils

2 of 10

Client

: COFFEY GEOTECHNICS

Work Order : EB0704186



#### Comments

This report for the ALSE reference EB0704186 supersedes any previous reports with this reference. Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- Analytical Results for Samples Submitted
- Surrogate Recovery Data

The analytical procedures used by ALS Environmental have been developed from established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insuffient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits). Where LOR of reported result differ from standard LOR, this may be due to high moisture, reduced sample amount or matrix interference. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number, LOR = Limit of Reporting. \* Indicates failed Surrogate Recoveries.

Specific comments for Work Order EB0704186

Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. Conversion to liming rate in kg/m3 = kg/t x wet bulk density in t/m3. Excess ANC not required because pH OX less than 6.5.

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Client

COFFEY GEOTECHNICS

Work Order

EB0704186

ALS Enulronmental Client Sample ID : BH36 0.5-1.0 SOIL BH36 3.5-4.0 SOIL BH37 5,0-5,5 SOIL BH37-6.5-7.0 SOIL Analytical Results Sample Matrix Type / Description :

	Sample Matrix Type / Description Sample Date / Tim Laboratory Sample i	e: 11 Apr 2007 15:00	SOIL 11 Apr 2007 15:00	SOIL 11 Apr 2007 15:00	SOIL 11 Apr 2007 15:00	SOIL 11 Apr 2007 15:00
	AS number LOR Units	EB0704186-001	EB0704186-002	EB0704186-003	EB0704186-004	EB0704186-005
EA029-A: pH Measurements				A 1,245-1179 (9-6.00), D		
pH KCI (23A)	0.1 pH Unit	4.6	5.2	4.5	4.6	4.2
pH OX (23B)	0.1 pH Unit	4.2	3.8	2.7	2.7	4,1
EA029-8: Acidity Trail					Street and the street of the street	
Titratable Actual Acidity (23F)	2 mole H+/t	26	11	37	41	108
Titratable Peroxide Acidity (23G)	2 mole H+/t	28	19	120	118	137
Titratable Sulfidic Acidity (23H)	2 mole H+ / t	<2	8	63	77	29
sulfidic - Tifratable Actual Acidity (s-23F)	0.02 % pyrite S	0.04	<0.02	0.06	0.06	0.17
sulfidic - Titratable Peroxide Acidity (s-23G)	0,02 % pyrite S	0.04	0.03	0.19	0,19	0.22
sulfidic - Titratable Sulfidic Acidity (s-23H)	0.02 % pyrite S	<0.02	<0.02	0,13	0.12	0.05
EA029-C: Sulfur Trail		:	The second secon		da visasi ne ne	1 1 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -
KCI Extractable Sulfur (23Ce)	0.02 % \$	<0.02	<0.02	<0.02	<0.02	l <0.02
Peroxide Sulfur (23De)	0.02 % S	<0.02	<0.02	0.09	0,10	0.04
Peroxide Oxidisable Sulfur (23E)	0.02 % S	<0.02	<0.02	0.09	0.10	0.04
acidity - Peroxide Oxidisable Sulfur (a-23E)	10 mole H+/t	<10	<10	56	63	25
EA029-D: Calcium Values			/ .1444::::54.a.a.a.		Adeles and a comment	
KCI Extractable Calcium (23Vh)	0.02 % Ca	0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Calcium (23Wh)	0.02 % Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Acid Reacted Calcium (23X)	0.02 % Ca	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Acid Reacted Calcium (a-23X)	10 mole H+ / t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	0.02 % \$	<0.02	<0.02	<0,02	<0.02	<0.02
EA029-E: Magnesium Values				<u>"Îgrandî de kirinê de kirinê</u>		
KCI Extractable Magnesium (23Sm)	0.02 % Mg	0,02	<0.02	<0.02	<0.02	0.04
Peroxide Magnesium (23Tm)	0.02 % Mg	<0.02	<0.02	<0.02	<0.02	0.04
Acid Reacted Magnesium (23U)	0.02 % Mg	<0,02	<0.02	<0.02	<0.02	<0.02
acidity - Actd Reacted Magnesium (a-23U)	10 male H+/1	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	0.02 % S	<0.02	<0.02	<0.02	<0.02	<0,02
EA029-G: Retained Acidity				Na utraetiku net	HEALTH OF THE	
Net Acid Soluble Sulfur (20Je)	0.02 % S	<u> </u>	<del>-</del>	WHAT	——————————————————————————————————————	0.03
acidity - Net Acid Soluble Sulfur (a-20J)	10 mole H+/t			<del>_</del>		14
sulfidic - Net Acid Soluble Sulfur (s-20J)	0.02 % pyrite S		******	_		0,02
HCI Extractable Sulfur (208e)	0.02 % \$				1	0.03

A Compact Brothers Limited Company

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Client

: COFFEY GEOTECHNICS

Work Order

: EB0704186

ALS Environmental Client Sample ID: BH36 0.5-1.0 BH36 3.5-4,0 BH37 5.0-5.5 BH38 0.5-1.0 BH37 6.5-7.0 Analytical Results Sample Matrix Type / Description : SOIL SOIL SOIL SOIL SOIL 11 Apr 2007 Sample Date / Time 11 Apr 2007 11 Apr 2007 11 Apr 2007 11 Apr 2007 15:00 15:00 15:00 15:00 15:00 Laboratory Sample ID: EB0704186-001 EB0704186-002 EB0704186-003 EB0704186-004 EB0704186-005 Analyte CAS number LOR Units EA029-H: Acid Base Accounting ANC Fineness Factor 0,5 1.5 1.5 1.5 Net Acidity (sulfur units) 0.02 % S 0.04 < 0.02 0.15 0.17 0.24 Net Acidity (acidity units) 10 mole H+/t 93 147 26 11 104 Liming Rate 1 kg CaCO3/t 2 <1 7 11

ALS

Page Number

: 5 of 10

Client

: COFFEY GEOTECHNICS

Work Order

: EB0704186

ALS Environmental

Work Order : EB0704186							J	<u>ALS Environment</u>
Analytical Results	Sample	Malrix Ty Sen	llent Sample ID : ype / Description : nple Date / Time :	BH38 6.5-7.0 SOIL 11 Apr 2007 15:00	TP34 1.0-1.1 SOIL 5 Apr 2007 15:00	TP33:1,1-1,2 SOIL 5 Apr 2007 15:00	TP32 1.6-1.7 SOIL 5 Apr 2007 15:00	TP30 1.5-1.8 SOIL 5 Apr 2007 15:00
····			ratory Sample ID:	WW. A. ** * * * * * * * * * * * * * * * *				
Analyte	CAS number	LOR	Units	EB0704186-006	EB0704186-007	EB0704186-008	EB0704186-009	EB0704186-010
EA029-A: pH Measurements					<u>in is legishtly fisched</u>		<u>, 4 141,</u>	
pH KCI (23A)			pH Unit	5.2	4.9	5.7	5.0	5.0
pH OX (23B)		0.1	pH Unit	4.2	2.8	3.0	2,8	3,5
EA029-B: Acidity Trail					Company of the Compan			
Titratable Actual Acidity (23F)		2	mole H+ / t	11	15	2	7	11
Titratable Peroxide Acidity (23G)		2	mole H+/t	17	99	42	55	56
Titratable Sulfidic Acidity (23H)		2	mole H+/t	6	84	40	47	45
sulfidic - Titratable Actual Acidity (s-23F)		0.02	% pyrite S	<0.02	0.02	<0.02	<0,02	<0.02
sulfidic - Titratable Peroxide Acidity (s-23G)		0.02	% pyrite S	0.03	0.16	0.07	0.09	0.09
sulfidic - Titratable Sulfidic Acidity (s-23H)		0.02	% pyrite S	<0.02	0.13	0.06	0.08	0.07
EA029-C: Sulfur Trail			· · · · · · · · · · · · · · · · · · ·		and the second second			
KCI Extractable Sulfur (23Ce)		0.02	% S	<0.02	0.04	<0.02	<0.02	<0.02
Peroxide Sulfur (23De)		0.02	% S	<0.02	0,21	0.12	0.12	0.08
Peroxide Oxidisable Sulfur (23E)		0.02	% S	<0.02	0.16	0.12	0.12	0.08
acidity - Peroxide Oxidisable Sulfur (a-23E)		10	mole H+/t	<10	102	75	76	47
EA029-D: Calcium Values				* *		dia non antique de la companya de l La companya de la co		
KCI Extractable Calcium (23Vh)		0.02	% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Calcium (23Wh)			% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Acid Reacted Calcium (23X)			% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Acid Reacted Calcium (a-23X)			mole H+/t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)		0.02		<0.02	<0.02	<0.02	<0,02	<0.02
EA029-E: Magnesium Values			<del></del>		and the second second second	* * * * * * * * * * * * * * * * * * *	The state of the s	The second of the survey.
KCI Extractable Magnesium (23\$m)		0.02	% Mg	<0.02	0.03	<0.02	<0.02	I <0.02
Peroxide Magnesium (23Tm)			% Mg	<0.02	0.03	0.02	<0.02	<0.02
Acid Reacted Magnesium (23U)			% Mg	<0.02	<0.02	0.02	<0.02	<0.02
acidity - Acid Reacted Magnesium (a-23U)	····		mole H+/t	<10	<10	18	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)		0.02	% S	<0.02	<0.02	0.03	<0.02	<0,02
EA029-H: Acid Base Accounting			l					19 1 2 ( )
ANC Fineness Factor		0.5	<sub>-</sub>	1,5	1.5	1.5	1,5	1.5
Net Acidity (sulfur units)		0.02	% S	<0.02	0.19	0.12	0.13	0.09
Net Acidity (acidity units)			mole H+/t	11	117	77	84	58
Liming Rate			kg CaCO3/t	<1	9	6	6	4

: 6 of 10

Client

: COFFEY GEOTECHNICS

Work Order



		Client Sample ID :	TROO DIGITALE				ALS: Enutrammunt:
Analytical Results	Sample Matrix	Type / Description : ample Date / Time :	TP28 0.6-0.7 SOIL 5 Apr 2007 15:00	TP27 414-1.2 SOIL 5 Apr 2007 15:00	TP26 1:5-1:6 SOIL 5 Apr 2007 15:00	TP25 1.9-2:0 SOIL 5 Apr 2007 15:00	TP19 0.5-0.6 SOIL 5 Apr 2007 15:00
Analyte C/		oratory Sample ID :	EB0704186-011	ED0704490 049	ED0704400 044	F557774400 044	
EA029-A: pH Measurements	AS number LOF	? Units	EB0704186-011	EB0704186-012	EB0704186-013	EB0704186-014	EB0704186-015
pH KCI (23A)			<del></del>	The state of the s			The state of the s
pH OX (23B)		pH Unit	4.4 3.1	5.0	5.4 3.3	4,3	4.5
EA029-B: Acidity Trail		predint	3.1				3.6
Titratable Actual Acidity (23F)	2	mala III It		e de la companya de l		Prince (Alberti	
Titratable Peroxide Acidity (23G)	2	mole H+/t	53 94	21	7	46	36
Titratable Sulfidic Acidity (23H)	2		40		197	53	95
suffidic - Titratable Actual Acidity				12	189	8	59
(s-23F)	0.02	% pyrite S	0.08	0.03	<0.02	0.07	0.06
sulfidic - Tilratable Peroxide Acidity (s-23G)	0.02	% pyrite S	0.15	0,05	0.32	0,08	0.18
sulfidic - Tilratable Sulfidic Acidity (s-23H)	0.02	% pyrite S	0.06	<0.02	0.30	<0.02	0.09
EA029-C: Sulfur Trail		<u>-</u>				<u>.                                    </u>	v - 111 - 1111 - 1114 - 4114 - 4114 - 114
KCI Extractable Sulfur (23Ce)	0.00	% S	<0.02	1 <0.02	1		
Peroxide Sulfur (23De)		% S	<0.02	<0.02	<0,02 <0.02	<0.02 0.05	<0.02
Peroxide Oxidisable Sulfur (23E)		% S	<0.02	<0.02	<0.02	0.05	0.02
acidity - Peroxide Oxidisable Sulfur (a-23E)		mole H+/t	<10	<10	<10	30	13
EA029-D: Catcium Values					a eresti firik iyaya, ili ili ili i		
KCI Extractable Calcium (23Vh)	0.02	% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Calcium (23Wh)		% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
Acid Reacted Calcium (23X)		% Ca	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Acid Reacted Calcium (a-23X)		mole H+/t	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)		% S	<0.02	<0.02	<0.02	<0.02	<0.02
EA029-E: Magnesium Values					The second secon		
KCI Extractable Magnesium (23\$m)	0.02	! % Mg	<0.02	<0.02	<0.02	<0,02	0.02
Peroxide Magnesium (23Tm)		% Mg	<0.02	<0.02	<0.02	<0.02	0.02
Acid Reacted Magnesium (23U)		% Mg	<0.02	<0.02	<0.02	<0.02	<0.02
acidity - Acid Reacted Magnesium (a-23U)	10		<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	0.02	1 % S	<0.02	<0.02	<0.02	<0.02	<0,02
EA029-G: Retained Acidity				The Francisco Committee of the Committee			
Net Acid Soluble Sulfur (20Je)	0.02	% S	<0.02			<0.02	
acidity - Net Acid Soluble Sulfur (a-20J)		mole H+/t	<10	****		<10	
sulfidic - Net Acid Soluble Sulfur (s-20J)		% pyrite S	<0.02	Mint	<del>-</del>	<0.02	& bash
HCI Extractable Sulfur (208e)	0.02	% S	<0.02			<0,02	<del></del>
		<del></del>		<del></del>	1		L

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Page Number

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Client

: COFFEY GEOTECHNICS

Work Order

EB0704186

ALS Environmental

<u> </u>		<del></del>					<del> </del>	
Analytical Results	Samp	ote Matrix Type / Sample (	Date / Time :	TP28 0.6-0.7 SOIL 5 Apr 2007 15:00	TP27 1.1-1.2 SOIL 5 Apr 2007 15:00	TP26:1,5-11.6 SOIL 5 Apr 2007 15:00	SOIL 5 Apr 2007 15:00	TP19 0.5-0.6 SOIL 5 Apr 2007 15:00
		Laboratory	Sample ID :		1	1		1
Analyte	CAS number	LOR	Units	EB0704186-011	EB0704186-012	EB0704186-013	EB0704186-014	EB0704186-015
EA029-H: Acid Base Accounting						war blome to overline to be		
ANC Fineness Factor		0.5	1	1,5	1,5	1,5	1,5	1.5
Net Acidity (sulfur units)		0.02 % S		0.08	0.03	<0.02	0.12	0.08
Net Acidity (acidity units)		10 mole	H+/t	53	21	<10	76	49
Liming Rate		1 kg C	aCO3/t	4	2	<1	6	4

: 8 of 10

Client

: COFFEY GEOTECHNICS

Work Order

: EB0704186 ALS Enulrammental Client Sample ID : TP14 0.6-0.7 SOIL TP6 2:0-2;1 SOIL BH37 0.5-1.0 SOIL Analytical Results BH37 2.0-2,5 SOIL Sample Matrix Type / Description :

	odinje i	Sample Date / Time : Laboratory Sample ID :	5 Apr 2007 15:00	5 Apr 2007 15:00	(5 Apr 2007) (15:00)	SOIL (5 Apr 2007) (15:00)	
Analyte	CAS number	LOR Units	EB0704186-016	EB0704186-017	EB0704186-018	EB0704186-019	
EA029-A: pH Measurements		······································	<del></del>				
pH KCI (23A)		0.1 pH Unit	4,1	4,9	5.1	5,0	
pH OX (23B)	• • • • • • • • • • • • • • • • • • • •	0.1 pH Unit	4.1	3.9	4.1	3.2	
EA029-B: Acidity Trail							
Titratable Actual Acidity (23F)		2 mole H+ / t	70	16	14	24	
Titratable Peroxide Acidity (23G)		2 mole H+/t	22	15	102	102	
Titratable Sulfidic Acidity (23H)		2 mole H+/t	<2	<2	88	78	
sulfidic - Titratable Actual Acidity (s-23F)	·	0.02 % pyrite S	0.11	0.02	0.02	0.04	
sulfidic - Titratable Peroxide Acidity		0.02 % pyrite S	0,04	0.02	0,16	0.16	
_(s-23G)						1	
sulfidic - Titratable Sulfidic Acidity (s-23H)		0.02 % pyrite S	<0.02	<0.02	0.14	0.12	
EA029-C: Sulfur Trail					Proper windown Dode tel cyte, a co		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
KCI Extractable Sulfur (23Ce)		0.02 % S	0.04	<0.02	<0.02	<0.02	
Peroxide Sulfur (23De)		0.02 % S	0.06	<0.02	<0.02	0.03	
Peroxide Oxidisable Sulfur (23E)		0,02 % S	<0.02	<0.02	<0.02	0.03	
acidity - Peroxide Oxidisable Sulfur (a-23E)	, <u></u>	10 mole H+/t	10	<10	<10	21	
EA029-D: Calcium Values					The Control of the American		
KCI Extractable Calcium (23Vh)	•	0.02 % Ca	<0.02	<0.02	<0.02		
Peroxide Calcium (23Wh)		0.02 % Ca	<0.02	<0.02	<0.02	<0.02 <0.02	
Acid Reacted Calcium (23X)		0.02 % Ca	<0.02	<0.02	<0.02	<0.02 <0.02	
acidity - Acid Reacled Calcium (a-23X)		10 mole H+/t	<10	<10	<10	<10	<del></del>
sulfidic - Acid Reacted Calcium (s-23X)		0.02 % S	<0.02	<0.02	<0.02	<0.02	
EA029-E: Magnesium Values		0.04 70 0		The state of the s	1 10,02		
KCI Extractable Magnesium (23Sm)		0,02 % Mg	0.08	<0,02	<0.02	April 1997	
Peroxide Magnesium (23Tm)	<del> </del>	0.02 % Mg	0.09	<0.02	<0.02	<0.02	<u> </u>
Acid Reacted Magnesium (23U)		0.02 % Mg	<0.02	<0.02	<0.02	<0.02	
acidity - Acid Reacted Magnesium (a-23U)		10 mole H+/t	12	<10	<10	<10	
sulfidic - Acid Reacted Magnesium (s-23U)		0.02 % S	<0.02	<0.02	<0,02	<0.02	
EA029-G: Retained Acidity			<del></del>	<u>l</u>	<u> </u>		
Net Acid Soluble Sulfur (20Je)		0.00 0/ 0		ega or william popularisti i i e			
acidity - Net Acid Soluble Sulfur (a-20J)		0.02 % S	<0.02		***	mm.	
sulfidic - Net Acid Soluble Sulfur		10 mole H+ / t	<10		<u> </u>		
(s-20J)		0.02 % pyrite S	<0.02	_	<del></del>	·	
HCI Extractable Sulfur (20Be)		0.02 % S	0.05	_			

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Page Number

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Client

: COFFEY GEOTECHNICS

Work Order

: EB0704186

1,50704100	· · · · · · · · · · · · · · · · · · ·		·			<u>ALS Equironmunical</u>
Analytical Results	Client Sample ID : Sample Matrix Type / Description : Sample Date / Time : Laboratory Sample ID :	TP14 0.6-0.7 SOIL 5 Apr 2007 15:00	TP6 2.0-2.1 SOIL 5 Apr 2007 15:00	BH37 0.5-1.0 SOIL ( 5 Apr 2007 ) ( 15:00 )	BH37 2.0-2.5 SOIL ( 5 Apr 2007 ) ( 15:00 )	
Analyte	CAS number LOR Units	EB0704186-016	EB0704186-017	EB0704186-018	EB0704186-019	
EA029-H: Acid Base Accounting			The second second			
ANC Fineness Factor	0.5	1,5	1.5	1.5	1.5	7. (3. (4. (4. (3. (4. (4. (4. (4. (4. (4. (4. (4. (4. (4
Net Acidity (sulfur units)	0.02 % S	0.14	0.02	0.02	0.07	<del>                                     </del>
Net Acidity (acidity units)	10 mole H+ / t	84	16	14	44	~ <del> </del>
Liming Rate	1 kg CaCO3/t	6	1	1	3	<del> </del>

: 10 of 10

Client

: COFFEY GEOTECHNICS

Work Order

EB0704186

## Surrogate Control Limits

No surrogates present on this report.

ALS Emularor mantal

Report version : COANA 3.02

1.



job no:

GEOTSGTE20248AA sheet 1 of 1

acid sulfate soil screening test

office:

Newcastle (LABTSGTE00173AA)

client:

TATTERSAL SURVEYORS

date:

12/04/07

principal:

test location:

Newcastle

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

NH/GR

location:

**TEA GARDENS** 

checked by:

date samples recovered:

pH meter used/serial Horiba

date of calibration:

hydrogen peroxide pH prior to use: 5.46

hydrogen peroxide temperature prior to use:

22.3

pth RL m) (mAHD)	soil description	pH <sub>F</sub> pH in 1:5 distilled					}	Colour	gen peroxide)	·
		water	time (mins)	pH FOX	temp (°C)	Effervescence (see note below)	Odour	change during reaction	pH Change (ie pHr-pHrox)	Additional comments
)-1.1	Sand/ Clay	5.60	10	3.85	25	b	Υ	N	1.75	
1-1.2	Sand	4.47	10	3.35	25	a	N	N	1.12	
S-0.7	Sand / Clay	4.95	10	3.55	25	b	Υ	N	1.4	
3-1.9	Sand	5.59	10	4.68	25	а	N	N	0.91	
5-1.6	Sand	4.71	10	2.60	25	а	N	N	2.11	
9-2.0	Sand	5.25	10	4.15	25	а	N	N	1.1	
5-0.6	Clay / Sand	5.03	10	3.63	24	а	N	N	1.4	
)-1.1	Sand	5.11	10	3.88	24	а	N	N	1.23	
9-2.0	Sand	5.56	10	5.24	24	а	N	N	0.32	
3- 3- 3-	1.2 0.7 1.9 1.6 2.0 0.6	1.2 Sand 0.7 Sand Clay 1.9 Sand 1.6 Sand 2.0 Sand 0.6 Clay / Sand 1.1 Sand	Sand   Sand	Sand 4.47 10 0.7 Sand Clay 4.95 10 1.9 Sand 5.59 10 1.6 Sand 4.71 10 2.0 Sand 5.25 10 0.6 Clay / Sand 5.03 10 1.1 Sand 5.11 10	1.2     Sand     4.47     10     3.35       0.7     Sand / Clay     4.95     10     3.55       1.9     Sand     5.59     10     4.68       1.6     Sand     4.71     10     2.60       2.0     Sand     5.25     10     4.15       0.6     Clay / Sand     5.03     10     3.63       1.1     Sand     5.11     10     3.88	1.2 Sand 4.47 10 3.35 25 0.7 Sand Clay 4.95 10 3.55 25 1.9 Sand 5.59 10 4.68 25 1.6 Sand 4.71 10 2.60 25 2.0 Sand 5.25 10 4.15 25 0.6 Clay/Sand 5.03 10 3.63 24 1.1 Sand 5.11 10 3.88 24	1.2 Sand 4.47 10 3.35 25 a  0.7 Sand Clay 4.95 10 3.55 25 b  1.9 Sand 5.59 10 4.68 25 a  1.6 Sand 4.71 10 2.60 25 a  2.0 Sand 5.25 10 4.15 25 a  0.6 Clay/Sand 5.03 10 3.63 24 a  1.1 Sand 5.11 10 3.88 24 a	1.2 Sand 4.47 10 3.35 25 a N  0.7 Sand Clay 4.95 10 3.55 25 b Y  1.9 Sand 5.59 10 4.68 25 a N  1.6 Sand 4.71 10 2.60 25 a N  2.0 Sand 5.25 10 4.15 25 a N  0.6 Clay / Sand 5.03 10 3.63 24 a N  1.1 Sand 5.11 10 3.88 24 a N	1.2 Sand 4.47 10 3.35 25 a N N  0.7 Sand Clay 4.95 10 3.55 25 b Y N  1.9 Sand 5.59 10 4.68 25 a N N  1.6 Sand 4.71 10 2.60 25 a N N  2.0 Sand 5.25 10 4.15 25 a N N  0.6 Clay / Sand 5.03 10 3.63 24 a N N  1.1 Sand 5.11 10 3.88 24 a N N	4.2       Sand       4.47       10       3.35       25       a       N       N       1.12         0.7       Sand / Clay       4.95       10       3.55       25       b       Y       N       1.4         1.9       Sand       5.59       10       4.68       25       a       N       N       0.91         1.6       Sand       4.71       10       2.60       25       a       N       N       2.11         2.0       Sand       5.25       10       4.15       25       a       N       N       1.1         0.6       Clay / Sand       5.03       10       3.63       24       a       N       N       1.23         1.1       Sand       5.11       10       3.88       24       a       N       N       1.23

2. Strong Odour:



job no:

LABTSGTE00173AA sheet **1** of **1** 

acid sulfate soil screening test

office:

Newcastle

client:

TATTERSAL SURVEYORS

date:

13/04/07

principal:

(63

test location:

Newcastle

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

NH

location:

Tea Gardens

checked by:

date samples recovered:

pH meter used/serial Horiba

date of calibration:

hydrogen peroxide pH prior to use: 5.46

hydrogen peroxide temperature prior to use:

22.3

RL (mAHD)	soil description	pH <sub>F</sub> pH in 1:5 distilled water	time (mins)	· pH FOX	temp	Effervescence		Colour	gen peroxide)	
	Sand	distilled			(°C)	(see note below)	Odour	change during reaction	<sub>P</sub> H Change (ie <sub>P</sub> H <sub>F</sub> - <sub>P</sub> H <sub>FOX</sub> )	Additional comments
		4.81	10	4.17	23	A	N	N	0.64	
	Sand	5.27	10	4.45	23	Α	N	N	0.82	
	Silty Sand	4.76	10	4.15	23	Α	N	N	0.61	
	Sand	4.80	10	4.15	23	Α	N	N	0.65	
	Clay	5.62	10	4.13	23	Α	Υ	N	1.49	- " "
	Sand	5.46	10	5.21	23	Α	N	N	0.25	
	Sand	5.70	10	5.37	24	Α	N	N	0.33	
	Silty Sand	5.83	10	5.40	24	b	N	N	0.43	
		<u> </u>						<del></del>		
				bserved Reaction: a. No visible efferves						



job no:

LABTSGTE00173AA sheet 1 of 1

acid sulfate soil screening test

office:

Newcastle

client:

TATTERSAL SURVEYORS

date:

12/04/07

principal:

test location:

Newcastle

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

NH

location:

TEA GARDENS

checked by:

date samples recovered: 10-04-07

pH meter used/serial

date of calibration:

hydrogen peroxide pH prior to use: 5.46

hydrogen peroxide temperature prior to use:

22.3

				₽HF					(oxidation	eH <sub>FOX</sub> n in 30% hydro	gen peroxide)	
sample location	depth (m)	RL (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	<b>рН</b> Fox	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	ρΗ Change (ie ρΗ <sub>Γ</sub> -ρΗ <sub>ΓΟΧ</sub> )	Additional comments
TP12	0.6-0.7		Sand	5.99	10	3.98	22		N	N	2.01	
TP12	1.1-1.2		Sand	5.66	10	4.13	22		N	N	1.53	
TP12	1.9-2.0		Sand	6.44	10	4.71	23		N	N	1.73	
TP13	1,1-1,2		Sand	5.30	10	4.28	23		N	N	1.02	
TP14	0.6-0.7		Clay	5.20	10	3.26	23		N	N	1.94	
TP14	1.7-1.8		Clay	4.89	10	3.42	23		N	N.	1.47	
TP15	1.1-1.2		Sand	4.84	10	3.85	23		N	N	0.99	
TP34	1.9-2.0		Sand	6.33	10	5.45	23		N	N	0.88	
TP31	0.6-0.7		Sand	6.56	10	4.80	23		N	N	1.76	
TP30	0.6-0.7		Sand	6.00	10	4.90	23		Ni Ni	N	1,1	
TP32	1.6-1.7		Sand	6.40	10	1.43	30		Υ	N	4.97	

2. Strong Odour:



LABTSGTE00173AA sheet **1** of **1** 

acid sulfate soil screening test

office:

Newcastle

client:

TATTERSAL SURVEYORS

date:

12/04/07

principal:

test location:

Newcastle

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

NH

location:

**TEA GARDENS** 

checked by:

date samples recovered:

10-04-07

pH meter used/serial Horiba

date of calibration:

hydrogen peroxide pH prior to use:

5.46

hydrogen peroxide temperature prior to use:

22.3

				ьҢғ					(oxidation	PH <sub>FOX</sub> i in 30% hydro	gen peroxide)	
sample ocation	depth (m)	RL (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	p <b>H</b> FOX	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	pH Change (ie pH <sub>F</sub> -pH <sub>FOX</sub> )	Additional comments
TP31	1.0 1.1		Sand	6.00	10	3.63	24	Α	N	N	2.37	
TP34	0.55 - 0.65		Sand	6.76	10	4.51	25	В	Yes	N	2.25	
TP32	0.7 - 0.8		Sand	5.20	10	3.91	24	s	N	N	1.29	
TP33	1.1-1.2		Sand	6.34	10	1.45	30	В	Yes	N	4.89	
TP34	1.0 1.1		Sand	6,35		1.36	33	В	Yes	Yes	4.99	Lighter in peroxide
TP30	1.5 – 1.6		Sand	5.25	10	2.81	25	b	Yes	N	2.44	
	······································										<u> </u>	
											<del> </del>	

NOTES:

1. Observed Reaction:

2. Strong Odour:

a. No visible effervescenceb. Slight to moderate effervescence



LABTSGTE00173AA sheet 1 of 1

acid sulfate soil screening test

office:

Newcastle

client:

TATTERSAL SURVEYORS

date:

13/04/07

principal:

test location:

Newcastle

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

NH

location:

TEA GARDENS

checked by:

date samples recovered: 10-04-07

pH meter used/serial Horiba

date of calibration:

hydrogen peroxide pH prior to use: 5.49

hydrogen peroxide temperature prior to use: 22.0

				рНe					oxidation	∌H <sub>EOX</sub> in 30% hydro	gen peroxide)	
sample ocation	depth (m)	RL (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	<b>pH</b> Fox	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	թН Change (ie ρН <sub>F</sub> -ρН <sub>FΟX</sub> )	Additional comments
TP4	2.0-2.1		Sand	5.75	10	1.65	28	В	Υ	Y	4.1	Lighter After Reaction
TP19	1.1-1.2		Clay	5.20	10	3.50	23	A	N	N	1.7	
TP9	1.0-1.1		Sand	4.90	10	3.60	23	Α	N	N	1.3	· · · · · · · · · · · · · · · · · · ·
TP25	0.6-0.7		Sand	4.55	10	3,25	22	A	N	N	1.3	
TP25	1.9-2.0		Clay	4.36	10	3.26	23	A	N	N	1.1	
ТР6	2.0-2.1		Sand	4.94	10	4.06	22	A	N	N	0.88	
										·		
	··········							<del></del>				
						<del></del>		<del></del>				
	· · · · · ·									··· v.,.		V



LABTSGTE00173AA sheet 1 of 2

acid sulfate soil screening test

office:

Newcastle

client:

TATTERSAL SURVEYORS

date:

13/04/07

principal:

test location:

Newcastle

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

NH/GR

location:

**TEA GARDENS** 

checked by:

date samples recovered:

pH meter used/serial Horiba

date of calibration:

hydrogen peroxide pH prior to use: 5.28

hydrogen peroxide temperature prior to use:

21.0

				pHip		:		ed executive.			gen peroxide)	
sample location	depth (m)	RL. (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	p <b>H</b> FOX	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	PH Change (ie PHF-PHFOX)	Additional comments
TP16	0.5-0.6		Sand	4.96	10	4.72	21.5	а	N	N	0.24	
TP16	1.7-1.8		Sand	4.93	10	3.83	21.5	a	N	N.	1.1	
ТР3	1.7-1.8		Sand	5.65	10	5.42	21.0	а	N	N	0.23	
TP5	1.5-1.6		Sand	5.25	10	4.50	21.5	а	N	N	0.75	
TP5	0.9-1.0		Sand	5.78	10	4.98	21.5	а	N	N	0.8	
TP2	1.0-11		Sand	5.53	10	3.36	21.5	a	N	N	2.17	
TP10	0.5-0.6		Sand	5.25	10	4.60	21	a	N	N	0.65	
TP10	1.8-1.9		Sand	5.50	10	4.60	21	a	N	N	0.9	
TP1	1.0-1.1		Sand	5.60	10	4.79	21	а	N	N	0.81	
TP262	0.5-0.6		Sand	4.90	10	4.70	21	а	N	N	0.2	
TP26	1.0-1.1		Sand	4.75	10	4.28	21	a	N	N	0.47	

NOTES:

1. Observed Reaction: 2. Strong Odour:

a. No visible effervescenceb. Slight to moderate effervescence



LABTSGTE00173AA sheet 2 of 2

acid sulfate soil screening test

office:

Newcastle

client:

TATTERSAL SURVEYORS

date:

13/04/07

principal:

test location:

Newcastle

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

NH/GR

location:

**TEA GARDENS** 

checked by:

date samples recovered:

pH meter used/serial Horiba

date of calibration:

hydrogen peroxide pH prior to use: 5.46

hydrogen peroxide temperature prior to use:

22.3

	•			pНp		٠.			(oxidation	⊮H <sub>FOX</sub> n in 30% hydro	gen peroxide)	X-1-1-2-X
sample location	depth (m)	RL (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	p <b>H</b> Fox	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	PH Change (ie pH <sub>F</sub> -pH <sub>FOX</sub> )	Additional comments
TP21	1.1-1.2		Sand	5.30	10	5.20	21	a	N	N	0.1	
TP10	1.1-1.2		Sand	5.30	10	4.80	22	а	N	N	0.5	
TP20	0.6-0.7		Sand	5.03	10	4.17	22	а	z	N	0.86	
TP20	1.6-1.7		Sand	5.10	10	5.01	22	а	N	N	0.09	
TP29	1.1-1.2		Sand	5.20	10	4.03	22	b	Y	N	1.17	,
TP28	1.7-1.8		Sand	5.10	10	4.60	22	а	N	N	0.5	
TP19	0.5-0.6		Sand	4.96	10	3.70	22	b	Y	N	1.26	
TP1	0.5-0.6		Sand	7.28	10	5.32	24	а	N	N	1.96	
		ļ					ļ					
				1	L			<u> </u>		L	<u> </u>	

NOTES:

1. Observed Reaction:

2. Strong Odour:

a. No visible effervescenceb. Slight to moderate effervescence



LABTSGTE00173AA sheet 1 of 1

acid sulfate soil screening test

office:

Newcastle

client:

TATTERSAL SURVEYORS

date:

12/04/07

principal:

test location:

Newcastle

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

NH

location:

**TEA GARDENS** 

checked by:

date samples recovered: 10-04-07

pH meter used/serial Horiba

date of calibration:

hydrogen peroxide pH prior to use: 5.46

hydrogen peroxide temperature prior to use:

22.3

				ьНе					(oxidation	eH <sub>FOX</sub> n in 30% hydro	gen peroxide)	
ample ocation	depth (m)	RL (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	рН гох	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	PH Change (ie PHF-PHFOX)	Additional comments
TP31	1.0-1.1		Sand	6.00	10	3.63	24	а	N	N	2.37	
TP34	0.55-0.65		Sand	6.76	10	4.51	25	b	Υ	N	2.25	
TP32	0.7-0.8		Sand	5.20	10	3.91	24	a	N	N	1.29	
TP33	1.1-1.2		Sand	6.34	10	1.45	30	b	Y	N	4.89	
TP34	1.0-1.1		Sand	6.35	10	1.36	33	b	Y	Y	4.99	Lighter in Peroxide
TP30	1.5-1.6		Sand	5.25	10	2.81	25	b	Y	N	2.44	
								i				
			1									
OTES:	1	Ohean	ed Reaction:	a Na vieible	effector	scence	Slight	to moderate efferve	L	c Vigorous	s effervescent reac	tion



LABTSGTE00173AA sheet 1 of 2

acid sulfate soil screening test

office:

Newcastle

client:

TATTERSAL SURVEYORS

date:

13/04/07

principal:

test location:

Newcastle

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

NH/

location:

TEA GARDENS

checked by:

date samples recovered: 11/04/07

pH meter used/serial Horiba

date of calibration:

hydrogen peroxide pH prior to use: 5.47

hydrogen peroxide temperature prior to use:

23.0

				ρΗϝ					(òxidatior	PH <sub>POX</sub> i in 30% hydro	gen peroxide)	
sample location	depth (m)	RL (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	p <b>H</b> Fox	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	pH Change (ie pHr-pHrox)	Additional comments
BH23	0.5-1.0		Sand	5.83	10	5.01	22	a	N	N	0.82	
BH35	2.0-2.5		Sand	6.15	10	4.30	23	b	N	N	1.85	
BH35	3.5-4.0		Sand	6.45	10	5.18	22	а	N	N	1.27	
BH36	0.5-1.0		Sand	5.03	10	4.24	23	b	Y	N	0.79	
ВН36	2.0-2.5		Sand	5.26	10	3.78	22	а	N	N	1.4	
BH36	3,5-4.0		Sand	5.75	10	3.26	22	a	N	N	2.49	
ВН36	5.0-5.5		Sand	6.19	10	4.22	23	a	N	N	1.97	
ВН37	0.5-1,0		Sand	5.85	10	4.67	23	b	N	N	1.18	
ВН37	2.0-2.5		Sand	5.55	10	3.92	22	а	N	N	1.63	
BH37	3.5-4.0		Sand	5.80	10	4.25	22	a	Y	N	1.55	
BH37	5. <b>0-</b> 5.5		Sand	5.83	10	3.27	22	b	N	N	2.56	



LABTSGTE00173AA sheet 2 of 2

acid sulfate soil screening test

office:

Newcastle

client:

TATTERSAL SURVEYORS

date:

13/04/07

principal:

test location:

Newcastle

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

NH/GR

location:

**TEA GARDENS** 

checked by:

date samples recovered:

pH meter used/serial Horiba

date of calibration:

hydrogen peroxide pH prior to use: 5.46

hydrogen peroxide temperature prior to use:

22.3

				₽Н₽					(oxidation	»H <sub>FOX</sub> n in 30% hydro:	gen peroxide)	
sample location	depth (m)	RL (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	pH FOX	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	∍H Change (ie բHբ-բHϝοχ)	Additional comments
ВН37	6.5-7.0		Sand	5.73	10	3.07	23	b	2	N	2.66	
BH58	0.5-1.0		Sand / Clay	5.19	10	4.20	22	b	N	N	0.99	
BH38	2.0-2.5		Sand / Clay	5.50	10	4.15	22	а	Y	N	1.35	
BH38	3.5-4.0		Sand	5.53	10	4.38	21	a	N	N	1.15	
BH38	5.0-5.5		Sand	5.93	10	4.55	22	а	Ni	N	1.38	
ВН38	6.5-7.0		Sand	5.63	10	4.26	22	а	Υ	N	1.39	
				ļ								
		<del></del>	····					·	<del></del>			
		<u> </u>	<del></del>			·						<u></u>
												·

NOTES:

1. Observed Reaction: 2. Strong Odour:

a. No visible effervescenceb. Slight to moderate effervescence

# RESULTS OF ACID SULFATE SOIL ANALYSIS (Page 1 of 1)

9 samples supplied by Coffey on 14th June, 2007 - Lab. Job No. E7466 Analysis requested by Warabrook. - Your Project: Proposed subdivision

Sample Site	Depth (m)	EAL lab code	Texture (note 6)	Moisture Content (% moisture)	Lab. Bulk Density tonne DW/m³	TAA pH <sub>ic</sub> i	Titratable Actual Acidity (TAA) mole H <sup>†</sup> /tonne (to pH 6.5)	Reduced Inorganic Sulfur (% chromium reducible S) (%Scr) (note 2)	Reduced Inorganic Sulfur (Scr) mole H*/tonne	NET ACIDITY Chromium Suite mole H*/tonne (based on %Scrs)	LIME CALCULATION  Chromium Suite  ka CaCO <sub>3</sub> /m³  (includes 1.5 safety Factor)
Method No.		partiti eli				23A	23F	228	a- 22B	note 5	note 5
TP 39 TP 40	1.0 - 1.1 1.5 -1.6	E7466/1 E7466/2	Fine Coarse	24.9 15.9	1.2 1.3	4.27	52	0.006	4	56	5
TP 41	0.5 - 0.6	E7466/3	Fine	18.0	1.6	4.83 4.42	9 39	<0.005 <0.005	0	39	1 5
TP 42 TP 43	1.0 - 1.1 1.7 - 1.8	E7466/4 E7466/5	Fine Coarse	21.9 11.7	1.1 1.4	4.63 5.13	33 7	0.007 <0.005	4 0	37 7	3 1
BH 45 BH 46	5.5 - 5.9 1.0 - 1.1	E7466/6 E7466/7	Coarse Coarse	16.0 18.5	1.6 1.3	5.04 5.38	16 3	0.011 0.028	7 17	22 20	3 2
BH 46 BH 46	2.5 - 3.0 5.5 - 6.0	E7466/8 E7466/9	Coarse Coarse	17.8 18.3	1.4 1.4	5.23 5.91	9	0.016 0.013	10 8	18 10	2

#### NOTE:

- 1 All analysis is Dry Weight (DW) samples dried and ground immediately upon arrival (unless supplied dried and ground)
- 2 Samples analysed by SPOCAS method 23 (ie Suspension Peroxide Oxidation Combined Acidity & sulfate) and 'Chromium Reducible Sulfur' technique (Scr Method 22B)
- 3 Methods from Ahern, CR, McElnea AE, Sullivan LA (2004). Acid Sulfate Soils Laboratory Methods Guidelines. QLD DNRME.
- 4 Bulk density was determined immediately on arrival to laboratory (insitu bulk density is preferred)
- 5 ABA Equation: Net Acidity = Potential Sulfidic Acidity (ie. Scrs or Sox) + Actual Acidity + Retained Acidity measured ANC/FF
- 6 For Texture: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays
- 7 .. Denotes not requested or required
- 8 CRS, TAA and ANC are NATA certified but other SPOCAS segments are currently not NATA certification
- 9- Results at or below detection limits are replaced with '0' for calculation purposes.
- 10 Projects that disturb >1000 tonnes of soil, the ≥0.03% S classification guideline would apply.

(Classification of potential acid sulfate material if: coarse Scr≥0.03%S or 19mole H+/t; medium Scr≥0.06%S or 37mole H+/t; fine Scr≥0.1%S or 62mole H+/t)



Lab, Accred, No.: 14960



sheet 1 of 5

acid sulfate soil screening test

office:

NEWCASTLE

client:

TATTERSALL SURVEYORS PTY LTD

date:

08-06-07

principal:

test location:

NEWCASTLE

project:

RIVERSIDE ESTATE PROJECT APPLICATION tested by:

SB

TEA GARDENS

location:

REFER TO FIGURE 1

checked by:

date samples recovered: 01-04-07

pH meter used/serial HORIBA

date of calibration:

08-06-07

hydrogen peroxide pH prior to use: 5.45

hydrogen peroxide temperature prior to use:

20.4

				ьНE					(oxidation	<sub>P</sub> H <sub>FOX</sub> n in 30% hydrog	en peroxide)	
sample location	depth (m)	RL (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	pH FOX	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	<sub>P</sub> H Change (ie <sub>P</sub> H <sub>F</sub> -pH <sub>FOX</sub> )	Additional comments
TP39	0.5-0.6		Clay	7.47	20	4.38	20.6	В	A		3.09	
TP39	1.0-1.1		Clay	6.75	25	3.86	20.7	В	A		2.89	
TP39	1.5-1.6		Sand	7.29	15	5.46	20.3	А	А		1.83	
BH46	1.0-1.5		Sand	6.57	22	2.28	20.3	В	В		4.29	
BH46	2.5-3.0		Sand	6.70	21	4.38	20.2	В	А		2.32	
BH46	4.0-4.5		Sand	7.67	20	4.66	20.2	Α	А		3.01	
BH46	5.5-6.0		Sand	7.68	19	5.33	20.0	А	А		2.35	
BH46	7.0-7.5		Sand	7.25	18	5.77	19.9	А	Α		1.48	
NOTES:	1.		ed Reaction:					to moderate efferves			effervescent rea	



sheet 2 of 5

acid sulfate soil screening test

office:

**NEWCASTLE** 

client:

TATTERSALL SURVEYORS PTY LTD

date:

08-06-07

principal:

test location:

**NEWCASTLE** 

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

SB

TEA GARDENS

location:

REFER TO FIGURE 1

checked by:

date samples recovered: 01-04-07

pH meter used/serial HORIBA

date of calibration:

08-06-07

hydrogen peroxide pH prior to use: 5.15

hydrogen peroxide temperature prior to use:

20.2

				рНF					(oxidation	<sub>P</sub> H <sub>FOX</sub> i in 30% hydro	gen peroxide)	
sample ocation	depth (m)	RL (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	pH Fox	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	PH Change (ie PHE-PHFOX)	Additional comments
TP41	0.5-0.6		Clay	5.20	42	3.86	20.8	В	В		1.34	
TP41	1.0-1.1		Sandy Clay	5.18	43	4.06	20.8	В	А		1.12	
TP41	1.5-1.6		Clayey Sand	5.02	44	4.35	21.0	А	А		0.67	
TP41	2.4-2.5		Sand	6.02	46	4.67	20.7	А	Α		1.35	
TP40	0.5-0.6		Clay	6.17	55	4.64	20.4	В	Α		1.53	
TP40	1.0-1.1		Clay	5.65	56	4.50	20.4	А	А		1.15	
TP40	1.5-1.6		Sand	5.90	57	4.73	20.3	А	Α		1.17	
IOTES:	1.		ed Reaction: a					o moderate efferves				

2. Strong Odour:



sheet 3 of 5

acid sulfate soil screening test

office:

**NEWCASTLE** 

client:

TATTERSALL SURVEYORS PTY LTD

date:

08-06-07

principal:

test location:

**NEWCASTLE** 

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

SB

**TEA GARDENS** 

location:

REFER TO FIGURE 1

checked by:

date samples recovered: 01-04-07

pH meter used/serial HORIBA

date of calibration:

08-06-07

hydrogen peroxide pH prior to use: 5.55

hydrogen peroxide temperature prior to use:

20.6

				рН⊧					(oxidation	<sub>P</sub> H <sub>FOX</sub> n in 30% hydro	gen peroxide)	
sample location	depth (m)	RL (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	<b>pH</b> Fox	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	PH Change (ie PHF-PHFox)	Additional comments
TP43	0.5-0.6		Sand	4.09	15	4.94	21.2	В	А		-	
TP43	1.0-1.1		Sand	5.26	16	4.90	20.9	А	А		0.36	
TP43	1.7-1.8		Sand	5.83	18	5.18	20.7	А	А		0.65	
TP42	0.5-0.6		Clay	5.71	30	4.24	20.7	В	А		1.47	
TP42	1.0-1.1		Sandy Clay	5.25	30	4.19		А	Α		1.06	
TP42	1.5-1.6		Sand	5.44		4.15	20.8	В	A		1.29	
			<del>.</del> .	-						••••·		
							T					
NOTES:	4	Observe	ed Reaction: a	Nia - Calleia			Ollintia	to moderate efferves			effervescent rea	



sheet 4 of 5

acid sulfate soil screening test

office:

**NEWCASTLE** 

client:

TATTERSALL SURVEYORS PTY LTD

date:

08-06-07

principal:

test location:

NEWCASTLE

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

SB

**TEA GARDENS** 

location:

**REFER TO FIGURE 1** 

checked by:

date samples recovered: 01-04-07

pH meter used/serial HORIBA

date of calibration:

07-06-07

hydrogen peroxide pH prior to use: 5.44

hydrogen peroxide temperature prior to use:

20.9

				₽HF					(oxidation	<sub>P</sub> H <sub>FOX</sub> n in 30% hydro	gen peroxide)	
sample location	depth (m)	RL (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	pH Fox	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	⊧H Change (ie ⊧Н <sub>Е</sub> -⊧Н <sub>ЕОХ</sub> )	Additional comments
TP44	0.5-0.6		Sand	4.70	28	4.57	20.4	В	В		0.13	
TP44	1.0-1.1		Silty Sand	4.95	30	4.75	20.4	В	А		0.20	
TP44	1.5-1.6		Sand	5.04	31	5.07	20.5	Α	Α			
NOTES:	1	Obcony	ed Reaction:	No visible	offense	200000	Slight	to moderate efferve		- Microsoft	effervescent res	

NOTES:

1. Observed Reaction:

a. No visible effervescenceb. Slight to moderate effervescence

c. Vigorous effervescent reaction



sheet **5** of **5** 

acid sulfate soil screening test

office:

**NEWCASTLE** 

client:

TATTERSALL SURVEYORS PTY LTD

date:

08-06-07

principal:

test location:

**NEWCASTLE** 

project:

RIVERSIDE ESTATE PROJECT APPLICATION

tested by:

SB

location:

REFER TO FIGURE 1

checked by:

date samples recovered: 01-04-07

**TEA GARDENS** 

pH meter used/serial HORIBA

date of calibration:

08-06-07

hydrogen peroxide pH prior to use: 5.46

hydrogen peroxide temperature prior to use:

20.3

				рН₅	ρΗ <sub>FOX</sub> (oxidation in 30% hydrogen peroxide)							
sample location	depth (m)	RL (mAHD)	soil description	pH in 1:5 distilled water	time (mins)	pH Fox	temp (°C)	Effervescence (see note below)	Odour	Colour change during reaction	PH Change (ie PHF-PHFOX)	Additional comments
BH45	1.0-1.5		Sand	6.35	15	5.21	20.3	А	Α		1.14	
BH45	2.5-3.0		Sand	6.84	16	5.40	19.9	А	А		1.44	
BH45	4.0-4.5		Sand	6.16	17	4.72	19.9	А	А		1.44	
BH45	4.0-4.5*		Sand	7.10	18	5.45	19.5	А	А		1.65	
BH45	5.5-5.9		Sand	6.17	20	4.80	20.1	А	А		1.37	
BH45	7.0-7.4		Sand	6.49	21	5.34	20.0	А	А		1.15	
BH45	8.5-9.0		Sand	6.68	21	5.20	20.0	А	А		1.48	
BH45	10.0-10.5		Sand	6.95	22	5.09	20.0	A	А		1.85	
NOTES:	1.	Observe	ed Reaction: a	. No visible	efferves	cenceh	Slight	to moderate efferves	rence	c Vicerous	effervescent rea	otion

2. Strong Odour:

# Appendix C

Acid Sulfate Soils Management Plan



4 June 2007

Tattersall Surveyors Pty Ltd PO Box 54 RAYMOND TERRACE NSW 2324

Attention: Bob Lander

Dear Bob

**RE: PROPOSED SUBDIVISION** 

RIVERSIDE ESTATE PROJECT APPLICATION AND SUBSEQUENT STAGES, TEA GARDENS

**GENERAL ACID SULFATE SOILS MANAGEMENT PLAN** 

Please find enclosed a generic Acid Sulfate Soils (ASS) Management Plan for all future developments within the proposed Riverside Estate Project Application and subsequent stages, Tea Gardens. The plan is aimed at being useable by all future service installers, builders or property owners. It presents an overview of acid sulfate conditions at the site, the potential for exposure to ASS and then provides recommendations and procedures for management and monitoring of ASS conditions.

If you have any questions regarding this management plan, please do not hesitate to contact Robert Pearce or the undersigned.

For and on behalf of Coffey Geotechnics Pty Ltd

Author land

**Arthur Love** 

Principal Geotechnical Engineer

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1	INTRODUCTION	1
2	SITE CONDITIONS AND PROPOSED DEVELOPMENT	1
3	WHAT ARE ACID SULFATE SOILS (ASS)?	1
3.1	Background Information	1
3.2	Significance of ASS	2
4	ASS AND THE DEVELOPMENT OF RIVERSIDE ESTATE	2
5	POTENTIAL FOR OXIDATION OF ACID SULFATE SOILS	2
6	MANAGEMENT OF EXPOSED ACID SULFATE SOILS	3
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8	CONTINGENCY PLAN	5
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i

### 1 INTRODUCTION

Coffey Geotechnics Pty Ltd (Coffey) has prepared a generic Acid Sulfate Soils Management Plan for future developments within the proposed Riverside Estate Project Application, Tea Gardens. The work was commissioned by Bob Lander of Tattersall Surveyors, on behalf of Crighton Properties, the developers of the Riverside Estate.

The Riverside Estate area has been subject to numerous previous acid sulfate soil (ASS) assessments and management plans. Previous development of the adjoining Myall Quays estate has been undertaken in accordance with ASS Management Plans prepared specifically for the development earthworks programs.

The purpose of the plan provided in this document was to provide a generic plan for management of ASS in future earthworks that occur within the Riverside Estate. It is understood the plan is to be provided as a reference to all lot purchasers and contractors required to work on the site. It has therefore been formatted in a way that will be useable to individual land owners to assist in obtaining DA approvals and in controlling and managing ASS during the development of each lot.

#### 2 SITE CONDITIONS AND PROPOSED DEVELOPMENT

Topographically, the proposed development area is located within low lying coastal sand plains, with elevations typically of the order of 0.75m to between about 2.5m to 3m AHD. Vegetation generally comprises of tall grasses and scattered medium sized eucalypts.

Geologically the site is located within a region of windblown sand deposits probably of Pleistocene age (ie. greater than 20,000 years old) overlain by alluvial clays and the subsurface profiles encountered during our current investigation at the site and numerous previous investigations at the adjoining Myall Quays site revealed four main natural materials:

- TOPSOIL: Silty Clayey SAND, fine to medium grained, dark brown and dark grey;
- ALLUVIAL CLAY: Sandy CLAY and CLAY, medium to high plasticity and Clayey SAND, fine to medium grained;
- AEOLIAN SAND: fine to medium grained, pale grey / white and pale grey / brown;
- INDURATED SAND: fine to medium grained, dark brown, pale brown and orange / brown.

Groundwater depths generally vary from 0.3m to 2.0m below the surface.

# 3 WHAT ARE ACID SULFATE SOILS (ASS)?

# 3.1 Background Information

Acid Sulfate Soils (ASS) are soils which contain significant concentrations of iron sulphide or pyrite which, when exposed to oxygen in the presence of sufficient moisture, oxidises, resulting in the generation of sulfuric acid. Unoxidised pyritic soils are referred to as <u>potential</u> ASS. When the soils are exposed, the oxidation of pyrite occurs and sulphuric acids are generated, the soils are said to be <u>actual</u> ASS.

Pyritic soils typically form in waterlogged, saline sediments rich in iron and sulfate. Typical environments for the formation of these soils include tidal flats, salt marshes and mangrove swamps below about RL 1m AHD. They can also form as bottom sediments in coastal rivers and creeks.

Pyritic soils of concern on low lying NSW and coastal lands have mostly formed in the Holocene period, (ie. 10,000 years ago to present day) predominantly in the 7,000 years since the last rise in sea level. It is generally considered that pyritic soils which formed prior to the Holocene period (ie. >10,000 years ago) would already have oxidised and leached during periods of low sea level which occurred during ice ages, exposing pyritic coastal sediments to oxygen.

# 3.2 Significance of ASS

Disturbance or poorly managed development and use of acid sulfate soils can generate significant amounts of sulfuric acid, which can lower soil and water pH to extreme levels (generally <4) and produce acid salts, resulting in high salinity.

The low pH, high salinity soils can reduce or altogether preclude vegetation growth and can produce aggressive soil conditions which may be detrimental to concrete and steel components of structures, foundations, pipelines and other engineering works.

Generation of the acid conditions often releases aluminium, iron and other naturally occurring elements from the otherwise stable soil matrices. High concentrations of some such elements, coupled with low pH and alterations to salinity can be detrimental to aquatic life. In severe cases, affected waters flowing off-site into aquatic ecosystems can have a detrimental effect on aquatic ecosystems.

#### 4 ASS AND THE DEVELOPMENT OF RIVERSIDE ESTATE

Prior to development, the area was occupied by low lying sand plains with elevations typically of the order of 0.75m to about 3m AHD.

The development of the adjoining Myall Quays residential estate involved raising the level of the land to achieve a minimum surface level of 2.1m AHD. Fill used to raise land levels was won onsite and from a sand pit located to the west of the site. All fill used in the development was tested in accordance with relevant guidelines and if necessary treated in accordance with the Acid Sulfate Soils Management Plan for the site. Similar fill materials will also be used to raise site levels across part of Riverside Estate Project Application.

#### 5 POTENTIAL FOR OXIDATION OF ACID SULFATE SOILS

Installation of services involves placement of sewer mains to varying depths of up to 8m below final ground surface level. Risers are installed on each lot so the connection to sewer will not be required to extend to a depth of more than 1m. However, there is a requirement to pier structures in the vicinity of the sewer main to below the zone of influence. As this will be below the water table in most cases driven or screw piles are likely to be used and therefore extensive exposure of ASS is not likely.

As the majority of residential developments do not involve excavation below 1m depth, the following scenarios for exposure of ASS are envisaged:

Swimming pool excavations exceeding 1m deep;

- · Bored piers exceeding 1m deep;
- Other excavations that exceed 1m deep or involve dewatering by lowering the water table to depths
  of more than 1m.

It is assumed that excavations for roads will not be below 1m deep and therefore it is not envisaged that road excavation will encounter ASS or Potential ASS.

For any such proposed excavations, or dewatering projects, an acid sulfate soils assessment should be undertaken, involving sampling and analysis of soils to the proposed depth of excavation.

#### 6 MANAGEMENT OF EXPOSED ACID SULFATE SOILS

#### 6.1 Neutralisation

The preferred method for managing the relatively small quantities of acid sulfate soil likely to be excavated is neutralisation by lime. The required dosing rate should be derived from testing of representative samples of the soil prior to excavation. Soil samples should be obtained at a rate of 1 per 50m³ of soil disturbed. Samples should be taken by a suitably qualified soils technician, engineer, or soil scientist and submitted to a NATA registered laboratory for analysis by POCAS or Chromium Reducible Sulfur methods.

The recommended liming agent is fine agricultural lime with an Effective Neutralising Value (ENV) of 98% or more. Using lime of this type, the required dosing rate can be calculated from the results of the laboratory testing using the following formula:

Lime required (kg lime/tonne soil) = 1.5 x Total Potential Acidity (kg H<sub>2</sub> SO<sub>4</sub>/tonne soil)

The lime and soil should be thoroughly mixed, preferably in a bunded area as close as possible to the source, with provision for runoff water to be collected and treated prior to release. Exposed soils in the walls and floors of the excavations should be treated by spreading of lime on the exposed surfaces.

For excavations disturbing less than 1,000 tonnes of soil, liming will be required unless analysis results fall below the following criteria:

SOIL TYPE	ACTION CRITERIA
Sand to loamy sand	0.03% oxidisable sulfur 18 mol H <sup>+</sup> /tonne
Sandy loam to light clay	0.06% oxidisable sulfur  36 mol H <sup>+</sup> /tonne
Medium to heavy clay or silty clay	0.1% oxidisable sulfur 62 mol H <sup>+</sup> /tonne

Where more than 1,000 tonnes of soil is to be disturbed, all soils should be treated unless test results fall below 0.03% oxidisable sulfur or 18 mol H<sup>+</sup>/tonne.

Neutralised soils can be used elsewhere on site provided test results on the neutralised soil meet the above criteria.

### 6.2 Dewatering

To minimise the impacts of dewatering for installation of services or other excavations, the following recommendations apply:

- Where possible, undertake excavations in the wet (ie without dewatering);
- Minimise the depth and extent of dewatering by staging the works and maintaining the groundwater level as close as possible to the working surface or pipe inverts;
- Minimise the time of exposure of potential ASS by staging excavations, immediately installing services or pipes and backfilling excavation as soon as services are installed;
- Excavated groundwater should be pumped to a holding tank, pond or bunded area. The pH of the
  water should be measured and the water released only if a pH of 6.5 to 9.0 is achieved. If water pH
  is less than 6.5, lime should be added as a slurry to the water until pH meets the required values.
  The preferred method of water disposal is by overland discharge at a rate that allows infiltration into
  the sand subsoils. Direct runoff to surface drainage or waterways should be avoided;
- Larger exposures, such as those on the batters of detention basins should be further limed and the
  lower parts of the batter should have a lime buffer placed in the form of limed sand bags (10% lime
  in sand) to allow neutralisation of acid leachate generated from the excavation walls. If required, (as
  indicated by pH monitoring) additional neutralisation of water should be undertaken.

## 7 MONITORING

#### 7.1 pH Monitoring

The following monitoring is recommended to gauge neutralisation of excavated potential ASS:

- Daily measurement of soil pH in distilled water and hydrogen peroxide. Additional lime should be added if soil pH <4 (in distilled water) or pH<3 (in hydrogen peroxide) is encountered;</li>
- Laboratory testing by POCAS or CRS methods at a rate of one per 50m³ (or part thereof) of neutralised soil;
- Monitoring and liming should continue until required levels have been achieved.

#### 7.2 Water Monitoring

Monitoring of pH in water discharged from dewatering operation should be as discussed in Section 7.1.

Surface waters, such as drainage lines, ponds or creeks in the vicinity of excavations or dewatering operation should also be monitored. Discharge to surface water should be avoided if practical, but where necessary, background water quality testing should be undertaken. Discharges should comply with ANZECC 2000 guidelines.

The following criteria are presented for discharge to surface water:

pH INDICATOR	FRESH WATER	MARINE ECOSYSTEM
рН	6.5 – 8.5	<0.2 unit change
Fe (Total)	500μg/L	N/A
Total Dissolved Solids	0-1500mg/L	>1500 mg/L
Aluminium (Total)	5μg/L for pH <6.5 100μg/L for pH >6.5	-

#### 8 CONTINGENCY PLAN

Contingency plans have been discussed in the preceding section but are summarised below. Sufficient lime should be stored on site to allow implementation of the plans.

#### Soil

Where tests indicate lime neutralisation has not achieved acceptable results, additional lime shall be mixed through the soil until an acceptable result is achieved.

#### Water

Water not meeting the criteria outlined above should be treated by addition of lime in the form of a slurry. Mixing rates should be judged by monitoring pH during the process and be confirmed by laboratory testing prior to release. Care should be taken to add lime gradually, as 'over-shooting' can occur rapidly in such operations.

### 9 CONCLUSIONS

All personnel on sites involved with excavation or dewatering should be made fully aware of the issues associated with exposure of ASS and the requirements of this plan.

The site management procedures should be constantly reviewed to ensure that opportunities for exposure and oxidation of ASS are minimised.

For and on behalf of Coffey Geotechnics Pty Ltd

Author lane

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