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# Engineering Log - Excavation

Excavation No. **TP26**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: **TATTERSALL SURVEYORS PTY LTD**

Date started: **4.4.2007**

Principal:

Date completed: **4.4.2007**

Project: **RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS**

Logged by: **CW**

Test pit location: **REFER TO FIGURE 1**

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 1.709

excavation dimensions: 1.5m long 0.4m wide | Northing: m | datum: AHD

**excavation information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetro-meter kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH | | N | | | 1.5 | 0.0 | | | **TOPSOIL:** Silty Sandy CLAY, medium plasticity, dark grey-black, sand fine to medium grained, with some rootlets to 100mm. | M | | | TOPSOIL |
| | | | | D | | 0.5 | | SP | **SAND:** fine to coarse grained, pale grey-white. | | D | | |
| | | | | D | 1.0 | 1.0 | | | Becoming pale brown / grey. | | | | |
| | | | | D | 0.5 | 1.5 | | | Pit collapsing due to groundwater. Test pit TP26 terminated at 1.5m | | | | |
| | | | | | 0.0 | 2.0 | | | | | | | |
| | | | | | -0.5 | 2.5 | | | | | | | |

Sketch

**method**
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

**support**
- S shoring
- N nil

**penetration** 1 2 3 4 — no resistance ranging to refusal

**water**
- water level on date shown
- water inflow
- water outflow

**notes, samples, tests**
- $U_{50}$ undisturbed sample 50mm diameter
- $U_{63}$ undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

**classification symbols and soil description** based on unified classification system

**moisture**
- D dry
- M moist
- W wet
- Wp plastic limit
- $W_L$ 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 |
| VD | very dense |

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# Engineering Log - Excavation

Excavation No. **TP27**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: **TATTERSALL SURVEYORS PTY LTD**

Date started: **4.4.2007**

Principal:

Date completed: **4.4.2007**

Project: **RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS**

Logged by: **CW**

Test pit location: **REFER TO FIGURE 1**

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 1.536

excavation dimensions: 1.5m long 0.4m wide | Northing: m | datum: AHD

| excavation information | | | | | | material substance | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| method | penetration 1 2 3 | 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 | pocket penetrometer kPa 100 200 300 400 | structure and additional observations |
| BH | | N | | | 1.0 / 0.5 | | | **TOPSOIL:** Silty (Clayey) SAND, fine to medium grained, dark grey-black, with some rootlets to 200mm. | D | | | TOPSOIL |
| | | | | D | 0.5 / 1.0 | | SM | **Silty SAND:** fine to medium grained, dark brown, with some cemented sand nodules. | M | VD | | |
| | | | 04-04-07 3:46pm | D | 1.0 / 0.5 | | SP | **SAND:** fine to coarse grained, brown / grey, with small percent of fines approximately 20-30% possibly clay lenses or nodules. | | | | |
| | | | | | 1.5 / 0.0 | | | Becoming pale grey-white. | M/W | | | |
| | | | | D | | | | Becoming pale grey / brown. | | | | |
| | | | | | 2.0 / -0.5 | | | Pit collapsing due to groundwater inflow. Test pit TP27 terminated at 1.8m | | | | |
| | | | | | 2.5 | | | | | | | |

Sketch

**method**
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

**support**
- S shoring
- N nil

**penetration** 1 2 3 4 — no resistance ranging to refusal

**water**
- water level on date shown
- water inflow
- water outflow

**notes, samples, tests**
- $U_{50}$ undisturbed sample 50mm diameter
- $U_{63}$ undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

**classification symbols and soil description** based on unified classification system

**moisture**
- D dry
- M moist
- W wet
- Wp plastic limit
- $W_L$ 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 |
| VD | very dense |

TESTPIT 20248AA LOGS.GPJ COFFEY.GDT 23.10.07

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# Engineering Log - Excavation

Excavation No. **TP28**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: **TATTERSALL SURVEYORS PTY LTD**

Date started: **4.4.2007**

Principal:

Date completed: **4.4.2007**

Project: **RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS**

Logged by: **CW**

Test pit location: **REFER TO FIGURE 1**

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 2.012

excavation dimensions: 1.5m long 0.4m wide | Northing: m | datum: AHD

**excavation information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetrometer kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH | | N | | | | 0.5 | | | TOPSOIL: Silty SAND, fine to medium grained, dark grey-black, with some rootlets. | D | | | TOPSOIL |
| | | | | D | 1.5 | | | SM | **Silty SAND:** fine to medium grained, dark brown-black / red, cemented sand nodules. | M | D | | |
| | | | | D | 1.0 | 1.0 | | | | | | | |
| | | | ▼ 04-04-07 3:31pm | | | | | SP | **SAND:** fine to coarse grained, pale brown / grey. | W | | | |
| | | | | D | 0.5 | 1.5 | | | Becoming brown / grey mottled orange. | | | | |
| | | | | | 0.0 | 2.0 | | | Test pit TP28 terminated at 1.8m | | | | |
| | | | | | | 2.5 | | | | | | | |

Sketch

**method**
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

**support**
- S shoring
- N nil

**penetration** 1 2 3 4 — no resistance ranging to refusal

**water**
- water level on date shown
- water inflow
- water outflow

**notes, samples, tests**
- $U_{50}$ undisturbed sample 50mm diameter
- $U_{63}$ undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

**classification symbols and soil description** based on unified classification system

**moisture**
- D dry
- M moist
- W wet
- Wp plastic limit
- $W_L$ 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 |
| VD | very dense |

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# Engineering Log - Excavation

Excavation No. **TP29**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: **TATTERSALL SURVEYORS PTY LTD**

Date started: **5.4.2007**

Principal:

Date completed: **5.4.2007**

Project: **RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS**

Logged by: **CW**

Test pit location: **REFER TO FIGURE 1**

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 2.170

excavation dimensions: 1.5m long 0.4m wide | Northing: m | datum: AHD

**excavation information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetrometer kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH | | N | | | 2.0 | 0.5 | | | **TOPSOIL:** Silty SAND, fine to medium grained, dark brown-black, with some rootlets. | D | | | TOPSOIL |
| | | | | D | 1.5 | | | | **Silty SAND:** fine to medium grianed, pale grey / pale brown. | | D | | |
| | | | | | | 1.0 | | SC | **Clayey SAND:** fine to medium grained, pale brown, low plasticity fines. | M | | | |
| | | | | D | 1.0 | | | | | | | | |
| | | | | | | 1.5 | | SP | **SAND:** fine to medium grained, pale grey-white. | W | | | |
| | | | | D | 0.5 | | | | | | | | |
| | | | 05-04-07 3:12pm | | 0.0 | 2.0 | | | Pit collapsing.<br>Test pit TP29 terminated at 1.7m | | | | |
| | | | | | | 2.5 | | | | | | | |

Sketch

**method**
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator

**support**
S shoring N nil

**penetration**
1 2 3 4 no resistance ranging to refusal

**water**
water level on date shown
water inflow
water outflow

**notes, samples, tests**
$U_{50}$ undisturbed sample 50mm diameter
$U_{63}$ undisturbed sample 63mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

**classification symbols and soil description**
based on unified classification system

**moisture**
D dry
M moist
W wet
Wp plastic limit
$W_L$ 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
VD very dense

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# Engineering Log - Excavation

Excavation No. **TP30**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: **TATTERSALL SURVEYORS PTY LTD**

Date started: **5.4.2007**

Principal:

Date completed: **5.4.2007**

Project: **RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS**

Logged by: **CW**

Test pit location: **REFER TO FIGURE 1**

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 1.159

excavation dimensions: 1.5m long 0.4m wide | Northing: m | datum: AHD

**excavation information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetro-meter kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH | | N | | | 1.0 | 0.0 | | | 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 |
| | | | 05-04-07 ▼ | | | 0.5 | | 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 odour. |
| | | | | D | 0.5 | | | | | | D | | |
| | | | | | | 1.0 | | | Becoming pale brown-grey. | | | | |
| | | | | D | 0.0 | | | | | | | | |
| | | | | | | 1.5 | | | Becoming dark brown-red, with some cemented sand nodules. | | | | |
| | | | | D | -0.5 | | | | | | | | |
| | | | | | | | | | Pit collapsing. Test pit TP30 terminated at 1.7m | | | | |
| | | | | | -1.0 | 2.0 | | | | | | | |
| | | | | | | 2.5 | | | | | | | |

Sketch

**method**
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator

**support**
S shoring N nil

**penetration**
1 2 3 4 no resistance ranging to refusal

**water**
water level on date shown
water inflow
water outflow

**notes, samples, tests**
$U_{50}$ undisturbed sample 50mm diameter
$U_{63}$ undisturbed sample 63mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

**classification symbols and soil description**
based on unified classification system

**moisture**
D dry
M moist
W wet
Wp plastic limit
$W_L$ 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 |
| VD | very dense |

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# Engineering Log - Excavation

Excavation No. **TP31**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: **TATTERSALL SURVEYORS PTY LTD**

Date started: **5.4.2007**

Principal:

Date completed: **5.4.2007**

Project: **RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS**

Logged by: **CW**

Test pit location: **REFER TO FIGURE 1**

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 0.732

excavation dimensions: 1.5m long 0.4m wide | Northing: m | datum: AHD

**excavation information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetrometer kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH | | N | | | 0.5 | 0.5 | | SC | **TOPSOIL:** Silty Clayey SAND, fine to medium grained, dark grey-black mottled white, low to medium plasticity fines, with layer of mulch and rootlets to 100mm. | D / M | MD | | TOPSOIL (swampy area) organic odour. |
| | | | | | | | | | **Clayey SAND:** fine to medium grained, pale grey / pale brown, low plasticity fines. | | D | | |
| | | | | D | 0.0 | 1.0 | | | Becoming grey / brown. | W | | | Very slow inflow of groundwater. |
| | | | 05-04-07 8:29am | D | -0.5 | 1.5 | | SP | **SAND:** fine to medium grained, dark brown-red, indurated cemented sand nodules. | | | | Rapid inflow of groundwater. |
| | | | | D | -1.0 | | | | **Silty Gravelly SAND:** fine to coarse grained, dark grey-black, gravel fine to medium grained, rounded-subrounded. | | | | |
| | | | | | -1.5 | 2.0 | | | Pit collapsing due to inflow of groundwater. Test pit TP31 terminated at 1.8m | | | | |
| | | | | | | 2.5 | | | | | | | |

Sketch

**method**
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator

**support**
S shoring N nil

**penetration**
1 2 3 4 no resistance ranging to refusal

**water**
water level on date shown
water inflow
water outflow

**notes, samples, tests**
$U_{50}$ undisturbed sample 50mm diameter
$U_{63}$ undisturbed sample 63mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

**classification symbols and soil description**
based on unified classification system

**moisture**
D dry
M moist
W wet
Wp plastic limit
$W_L$ 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 |
| VD | very dense |

TESTPIT 20248AA LOGS.GPJ COFFEY.GDT 23.10.07

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# Engineering Log - Excavation

Excavation No. **TP32**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: **TATTERSALL SURVEYORS PTY LTD**

Date started: **5.4.2007**

Principal:

Date completed: **5.4.2007**

Project: **RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS**

Logged by: **CW**

Test pit location: **REFER TO FIGURE 1**

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 0.994

excavation dimensions: 1.5m long 0.4m wide | Northing: m | datum: AHD

**excavation information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetro-meter kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH | | N | 05-04-07 8:47am ▼ | D | 0.5 | 0.5 | | | TOPSOIL: Silty Clayey SAND, fine to medium grained, dark grey-black mottled white, low plasticity fines, with some rootlets and roots (10mm). | D | | | TOPSOIL (swampy area) |
| | | | | | | | | SC | **Clayey SAND:** fine to coarse grained, pale grey-pale brown, low plasticity fines maybe low percentage of fines approximately 30-40%. | M | D | | Some inflow of water. |
| | | | | D | 0.0 | 1.0 | | | Becoming grey-brown, some presence of cemented sand nodules. | W | | | Moderate inflow of groundwater 8:47am. |
| | | | | D | -0.5 | 1.5 | | | Becoming grey mottled brown / orange and presence of subrounded to rounded gravel (fine to medium grained) less than 10mm size. | | | | |
| | | | | | -1.0 | 2.0 | | | Pit continually collapsed due to water table. Test pit TP32 terminated at 1.7m | | | | |
| | | | | | -1.5 | 2.5 | | | | | | | |

Sketch

**method**
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

**support**
- S shoring
- N nil

**penetration** 1 2 3 4 — no resistance ranging to refusal

**water**
- water level on date shown
- water inflow
- water outflow

**notes, samples, tests**
- $U_{50}$ undisturbed sample 50mm diameter
- $U_{63}$ undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

**classification symbols and soil description** based on unified classification system

**moisture**
- D dry
- M moist
- W wet
- Wp plastic limit
- $W_L$ 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 |
| VD | very dense |

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# Engineering Log - Excavation

Excavation No. **TP33**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: **TATTERSALL SURVEYORS PTY LTD**

Date started: **5.4.2007**

Principal:

Date completed: **5.4.2007**

Project: **RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS**

Logged by: **CW**

Test pit location: **REFER TO FIGURE 1**

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 0.923

excavation dimensions: 1.5m long 0.4m wide | Northing: m | datum: AHD

**excavation information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetro-meter kPa (100 200 300 400) | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH | | N | | | | | | | **TOPSOIL:** Silty Clayey SAND, fine to medium grained, dark grey-black mottled white, low plasticity fines, with some rootlets to 250mm. | D/M | | | TOPSOIL (swampy area) |
| | | | | | 0.5 | 0.5 | | SC | **Clayey SAND:** fine to coarse grained, pale grey-pale brown. | M | D | | |
| | | | | D | | | | | | | | | |
| | | | 05-04-07 8:56am ▼ | | 0.0 | 1.0 | | | Becoming grey / brown. | W | | | Very slow inflow of groundwater 8:56am, organic odour. |
| | | | | D | | | | | | | | | |
| | | | | | -0.5 | 1.5 | | | | | | | |
| | | | | D | -1.0 | 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 | | | | |
| | | | | | -1.5 | 2.5 | | | | | | | |

Sketch

**method**
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

**support**
- S shoring
- N nil

**penetration** 1 2 3 4 — no resistance ranging to refusal

**water**
- water level on date shown
- water inflow
- water outflow

**notes, samples, tests**
- $U_{50}$ undisturbed sample 50mm diameter
- $U_{63}$ undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

**classification symbols and soil description** based on unified classification system

**moisture**
- D dry
- M moist
- W wet
- Wp plastic limit
- $W_L$ 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 |
| VD | very dense |

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# Engineering Log - Excavation

Excavation No. **TP34**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: **TATTERSALL SURVEYORS PTY LTD**

Date started: **5.4.2007**

Principal:

Date completed: **5.4.2007**

Project: **RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS**

Logged by: **CW**

Test pit location: **REFER TO FIGURE 1**

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 0.893

excavation dimensions: 1.5m long 0.4m wide | Northing: m | datum: AHD

**excavation information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetrometer kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH | | N | | | | | | | **TOPSOIL:** Silty Clayey SAND, fine to medium grained, dark grey-black mottled white, low to medium plasticity fines. | M | | | TOPSOIL |
| | | | | | 0.5 | 0.5 | | SC | **Clayey SAND:** fine to coarse grained, pale grey-white, low plasticity fines.<br><br>Becoming pale grey-pale brown. | | D | | |
| | | | 05-04-07 9:13am ▼ | D | | | | SP | **SAND:** with some clayey lenses, fine to medium grained, low plasticity fines. | M/W | | | Very slow inflow of water, 9:13am. |
| | | | | | 0.0 | 1.0 | | SC | **Clayey SAND:** fine to coarse grained, grey / brown, low to medium plasticity fines.<br><br>Pit slowly collapsing due to water table. | W | MD | | |
| | | | | D | | | | | | | L | | |
| | | | | | -0.5 | 1.5 | | | | | MD | | |
| | | | | | -1.0 | 2.0 | | SM | **Silty SAND:** fine to medium grained, dark brown / red. | | | | |
| | | | | | | | | | Pit collapsing due to groundwater.<br>Test pit TP34 terminated at 2m | | | | |
| | | | | | -1.5 | 2.5 | | | | | | | |

Sketch

**method**
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

**support**
- S shoring
- N nil

**penetration** 1 2 3 4 — no resistance ranging to refusal

**water**
- water level on date shown
- water inflow
- water outflow

**notes, samples, tests**
- $U_{50}$ undisturbed sample 50mm diameter
- $U_{63}$ undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

**classification symbols and soil description** based on unified classification system

**moisture**
- D dry
- M moist
- W wet
- Wp plastic limit
- $W_L$ 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 |
| VD | very dense |

TESTPIT 20248AA LOGS.GPJ COFFEY.GDT 23.10.07

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# Engineering Log - Borehole

| | |
|---|---|
| Borehole No. | BH35 |
| Sheet | 1 of 1 |
| Project No: | GEOTSGTE20248AA |
| Client: | TATTERSALL SURVEYORS PTY LTD |
| Date started: | 11.4.2007 |
| Principal: | |
| Date completed: | 11.4.2007 |
| Project: | RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS |
| Logged by: | JJT |
| Borehole Location: | REFER TO FIGURE 1 |
| Checked by: | |

| | | | | | |
|---|---|---|---|---|---|
| drill model and mounting: | MD20 | Easting: | slope: -90° | R.L. Surface: | 1.006 |
| hole diameter: | 100 mm | Northing | bearing: | datum: | AHD |

**drilling information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetro-meter kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HF | | C | ▼ | SPT 2,2,3 N*=5 | 0 | 1 | | SP | **SAND:** fine to medium grained, grey. | M | MD | | |
| | | | | | | | | | | W | | | |
| | | | | | -1 | 2 | | | | | D | | |
| | | | | SPT 2,3,11 N*=14 | -2 | 3 | | | | | | | |
| | | | | SPT 6,4,12 N*=16 | -3 | 4 | | | | | | | |
| | | | | | | | | | Borehole BH35 terminated at 4m | | | | |
| | | | | | -4 | 5 | | | | | | | |
| | | | | | -5 | 6 | | | | | | | |
| | | | | | -6 | 7 | | | | | | | |
| | | | | | | 8 | | | | | | | |

**method**

| | |
|---|---|
| AS | auger screwing* |
| AD | auger drilling* |
| RR | roller/tricone |
| W | washbore |
| CT | cable tool |
| HA | hand auger |
| DT | diatube |
| B | blank bit |
| V | V bit |
| T | TC bit |
| *bit shown by suffix e.g. | ADT |

**support**

M mud N nil
C casing

**penetration**

1 2 3 4 — no resistance ranging to refusal

**water**

▼ 10/1/98 water level on date shown
► water inflow
◄ water outflow

**notes, samples, tests**

| | |
|---|---|
| $U_{50}$ | undisturbed sample 50mm diameter |
| $U_{63}$ | 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 |

**classification symbols and soil description**

based on unified classification system

**moisture**

| | |
|---|---|
| D | dry |
| M | moist |
| W | wet |
| Wp | plastic limit |
| $W_L$ | 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 |
| VD | very dense |

coffey geotechnics

# Engineering Log - Borehole

Borehole No. **BH36**
Sheet 1 of 1
Project No: **GEOTSGTE20248AA**

Client: *TATTERSALL SURVEYORS PTY LTD*
Date started: *11.4.2007*
Principal:
Date completed: *11.4.2007*
Project: *RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS*
Logged by: *JJT*
Borehole Location: *REFER TO FIGURE 1*
Checked by:

drill model and mounting: MD20 | Easting: | slope: -90° | R.L. Surface: 2.361
hole diameter: 100 mm | Northing | bearing: | datum: AHD

**drilling information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetrometer kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HF | | C | ▼ | | 2 | 1 | | SC | **Clayey SAND:** fine to medium grained, black, clay low plasticity. | M | | | |
| | | | | SPT 4,4,5 N*=9 | | | | SP | **SAND:** fine grained, white. | W | D | | |
| | | | | | 1 | | | SP | **SAND:** fine to medium grained, black (coffee rock). | | | | |
| | | | | | | 2 | | SP | **SAND:** fine grained, white. Becoming grey. | | | | |
| | | | | SPT 2,9,11 N*=20 | 0 | | | | | | | | |
| | | | | | | 3 | | | | | VD | | |
| | | | | SPT 6,13,24 N*=37 | -1 | | | | | | | | |
| | | | | | | 4 | | SP | **SAND:** fine to medium grained, black (coffee rock). Becoming softer. | | | | |
| | | | | | -2 | | | | | | | | |
| | | | | SPT 6,9,23 N*=32 | -3 | 5 | | | | | | | |
| | | | | | | 6 | | | | | | | |
| | | | | | -4 | | | | | | | | |
| | | | | SPT 8,16,14 N*=30 | | 7 | | | | | | | |
| | | | | | -5 | | | | Borehole BH36 terminated at 7m | | | | |
| | | | | | | 8 | | | | | | | |

**method**
AS auger screwing*
AD auger drilling*
RR roller/tricone
W washbore
CT cable tool
HA hand auger
DT diatube
B blank bit
V V bit
T TC bit
*bit shown by suffix
e.g. ADT

**support**
M mud N nil
C casing

**penetration** 1 2 3 4
no resistance ranging to refusal

**water**
▼ 10/1/98 water level on date shown
water inflow
water outflow

**notes, samples, tests**
$U_{50}$ undisturbed sample 50mm diameter
$U_{63}$ 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

**classification symbols and soil description**
based on unified classification system

**moisture**
D dry
M moist
W wet
Wp plastic limit
$W_L$ 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 |
| VD | very dense |

BOREHOLE 20248AA LOGS.GPJ COFFEY.GDT 23.10.07
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# Engineering Log - Borehole

| | |
|---|---|
| Borehole No. | BH37 |
| Sheet | 1 of 1 |
| Project No: | GEOTSGTE20248AA |
| Client: | TATTERSALL SURVEYORS PTY LTD |
| Date started: | 11.4.2007 |
| Principal: | |
| Date completed: | 11.4.2007 |
| Project: | RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS |
| Logged by: | JJT |
| Borehole Location: | REFER TO FIGURE 1 |
| Checked by: | |

drill model and mounting: MD20 | Easting: | slope: -90° | R.L. Surface: Not Measured

hole diameter: 100 mm | Northing | bearing: | datum: AHD

**drilling information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetrometer kPa (100 200 300 400) | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HF | | C | | SPT 4,6,10 N*=16 | | 1 | | SC | **Clayey SAND:** fine to medium grained, black, clay low plasticity. | M | | | |
| | | | ▼ | | | | | SP | **SAND:** fine to medium grained, white. | | D | | |
| | | | | | | | | | | W | | | |
| | | | | | | | | | Becoming dark brown, with some organic material. | | | | |
| | | | | SPT 1,7,8 N*=15 | | 2 | | | | | | | |
| | | | | | | 3 | | | | | | | |
| | | | | SPT 6,18,R N*=R | | 4 | | SP | **SAND:** fine to medium grained, black (coffee rock). | | VD | | INDURATED SAND |
| | | | | | | 5 | | | Becoming brown. | | | | |
| | | | | SPT 5,7,R N*=R | | | | | | | | | |
| | | | | | | 6 | | | | | | | |
| | | | | SPT 6,7,R N*=R | | 7 | | | | | | | |
| | | | | | | | | | Borehole BH37 terminated at 7m | | | | |
| | | | | | | 8 | | | | | | | |

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**method**

| | |
|---|---|
| AS | auger screwing* |
| AD | auger drilling* |
| RR | roller/tricone |
| W | washbore |
| CT | cable tool |
| HA | hand auger |
| DT | diatube |
| B | blank bit |
| V | V bit |
| T | TC bit |

*bit shown by suffix e.g. ADT

**support**

M mud N nil
C casing

**penetration**

1 2 3 4 — no resistance ranging to refusal

**water**

▼ 10/1/98 water level on date shown
water inflow
water outflow

**notes, samples, tests**

| | |
|---|---|
| $U_{50}$ | undisturbed sample 50mm diameter |
| $U_{63}$ | 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 |

**classification symbols and soil description** based on unified classification system

**moisture**

| | |
|---|---|
| D | dry |
| M | moist |
| W | wet |
| Wp | plastic limit |
| $W_L$ | 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 |
| VD | very dense |

coffey geotechnics

# Engineering Log - Borehole

| | |
|---|---|
| Borehole No. | BH38 |
| Sheet | 1 of 1 |
| Project No: | GEOTSGTE20248AA |
| Date started: | 11.4.2007 |
| Date completed: | 11.4.2007 |
| Logged by: | JJT |
| Checked by: | |

Client: TATTERSALL SURVEYORS PTY LTD

Principal:

Project: RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS

Borehole Location: REFER TO FIGURE 1

| | | | | | |
|---|---|---|---|---|---|
| drill model and mounting: | MD20 | Easting: | slope: -90° | R.L. Surface: | 2.303 |
| hole diameter: | 100 mm | Northing | bearing: | datum: | AHD |

**drilling information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetrometer kPa (100 200 300 400) | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HF | | C | | | 2 | 1 | | CL | **TOPSOIL:** Clayey SAND, fine grained, dark grey, clay low plasticity. | M | | | TOPSOIL |
| | | | | | | | | | **Sandy CLAY:** medium to high plasticity, grey, sand fine grained. | >Wp | | | |
| | | | | SPT 2,2,3 N*=5 | 1 | | | | | | | | |
| | | | | | | 2 | | CL | **Sandy CLAY:** low to medium plasticity, dark brown, sand fine grained. | W | | | |
| | | | | SPT 4,5,5 N*=10 | 0 | 3 | | SW | **SAND:** fine to medium grained, grey. | | D | | |
| | | | | | -1 | | | | Becoming black. | | | | |
| | | | | SPT 12,18,23 N*=41 | -2 | 4 | | | | | | | |
| | | | | SPT 4,8,11 N*=19 | -3 | 5 | | | | | | | |
| | | | | | -4 | 6 | | | | | MD | | |
| | | | | SPT 4,8,8 N*=16 | | 7 | | | | | | | |
| | | | | | -5 | 8 | | | Borehole BH38 terminated at 7m | | | | |

**method**

| | |
|---|---|
| AS | auger screwing* |
| AD | auger drilling* |
| RR | roller/tricone |
| W | washbore |
| CT | cable tool |
| HA | hand auger |
| DT | diatube |
| B | blank bit |
| V | V bit |
| T | TC bit |

*bit shown by suffix e.g. ADT

**support**

M mud N nil
C casing

**penetration** 1 2 3 4 — no resistance ranging to refusal

**water**

10/1/98 water level on date shown
water inflow
water outflow

**notes, samples, tests**

| | |
|---|---|
| $U_{50}$ | undisturbed sample 50mm diameter |
| $U_{63}$ | 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 |

**classification symbols and soil description** based on unified classification system

**moisture**

| | |
|---|---|
| D | dry |
| M | moist |
| W | wet |
| Wp | plastic limit |
| $W_L$ | 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 |
| VD | very dense |

coffey geotechnics

# Engineering Log - Excavation

Excavation No. **TP39**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: **TATTERSALL SURVEYORS PTY LTD**

Date started: **1.6.2007**

Principal:

Date completed: **1.6.2007**

Project: **RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS**

Logged by: **RJP**

Test pit location: **REFER TO FIGURE 1**

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 2.77

excavation dimensions: 2m long 0.45m wide | Northing: m | datum: AHD

| excavation information | | | | | | material substance | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| method | penetration 1 2 3 | 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 | pocket penetrometer kPa 100 200 300 400 | structure and additional observations |
| BH | | N | | | 2.5 / 0.5 | | | **TOPSOIL:** Sandy Silty CLAY, medium plasticity, dark grey, sand fine to medium grained. | M | | | TOPSOIL Root affected. |
| | | | | D | | | CH | **CLAY:** high plasticity, grey-brown and orange mottled, some sand. | >Wp | St | x | |
| | | | | | 2.0 / 1.0 | | CH | **CLAY:** high plasticity, grey-grey-brown, some orange mottled with a trace of sand fine to medium grained. | | | x | |
| | | | | D | | | | | | | | |
| | | | ► | | 1.5 | | SP | **SAND:** fine to medium grained, white / light grey-brown. | W | | | Pit collapsing below 1.4m, organic odour. |
| | | | | D | | | | | | | | |
| | | | | | 1.0 / 2.0 | | | Moderate groundwater inflow below 1.4m. Test pit TP39 terminated at 1.7m | | | | |
| | | | | | 0.5 / 2.5 | | | | | | | |

Sketch

**method**
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

**support**
- S shoring
- N nil

**penetration** 1 2 3 4 — no resistance ranging to refusal

**water**
- water level on date shown
- water inflow
- water outflow

**notes, samples, tests**
- $U_{50}$ undisturbed sample 50mm diameter
- $U_{63}$ undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

**classification symbols and soil description** based on unified classification system

**moisture**
- D dry
- M moist
- W wet
- Wp plastic limit
- $W_L$ 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 |
| VD | very dense |

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# Engineering Log - Excavation

Excavation No. **TP40**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: **TATTERSALL SURVEYORS PTY LTD**

Date started: **1.6.2007**

Principal:

Date completed: **1.6.2007**

Project: **RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS**

Logged by: **RJP**

Test pit location: **REFER TO FIGURE 1**

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 2.59

excavation dimensions: 2m long 0.45m wide | Northing: m | datum: AHD

**excavation information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetrometer kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH | | N | | | 2.5 | | | | **TOPSOIL:** Silty Sandy CLAY, medium plasticity, dark grey, sand fine to medium grained. | >Wp | | | TOPSOIL Root affected. |
| | | | | | | 0.5 | | CI | **Sandy CLAY:** medium plasticity, grey-brown and orange mottled, sand fine to medium grained. | | St | | |
| | | | | D | 2.0 | | | | Becoming grey-brown and sand content increasing to Sandy CLAY / Clayey SAND. | | | X | |
| | | | | D | 1.5 | 1.0 | | | | | | X | |
| | | | | | | | | SP | **SAND:** fine to medium grained, grey-brown with some clay. | W | | | |
| | | | ▶ | D | 1.0 | 1.5 | | SP | **SAND:** fine to medium grained, light grey-brown. | | | | Rapid groundwater inflow below 1.4m. Organic odour. |
| | | | | | 0.5 | 2.0 | | | Pit collapsing below 1.1m.<br>Test pit TP40 terminated at 1.7m | | | | |
| | | | | | | 2.5 | | | | | | | |

Sketch

**method**
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

**support**
- S shoring
- N nil

**penetration**
1 2 3 4 — no resistance ranging to refusal

**water**
- water level on date shown
- water inflow
- water outflow

**notes, samples, tests**
- $U_{50}$ undisturbed sample 50mm diameter
- $U_{63}$ undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

**classification symbols and soil description**
based on unified classification system

**moisture**
- D dry
- M moist
- W wet
- Wp plastic limit
- $W_L$ 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 |
| VD | very dense |

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Excavation No. **TP41**

# Engineering Log - Excavation

Sheet 1 of 1
Project No: **GEOTSGTE20248AA**

Client: ***TATTERSALL SURVEYORS PTY LTD*** Date started: ***1.6.2007***

Principal: Date completed: ***1.6.2007***

Project: ***RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS*** Logged by: ***RJP***

Test pit location: ***REFER TO FIGURE 1*** Checked by:

equipment type and model: 4WD Backhoe Pit Orientation: Easting: m R.L. Surface: 3.63

excavation dimensions: 2m long 0.45m wide Northing: m datum: AHD

**excavation information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetrometer kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH | | N | | | 3.5 | | | | **TOPSOIL:** Sandy CLAY, medium plasticity, grey-brown, sand fine to medium grained. | M | | | TOPSOIL Root affected. |
| | | | | D | 3.0 | 0.5 | | Cl | **Sandy CLAY:** medium plasticity, light grey-brown and orange mottled, sand fine to medium grained. | >Wp | St | X | |
| | | | | | | | | | Becoming light grey-light grey-brown and orange mottled. | | | X | |
| | | | | D | 2.5 | 1.0 | | | Sand content increasing light grey-brown and orange mottled. | | | | |
| | | | | D | 2.0 | 1.5 | | SP | **SAND:** fine to medium grained, light grey-brown some orange mottled, cemented. | M | | | |
| | | | ▶ | | 1.5 | 2.0 | | SP | **SAND:** fine to medium grained, white-light grey-brown. | W | | | Slow groundwater inflow below 2.2m. Organic odour. |
| | | | | D | | 2.5 | | | | | | | |

Test pit TP41 terminated at 2.5m

Sketch

**method**
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator

**support**
S shoring N nil

**penetration**
1 2 3 4 no resistance ranging to refusal

**water**
water level on date shown
water inflow
water outflow

**notes, samples, tests**
$U_{50}$ undisturbed sample 50mm diameter
$U_{63}$ undisturbed sample 63mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

**classification symbols and soil description**
based on unified classification system

**moisture**
D dry
M moist
W wet
Wp plastic limit
$W_L$ 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
VD very dense

coffey geotechnics

# Engineering Log - Excavation

Excavation No. **TP42**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: **TATTERSALL SURVEYORS PTY LTD**

Date started: **1.6.2007**

Principal:

Date completed: **1.6.2007**

Project: **RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS**

Logged by: **RJP**

Test pit location: **REFER TO FIGURE 1**

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 2.82

excavation dimensions: 2m long 0.45m wide | Northing: m | datum: AHD

**excavation information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetrometer kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH | | N | | | | | | | **TOPSOIL:** Silty Sandy CLAY, low to medium plasticity, sand fine to medium grained, dark grey-brown. | M | | | TOPSOIL Root affected. |
| | | | | | 2.5 | 0.5 | | Cl | **Sandy CLAY:** medium plasticity, grey-brown and orange mottled, sand fine to medium grained. | >Wp | St | x | |
| | | | | D | | | | | | | | | |
| | | | | | 2.0 | 1.0 | | Cl | **Sandy CLAY:** medium plasticity, grey-grey-brown some orange mottled, sand fine to medium grained, sand content increasing. | | | x | |
| | | | ► | D | | | | SP | **SAND:** fine to medium grained, white. | W | | | Very slow water inflow below 1.1m. |
| | | | | | 1.5 | 1.5 | | | Becoming grey-grey-brown, with a trace to some clay. | | | | |
| | | | | D | | | | | | | | | |
| | | | | | 1.0 | 2.0 | | | Test pit TP42 terminated at 1.7m | | | | |
| | | | | | 0.5 | 2.5 | | | | | | | |

Sketch

TESTPIT 20248AA LOGS.GPJ COFFEY.GDT 23.10.07

Form GEO 5.2 issue 3 Rev.2

**method**
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

**support**
- S shoring
- N nil

**penetration**
1 2 3 4 — no resistance ranging to refusal

**water**
- water level on date shown
- water inflow
- water outflow

**notes, samples, tests**
- $U_{50}$ undisturbed sample 50mm diameter
- $U_{63}$ undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

**classification symbols and soil description**
based on unified classification system

**moisture**
- D dry
- M moist
- W wet
- Wp plastic limit
- $W_L$ 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 |
| VD | very dense |

coffey geotechnics

# Engineering Log - Excavation

Excavation No. **TP43**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: **TATTERSALL SURVEYORS PTY LTD**

Date started: **1.6.2007**

Principal:

Date completed: **1.6.2007**

Project: **RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS**

Logged by: **RJP**

Test pit location: **REFER TO FIGURE 1**

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 4.75

excavation dimensions: 2m long 0.45m wide | Northing: m | datum: AHD

**excavation information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetro-meter kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH | | N | | | 4.5 | 0.5 | | SP | **SAND:** fine to medium grained, grey-brown. | M | | | AEOLIAN Root affected to 0.15m. |
| | | | | D | | | | | Becoming light grey-brown. | | | | |
| | | | | | 4.0 | 1.0 | | SP | **SAND:** fine to medium grained, grey-brown and orange mottled, trace to some clay. | | | | |
| | | | | D | | | | | | | | | |
| | | | | | 3.5 | 1.5 | | SP | **SAND:** fine to medium grained, light grey-brown, some weakly cemented nodules, grey-brown. | | | | |
| | | | ► | D | 3.0 | | | | | W | | | Very slow water inflow below 1.7m. |
| | | | | | | 2.0 | | | Test pit TP43 terminated at 1.85m | | | | |
| | | | | | 2.5 | 2.5 | | | | | | | |

Sketch

**method**
N natural exposure
X existing excavation
BH backhoe bucket
B bulldozer blade
R ripper
E excavator

**support**
S shoring N nil

**penetration**
1 2 3 4 no resistance ranging to refusal

**water**
water level on date shown
water inflow
water outflow

**notes, samples, tests**
$U_{50}$ undisturbed sample 50mm diameter
$U_{63}$ undisturbed sample 63mm diameter
D disturbed sample
V vane shear (kPa)
Bs bulk sample
E environmental sample
R refusal

**classification symbols and soil description**
based on unified classification system

**moisture**
D dry
M moist
W wet
Wp plastic limit
$W_L$ 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
VD very dense

TESTPIT 20248AA LOGS.GPJ COFFEY.GDT 23.10.07

Form GEO 5.2 Issue 3 Rev 2

coffey geotechnics

# Engineering Log - Excavation

Excavation No. **TP44**

Sheet 1 of 1

Project No: **GEOTSGTE20248AA**

Client: ***TATTERSALL SURVEYORS PTY LTD***

Date started: ***1.6.2007***

Principal:

Date completed: ***1.6.2007***

Project: ***RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS***

Logged by: ***RJP***

Test pit location: ***REFER TO FIGURE 1***

Checked by:

equipment type and model: 4WD Backhoe | Pit Orientation: | Easting: m | R.L. Surface: 4.46

excavation dimensions: 2m long 0.45m wide | Northing: m | datum: AHD

**excavation information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetrometer kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BH | | N | None Observed | D | 4.0 | 0.5 | | SP | **SAND:** fine to medium grained, dark grey-brown. | M | | | AEOLIAN Root affected to 0.3m. |
| | | | | | | | | | Becoming light grey-brown. | | | | |
| | | | | D | 3.5 | 1.0 | | SP | **SAND:** fine to medium grained, dark brown, some silt / Silty SAND. | | | | INDURATED SAND |
| | | | | D | 3.0 | 1.5 | | | Becoming cleaner and less cemented, brown. | | | | |
| | | | | D | | | | | | | | | |
| | | | | | 2.5 | 2.0 | | | Test pit TP44 terminated at 1.8m | | | | |
| | | | | | 2.0 | 2.5 | | | | | | | |

Sketch

**method**
- N natural exposure
- X existing excavation
- BH backhoe bucket
- B bulldozer blade
- R ripper
- E excavator

**support**
- S shoring
- N nil

**penetration** 1 2 3 4 — no resistance ranging to refusal

**water**
- water level on date shown
- water inflow
- water outflow

**notes, samples, tests**
- $U_{50}$ undisturbed sample 50mm diameter
- $U_{63}$ undisturbed sample 63mm diameter
- D disturbed sample
- V vane shear (kPa)
- Bs bulk sample
- E environmental sample
- R refusal

**classification symbols and soil description** based on unified classification system

**moisture**
- D dry
- M moist
- W wet
- Wp plastic limit
- $W_L$ 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 |
| VD | very dense |

coffey geotechnics

# Engineering Log - Borehole

| | |
|---|---|
| Borehole No. | BH45 |
| Sheet | 1 of 2 |
| Project No: | GEOTSGTE20248AA |
| Client: | TATTERSALL SURVEYORS PTY LTD |
| Date started: | 5.6.2007 |
| Principal: | |
| Date completed: | 5.6.2007 |
| Project: | RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS |
| Logged by: | RJP |
| Borehole Location: | REFER TO FIGURE 1 |
| Checked by: | |

drill model and mounting: | Easting: | slope: -90° | R.L. Surface: 3.20

hole diameter: mm | Northing | bearing: | datum: AHD

**drilling information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetrometer kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HF | | C | ▼ | SPT 2,5,7 N*=12 | 2 | 1 | | SP | SAND: fine to medium grained, grey-brown. | M | D | | AEOLIAN SAND |
| | | | | SPT 5,6,8 N*=14 | 0 | 3 | | | Becoming light grey-brown. | W | | | |
| | | | | SPT 3,15,21 N*=36 | -1 | 4 | | SP | Becoming dark grey-brown. | | VD | | |
| | | | | SPT 9,21,20 N*=41 | -3 | 6 | | | **SAND:** fine to coarse grained, dark brown, trace of gravel fine grained and silt. With a trace fine grained gravel. | | | | 20 blows for 100mm penetration. |
| | | | | SPT 8,18,21 N*=39 | -4 | 7 | | | Becoming fine to medium grained, light brown and brown. | | | | 21 blows for 100mm penetration. |

**method**

| | |
|---|---|
| AS | auger screwing* |
| AD | auger drilling* |
| RR | roller/tricone |
| W | washbore |
| CT | cable tool |
| HA | hand auger |
| DT | diatube |
| B | blank bit |
| V | V bit |
| T | TC bit |

*bit shown by suffix e.g. ADT

**support**

M mud N nil
C casing

**penetration** 1 2 3 4 — no resistance ranging to refusal

**water**

▼ 10/1/98 water level on date shown
water inflow
water outflow

**notes, samples, tests**

| | |
|---|---|
| $U_{50}$ | undisturbed sample 50mm diameter |
| $U_{63}$ | 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 |

**classification symbols and soil description** based on unified classification system

**moisture**

| | |
|---|---|
| D | dry |
| M | moist |
| W | wet |
| Wp | plastic limit |
| $W_L$ | 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 |
| VD | very dense |

coffey geotechnics

# Engineering Log - Borehole

| | |
|---|---|
| Borehole No. | BH45 |
| Sheet | 2 of 2 |
| Project No: | GEOTSGTE20248AA |
| Date started: | 5.6.2007 |
| Date completed: | 5.6.2007 |
| Logged by: | RJP |
| Checked by: | |

Client: TATTERSALL SURVEYORS PTY LTD

Principal:

Project: RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS

Borehole Location: REFER TO FIGURE 1

drill model and mounting: | Easting: | slope: -90° | R.L. Surface: 3.20

hole diameter: mm | Northing | bearing: | datum: AHD

**drilling information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetrometer kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HF | | C | | | -5 | 9 | | SP | SAND: fine to coarse grained, dark brown, trace of gravel fine grained and silt. *(continued)* | W | D | | |
| | | | | SPT 5,13,17 N*=30 | | | | | | | | | |
| | | | | | -6 | 10 | | | | | | | |
| | | | | SPT 1,6,15 N*=21 | -7 | | | | | | | | |
| | | | ▼ Collapsed back to 2.3m | | -8 | 11 | | | Borehole BH45 terminated at 10.45m | | | | |
| | | | | | -9 | 12 | | | | | | | |
| | | | | | -10 | 13 | | | | | | | |
| | | | | | -11 | 14 | | | | | | | |
| | | | | | -12 | 15 | | | | | | | |
| | | | | | | 16 | | | | | | | |

**method**

| | |
|---|---|
| AS | auger screwing* |
| AD | auger drilling* |
| RR | roller/tricone |
| W | washbore |
| CT | cable tool |
| HA | hand auger |
| DT | diatube |
| B | blank bit |
| V | V bit |
| T | TC bit |
| *bit shown by suffix e.g. | ADT |

**support**

M mud N nil
C casing

**penetration** 1 2 3 4 — no resistance ranging to refusal

**water**

▼ 10/1/98 water level on date shown
► water inflow
◄ water outflow

**notes, samples, tests**

| | |
|---|---|
| $U_{50}$ | undisturbed sample 50mm diameter |
| $U_{63}$ | 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 |

**classification symbols and soil description** based on unified classification system

**moisture**

| | |
|---|---|
| D | dry |
| M | moist |
| W | wet |
| Wp | plastic limit |
| $W_L$ | 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 |
| VD | very dense |

coffey geotechnics

# Engineering Log - Borehole

| | |
|---|---|
| Borehole No. | **BH46** |
| Sheet | 1 of 1 |
| Project No: | **GEOTSGTE20248AA** |
| Client: | ***TATTERSALL SURVEYORS PTY LTD*** |
| Date started: | **6.6.2007** |
| Principal: | |
| Date completed: | **6.6.2007** |
| Project: | ***RIVERSIDE ESTATE PROJECT APPLICATION, TEA GARDENS*** |
| Logged by: | **RJP** |
| Borehole Location: | ***REFER TO FIGURE 1*** |
| Checked by: | |

drill model and mounting: | Easting: | slope: -90° | R.L. Surface: 1.07

hole diameter: mm | Northing | bearing: | datum: AHD

**drilling information** | **material substance**

| method | penetration 1 2 3 | 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 | pocket penetro-meter kPa 100 200 300 400 | structure and additional observations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HF | | C | | | | | | | TOPSOIL: Sandy CLAY / Clayey SAND, low plasticity, dark grey, sand fine to medium grained, some silt. | M | | | TOPSOIL |
| | | | ▼ | | | 1 | | SP | **SAND:** fine to medium grained, grey-brown. | | MD | | |
| | | | | SPT 3,2,2 N*=4 | 0 | | | | Becoming light grey-brown. | W | | | |
| | | | | | -1 | 2 | | | | | | | |
| | | | | SPT 7,12,14 N*=26 | -2 | 3 | | SP | **SAND:** fine to medium grained, dark brown, trace silt. | | VD | | |
| | | | | SPT 5,16,23 N*=39 | -3 | 4 | | SP | **SAND:** fine to medium grained, some clay, brown and dark brown, trace fine grained gravel. | | | | |
| | | | | | -4 | 5 | | | | | | | |
| | | | | SPT 2,9,18 N*=27 | -5 | 6 | | SP | **SAND:** fine to medium grained, light brown. | | | | |
| | | | | SPT 3,10,18 N*=28 | -6 | 7 | | | Becoming fine to coarse grained, trace fine grained gravel, light grey-brown. | | | | |
| | | | | | | 8 | | | Borehole BH46 terminated at 7.45m | | | | |

**method**

| | |
|---|---|
| AS | auger screwing* |
| AD | auger drilling* |
| RR | roller/tricone |
| W | washbore |
| CT | cable tool |
| HA | hand auger |
| DT | dialube |
| B | blank bit |
| V | V bit |
| T | TC bit |
| *bit shown by suffix e.g. | ADT |

**support**

M mud N nil
C casing

**penetration**

1 2 3 4 — no resistance ranging to refusal

**water**

▼ 10/1/98 water level on date shown
► water inflow
◄ water outflow

**notes, samples, tests**

| | |
|---|---|
| $U_{50}$ | undisturbed sample 50mm diameter |
| $U_{63}$ | 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 |

**classification symbols and soil description** based on unified classification system

**moisture**

| | |
|---|---|
| D | dry |
| M | moist |
| W | wet |
| Wp | plastic limit |
| $W_L$ | 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 |
| VD | 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 AUSTRALIA 2304 | *Address* | : 32 Shand Street Stafford QLD Australia 4053 | | |
| *E-mail* | : robert_pearce@coffey.com.au | *E-mail* | : Services.Brisbane@alsenviro.com | | |
| *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*

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This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic 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 Soils | Inorganics - NATA 825 (818 - Brisbane) |

ALS Environmental

## 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.

ALS Environmental

## Analytical Results

| Analyte | CAS number | LOR | Units | Client Sample ID: BH36 0.5-1.0 / Sample Matrix Type / Description: SOIL / Sample Date / Time: 11 Apr 2007 15:00 / Laboratory Sample ID: EB0704186-001 | BH36 3.5-4.0 / SOIL / 11 Apr 2007 15:00 / EB0704186-002 | BH37 5.0-5.5 / SOIL / 11 Apr 2007 15:00 / EB0704186-003 | BH37 6.5-7.0 / SOIL / 11 Apr 2007 15:00 / EB0704186-004 | BH38 0.5-1.0 / SOIL / 11 Apr 2007 15:00 / EB0704186-005 |
|---|---|---|---|---|---|---|---|---|
| **EA029-A: pH Measurements** | | | | | | | | |
| pH KCl (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-B: Acidity Trail** | | | | | | | | |
| 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 | 83 | 77 | 29 |
| sulfidic - Titratable 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** | | | | | | | | |
| KCl Extractable Sulfur (23Ce) | | 0.02 | % S | <0.02 | <0.02 | <0.02 | <0.02 | <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** | | | | | | | | |
| KCl 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 | % S | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| **EA029-E: Magnesium Values** | | | | | | | | |
| KCl 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 - Acid Reacted Magnesium (a-23U) | | 10 | mole H+ / t | <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** | | | | | | | | |
| Net Acid Soluble Sulfur (20Je) | | 0.02 | % S | — | — | — | — | 0.03 |
| acidity - Net Acid Soluble Sulfur (a-20J) | | 10 | mole H+ / t | — | — | — | — | 14 |
| sulfidic - Net Acid Soluble Sulfur (s-20J) | | 0.02 | % pyrite S | — | — | — | — | 0.02 |
| HCl Extractable Sulfur (20Be) | | 0.02 | % S | — | — | — | — | 0.03 |

ALS Environmental

## Analytical Results

| Analyte | CAS number | LOR | Units | Client Sample ID: BH36 0.5-1.0 / Sample Matrix Type / Description: SOIL / Sample Date / Time: 11 Apr 2007 15:00 / Laboratory Sample ID: EB0704186-001 | BH36 3.5-4.0 / SOIL / 11 Apr 2007 15:00 / EB0704186-002 | BH37 5.0-5.5 / SOIL / 11 Apr 2007 15:00 / EB0704186-003 | BH37 6.5-7.0 / SOIL / 11 Apr 2007 15:00 / EB0704186-004 | BH38 0.5-1.0 / SOIL / 11 Apr 2007 15:00 / EB0704186-005 |
|---|---|---|---|---|---|---|---|---|
| **EA029-H: Acid Base Accounting** | | | | | | | | |
| ANC Fineness Factor | | 0.5 | | 1.5 | 1.5 | 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 | 26 | 11 | 93 | 104 | 147 |
| Liming Rate | | 1 | kg CaCO3/t | 2 | <1 | 7 | 8 | 11 |

ALS Environmental

## Analytical Results

| Analyte | CAS number | LOR | Units | Client Sample ID: BH38 6.5-7.0 / Sample Matrix Type / Description: SOIL / Sample Date / Time: 11 Apr 2007 15:00 / Laboratory Sample ID: EB0704186-006 | Client Sample ID: TP34 1.0-1.1 / Sample Matrix Type / Description: SOIL / Sample Date / Time: 5 Apr 2007 15:00 / Laboratory Sample ID: EB0704186-007 | Client Sample ID: TP33 1.1-1.2 / Sample Matrix Type / Description: SOIL / Sample Date / Time: 5 Apr 2007 15:00 / Laboratory Sample ID: EB0704186-008 | Client Sample ID: TP32 1.6-1.7 / Sample Matrix Type / Description: SOIL / Sample Date / Time: 5 Apr 2007 15:00 / Laboratory Sample ID: EB0704186-009 | Client Sample ID: TP30 1.5-1.6 / Sample Matrix Type / Description: SOIL / Sample Date / Time: 5 Apr 2007 15:00 / Laboratory Sample ID: EB0704186-010 |
|---|---|---|---|---|---|---|---|---|
| **EA029-A: pH Measurements** | | | | | | | | |
| pH KCl (23A) | | 0.1 | 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** | | | | | | | | |
| Titratable Actual Acidity (23F) | | 2 | mole H+ / t | 11 | 15 | 2 | 7 | 11 |
| Titratable Peroxide Acidity (23G) | | 2 | mole H+ / t | 17 | 99 | 42 | 56 | 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 | 0.05 | 0.08 | 0.07 |
| **EA029-C: Sulfur Trail** | | | | | | | | |
| KCl 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** | | | | | | | | |
| KCl 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 | % S | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| **EA029-E: Magnesium Values** | | | | | | | | |
| KCl Extractable Magnesium (23Sm) | | 0.02 | % Mg | <0.02 | 0.03 | <0.02 | <0.02 | <0.02 |
| Peroxide Magnesium (23Tm) | | 0.02 | % Mg | <0.02 | 0.03 | 0.02 | <0.02 | <0.02 |
| Acid Reacted Magnesium (23U) | | 0.02 | % Mg | <0.02 | <0.02 | 0.02 | <0.02 | <0.02 |
| acidity - Acid Reacted Magnesium (a-23U) | | 10 | 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** | | | | | | | | |
| ANC Fineness Factor | | 0.5 | | 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) | | 10 | mole H+ / t | 11 | 117 | 77 | 84 | 56 |
| Liming Rate | | 1 | kg CaCO3/t | <1 | 9 | 6 | 6 | 4 |

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## Analytical Results

| Analyte | CAS number | LOR | Units | Client Sample ID: TP28 0.6-0.7 SOIL 5 Apr 2007 15:00 EB0704186-011 | TP27 1.1-1.2 SOIL 5 Apr 2007 15:00 EB0704186-012 | TP26 1.5-1.6 SOIL 5 Apr 2007 15:00 EB0704186-013 | TP25 1.9-2.0 SOIL 5 Apr 2007 15:00 EB0704186-014 | TP19 0.5-0.6 SOIL 5 Apr 2007 15:00 EB0704186-015 |
|---|---|---|---|---|---|---|---|---|
| **EA029-A: pH Measurements** | | | | | | | | |
| pH KCl (23A) | | 0.1 | pH Unit | 4.4 | 5.0 | 5.4 | 4.3 | 4.5 |
| pH OX (23B) | | 0.1 | pH Unit | 3.1 | 2.8 | 3.3 | 2.2 | 3.6 |
| **EA029-B: Acidity Trail** | | | | | | | | |
| Titratable Actual Acidity (23F) | | 2 | mole H+ / t | 53 | 21 | 7 | 46 | 36 |
| Titratable Peroxide Acidity (23G) | | 2 | mole H+ / t | 94 | 33 | 197 | 53 | 95 |
| Titratable Sulfidic Acidity (23H) | | 2 | mole H+ / t | 40 | 12 | 189 | 8 | 59 |
| sulfidic - Titratable Actual Acidity (s-23F) | | 0.02 | % pyrite S | 0.08 | 0.03 | <0.02 | 0.07 | 0.06 |
| sulfidic - Titratable Peroxide Acidity (s-23G) | | 0.02 | % pyrite S | 0.15 | 0.05 | 0.32 | 0.08 | 0.15 |
| sulfidic - Titratable Sulfidic Acidity (s-23H) | | 0.02 | % pyrite S | 0.06 | <0.02 | 0.30 | <0.02 | 0.09 |
| **EA029-C: Sulfur Trail** | | | | | | | | |
| KCl Extractable Sulfur (23Ce) | | 0.02 | % S | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| Peroxide Sulfur (23De) | | 0.02 | % S | <0.02 | <0.02 | <0.02 | 0.05 | 0.02 |
| Peroxide Oxidisable Sulfur (23E) | | 0.02 | % S | <0.02 | <0.02 | <0.02 | 0.05 | 0.02 |
| acidity - Peroxide Oxidisable Sulfur (a-23E) | | 10 | mole H+ / t | <10 | <10 | <10 | 30 | 13 |
| **EA029-D: Calcium Values** | | | | | | | | |
| KCl 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 | % S | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| **EA029-E: Magnesium Values** | | | | | | | | |
| KCl Extractable Magnesium (23Sm) | | 0.02 | % Mg | <0.02 | <0.02 | <0.02 | <0.02 | 0.02 |
| Peroxide Magnesium (23Tm) | | 0.02 | % Mg | <0.02 | <0.02 | <0.02 | <0.02 | 0.02 |
| Acid Reacted Magnesium (23U) | | 0.02 | % Mg | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| acidity - Acid Reacted Magnesium (a-23U) | | 10 | mole H+ / t | <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** | | | | | | | | |
| Net Acid Soluble Sulfur (20Je) | | 0.02 | % S | <0.02 | --- | --- | <0.02 | --- |
| acidity - Net Acid Soluble Sulfur (a-20J) | | 10 | mole H+ / t | <10 | --- | --- | <10 | --- |
| sulfidic - Net Acid Soluble Sulfur (s-20J) | | 0.02 | % pyrite S | <0.02 | --- | --- | <0.02 | --- |
| HCl Extractable Sulfur (20Be) | | 0.02 | % S | <0.02 | --- | --- | <0.02 | --- |

ALS Environmental

## Analytical Results

| Analyte | CAS number | LOR | Units | Client Sample ID: TP28 0.6-0.7 | TP27 1.1-1.2 | TP26 1.5-1.6 | TP25 1.9-2.0 | TP19 0.5-0.6 |
|---|---|---|---|---|---|---|---|---|
| Sample Matrix Type / Description: | | | | SOIL | SOIL | SOIL | SOIL | SOIL |
| Sample Date / Time: | | | | 5 Apr 2007 15:00 | 5 Apr 2007 15:00 | 5 Apr 2007 15:00 | 5 Apr 2007 15:00 | 5 Apr 2007 15:00 |
| Laboratory Sample ID: | | | | EB0704186-011 | EB0704186-012 | EB0704186-013 | EB0704186-014 | EB0704186-015 |
| **EA029-H: Acid Base Accounting** | | | | | | | | |
| ANC Fineness Factor | | 0.5 | | 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 CaCO3/t | 4 | 2 | <1 | 6 | 4 |

ALS Environmental

## Analytical Results

| Analyte | CAS number | LOR | Units | Client Sample ID: TP14 0.6-0.7 SOIL 5 Apr 2007 15:00 EB0704186-016 | TP6 2.0-2.1 SOIL 5 Apr 2007 15:00 EB0704186-017 | BH37 0.5-1.0 SOIL ( 5 Apr 2007 ) ( 15:00 ) EB0704186-018 | BH37 2.0-2.5 SOIL ( 5 Apr 2007 ) ( 15:00 ) EB0704186-019 | |
|---|---|---|---|---|---|---|---|---|
| **EA029-A: pH Measurements** | | | | | | | | |
| pH KCl (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 (s-23G) | | 0.02 | % pyrite S | 0.04 | 0.02 | 0.16 | 0.16 | |
| sulfidic - Titratable Sulfidic Acidity (s-23H) | | 0.02 | % pyrite S | <0.02 | <0.02 | 0.14 | 0.12 | |
| **EA029-C: Sulfur Trail** | | | | | | | | |
| KCl 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) | | 10 | mole H+ / t | 10 | <10 | <10 | 21 | |
| **EA029-D: Calcium Values** | | | | | | | | |
| KCl Extractable Calcium (23Vh) | | 0.02 | % Ca | <0.02 | <0.02 | <0.02 | <0.02 | |
| Peroxide Calcium (23Wh) | | 0.02 | % Ca | <0.02 | <0.02 | <0.02 | <0.02 | |
| Acid Reacted Calcium (23X) | | 0.02 | % Ca | <0.02 | <0.02 | <0.02 | <0.02 | |
| acidity - Acid Reacted Calcium (a-23X) | | 10 | mole H+ / t | <10 | <10 | <10 | <10 | |
| sulfidic - Acid Reacted Calcium (s-23X) | | 0.02 | % S | <0.02 | <0.02 | <0.02 | <0.02 | |
| **EA029-E: Magnesium Values** | | | | | | | | |
| KCl Extractable Magnesium (23Sm) | | 0.02 | % Mg | 0.08 | <0.02 | <0.02 | <0.02 | |
| Peroxide Magnesium (23Tm) | | 0.02 | % Mg | 0.09 | <0.02 | <0.02 | <0.02 | |
| 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** | | | | | | | | |
| Net Acid Soluble Sulfur (20Je) | | 0.02 | % S | <0.02 | — | — | — | |
| acidity - Net Acid Soluble Sulfur (a-20J) | | 10 | mole H+ / t | <10 | — | — | — | |
| sulfidic - Net Acid Soluble Sulfur (s-20J) | | 0.02 | % pyrite S | <0.02 | — | — | — | |
| HCl Extractable Sulfur (20Be) | | 0.02 | % S | 0.05 | — | — | — | |

ALS Environmental

## Analytical Results

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

ALS Environmental

## Surrogate Control Limits

- No surrogates present on this report.

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

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***

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | pH Change (ie $pH_F$-$pH_{FOX}$) | Additional comments |
| *TP3* | *1.0-1.1* | | *Sand/ Clay* | *5.60* | *10* | *3.85* | 25 | b | Y | N | 1.75 | |
| *TP27* | *1.1-1.2* | | *Sand* | *4.47* | *10* | *3.35* | 25 | a | N | N | 1.12 | |
| *TP28* | *0.6-0.7* | | *Sand / Clay* | *4.95* | *10* | *3.55* | 25 | b | Y | N | 1.4 | |
| *TP22* | *1.8-1.9* | | *Sand* | *5.59* | *10* | *4.68* | 25 | a | N | N | 0.91 | |
| *TP6* | *1.5-1.6* | | *Sand* | *4.71* | *10* | *2.60* | 25 | a | N | N | 2.11 | |
| *TP9* | *1.9-2.0* | | *Sand* | *5.25* | *10* | *4.15* | 25 | a | N | N | 1.1 | |
| *TP24* | *0.5-0.6* | | *Clay / Sand* | *5.03* | *10* | *3.63* | 24 | a | N | N | 1.4 | |
| *TP24* | *1.0-1.1* | | *Sand* | *5.11* | *10* | *3.88* | 24 | a | N | N | 1.23 | |
| *TP24* | *1.9-2.0* | | *Sand* | *5.56* | *10* | *5.24* | 24 | a | N | N | 0.32 | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

NOTES: 1. Observed Reaction: a. No visible effervescenceb. Slight to moderate effervescence c. Vigorous effervescent reaction
2. Strong Odour:

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

job no:
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: pH meter used/serial Horiba date of calibration:

hydrogen peroxide pH prior to use: ***5.46*** hydrogen peroxide temperature prior to use: ***22.3***

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | pH Change (ie $pH_F$-$pH_{FOX}$) | Additional comments |
| *TP18* | *0.6-0.7* | | *Sand* | *4.81* | *10* | *4.17* | 23 | A | N | N | 0.64 | |
| *TP18* | *1.8-1.9* | | *Sand* | *5.27* | *10* | *4.45* | 23 | A | N | N | 0.82 | |
| *TP6* | *0.6-0.7* | | *Silty Sand* | *4.76* | *10* | *4.15* | 23 | A | N | N | 0.61 | |
| *TP6* | *1.0-1.1* | | *Sand* | *4.80* | *10* | *4.15* | 23 | A | N | N | 0.65 | |
| *TP4* | *0.5-0.6* | | *Clay* | *5.62* | *10* | *4.13* | 23 | A | Y | N | 1.49 | |
| *TP17* | *1.1-1.2* | | *Sand* | *5.46* | *10* | *5.21* | 23 | A | N | N | 0.25 | |
| *TP11* | *1.0-1.1* | | *Sand* | *5.70* | *10* | *5.37* | 24 | A | N | N | 0.33 | |
| *TP22* | *0.5-0.6* | | *Silty Sand* | *5.83* | *10* | *5.40* | 24 | b | N | N | 0.43 | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

NOTES: 1. Observed Reaction: a. No visible effervescenceb. Slight to moderate effervescence c. Vigorous effervescent reaction
2. Strong Odour:

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

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 Horiba date of calibration:

hydrogen peroxide pH prior to use: *5.46* hydrogen peroxide temperature prior to use: *22.3*

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | pH Change (ie $pH_F$-$pH_{FOX}$) | 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 | | N | N | 1.1 | |
| *TP32* | *1.6-1.7* | | *Sand* | *6.40* | *10* | *1.43* | 30 | | Y | N | 4.97 | |

NOTES: 1. Observed Reaction: a. No visible effervescence b. Slight to moderate effervescence c. Vigorous effervescent reaction
2. Strong Odour:

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

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 Horiba date of calibration:

hydrogen peroxide pH prior to use: *5.46* hydrogen peroxide temperature prior to use: *22.3*

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | pH Change (ie $pH_F$-$pH_{FOX}$) | Additional comments |
| *TP31* | *1.0 – 1.1* | | *Sand* | *6.00* | *10* | *3.63* | 24 | A | N | N | 2.37 | |
| *TP34* | *0.55 – 0.65* | | *Sand* | *6.76* | *10* | *4.51* | 25 | B | 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 | B | Yes | N | 4.89 | |
| *TP34* | *1.0 – 1.1* | | *Sand* | *6.35* | | *1.36* | 33 | B | Yes | Yes | 4.99 | Lighter in peroxide |
| *TP30* | *1.5 – 1.6* | | *Sand* | *5.25* | *10* | *2.81* | 25 | b | Yes | N | 2.44 | |
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NOTES: 1. Observed Reaction: a. No visible effervescenceb. Slight to moderate effervescence c. Vigorous effervescent reaction
2. Strong Odour:

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

job no:
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*

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | pH Change (ie $pH_F$-$pH_{FOX}$) | Additional comments |
| *TP4* | *2.0-2.1* | | *Sand* | *5.75* | *10* | *1.65* | 28 | B | Y | 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 | A | 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 | |
| *TP6* | *2.0-2.1* | | *Sand* | *4.94* | *10* | *4.06* | 22 | A | N | N | 0.88 | |
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NOTES: 1. Observed Reaction: a. No visible effervescenceb. Slight to moderate effervescence c. Vigorous effervescent reaction
2. Strong Odour:

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

job no:
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*

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | pH Change (ie $pH_F$-$pH_{FOX}$) | Additional comments |
| *TP16* | *0.5-0.6* | | *Sand* | *4.96* | *10* | *4.72* | 21.5 | a | N | N | 0.24 | |
| *TP16* | *1.7-1.8* | | *Sand* | *4.93* | *10* | *3.83* | 21.5 | a | N | N | 1.1 | |
| *TP3* | *1.7-1.8* | | *Sand* | *5.65* | *10* | *5.42* | 21.0 | a | N | N | 0.23 | |
| *TP5* | *1.5-1.6* | | *Sand* | *5.25* | *10* | *4.50* | 21.5 | a | N | N | 0.75 | |
| *TP5* | *0.9-1.0* | | *Sand* | *5.78* | *10* | *4.98* | 21.5 | a | 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 | a | N | N | 0.81 | |
| *TP262* | *0.5-0.6* | | *Sand* | *4.90* | *10* | *4.70* | 21 | a | 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: a. No visible effervescenceb. Slight to moderate effervescence c. Vigorous effervescent reaction
2. Strong Odour:

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

job no:
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*

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | pH Change (ie $pH_F$-$pH_{FOX}$) | 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 | a | N | N | 0.5 | |
| *TP20* | *0.6-0.7* | | *Sand* | *5.03* | *10* | *4.17* | 22 | a | N | N | 0.86 | |
| *TP20* | *1.6-1.7* | | *Sand* | *5.10* | *10* | *5.01* | 22 | a | 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 | a | 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 | a | N | N | 1.96 | |
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NOTES: 1. Observed Reaction: a. No visible effervescence b. Slight to moderate effervescence c. Vigorous effervescent reaction
2. Strong Odour:

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

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 Horiba date of calibration:

hydrogen peroxide pH prior to use: *5.46* hydrogen peroxide temperature prior to use: *22.3*

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | pH Change (ie $pH_F$-$pH_{FOX}$) | Additional comments |
| *TP31* | *1.0-1.1* | | *Sand* | *6.00* | *10* | *3.63* | 24 | a | N | N | 2.37 | |
| *TP34* | *0.55-0.65* | | *Sand* | *6.76* | *10* | *4.51* | 25 | b | Y | 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 | |
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NOTES: 1. Observed Reaction: a. No visible effervescence b. Slight to moderate effervescence c. Vigorous effervescent reaction
2. Strong Odour:

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

job no:
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*

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | pH Change (ie $pH_F$-$pH_{FOX}$) | 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 | a | N | N | 1.27 | |
| *BH36* | *0.5-1.0* | | *Sand* | *5.03* | *10* | *4.24* | 23 | b | Y | N | 0.79 | |
| *BH36* | *2.0-2.5* | | *Sand* | *5.26* | *10* | *3.78* | 22 | a | N | N | 1.4 | |
| *BH36* | *3.5-4.0* | | *Sand* | *5.75* | *10* | *3.26* | 22 | a | N | N | 2.49 | |
| *BH36* | *5.0-5.5* | | *Sand* | *6.19* | *10* | *4.22* | 23 | a | N | N | 1.97 | |
| *BH37* | *0.5-1.0* | | *Sand* | *5.85* | *10* | *4.67* | 23 | b | N | N | 1.18 | |
| *BH37* | *2.0-2.5* | | *Sand* | *5.55* | *10* | *3.92* | 22 | a | N | N | 1.63 | |
| *BH37* | *3.5-4.0* | | *Sand* | *5.80* | *10* | *4.25* | 22 | a | Y | N | 1.55 | |
| *BH37* | *5.0-5.5* | | *Sand* | *5.83* | *10* | *3.27* | 22 | b | N | N | 2.56 | |

NOTES: 1. Observed Reaction: a. No visible effervescence b. Slight to moderate effervescence c. Vigorous effervescent reaction
2. Strong Odour:

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

job no:
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*

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | $pH$ Change (ie $pH_F$-$pH_{FOX}$) | Additional comments |
| *BH37* | *6.5-7.0* | | *Sand* | *5.73* | *10* | *3.07* | 23 | b | N | 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 | a | 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 | a | N | N | 1.38 | |
| *BH38* | *6.5-7.0* | | *Sand* | *5.63* | *10* | *4.26* | 22 | a | Y | N | 1.39 | |
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NOTES: 1. Observed Reaction: a. No visible effervescence b. Slight to moderate effervescence c. Vigorous effervescent reaction
2. Strong Odour:

# 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/$m^3$ | TAA $pH_{KCl}$ | Titratable Actual Acidity (TAA) mole $H^+$/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 kg $CaCO_3/m^3$ (includes 1.5 safety Factor) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Method No.* | | | | | | *23A* | *23F* | *22B* | *a- 22B* | *note 5* | *note 5* |
| TP 39 | 1.0 - 1.1 | *E7466/1* | Fine | 24.9 | 1.2 | 4.27 | 52 | 0.006 | 4 | 56 | 5 |
| TP 40 | 1.5 -1.6 | *E7466/2* | Coarse | 15.9 | 1.3 | 4.83 | 9 | <0.005 | 0 | 9 | 1 |
| TP 41 | 0.5 - 0.6 | *E7466/3* | Fine | 18.0 | 1.6 | 4.42 | 39 | <0.005 | 0 | 39 | 5 |
| TP 42 | 1.0 - 1.1 | *E7466/4* | Fine | 21.9 | 1.1 | 4.63 | 33 | 0.007 | 4 | 37 | 3 |
| TP 43 | 1.7 - 1.8 | *E7466/5* | Coarse | 11.7 | 1.4 | 5.13 | 7 | <0.005 | 0 | 7 | 1 |
| BH 45 | 5.5 - 5.9 | *E7466/6* | Coarse | 16.0 | 1.6 | 5.04 | 16 | 0.011 | 7 | 22 | 3 |
| BH 46 | 1.0 - 1.1 | *E7466/7* | Coarse | 18.5 | 1.3 | 5.38 | 3 | 0.028 | 17 | 20 | 2 |
| BH 46 | 2.5 - 3.0 | *E7466/8* | Coarse | 17.8 | 1.4 | 5.23 | 9 | 0.016 | 10 | 18 | 2 |
| BH 46 | 5.5 - 6.0 | *E7466/9* | Coarse | 18.3 | 1.4 | 5.91 | 2 | 0.013 | 8 | 10 | 1 |

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.**

Lab. Accred. No.: 14960

**(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)**



checked: .....

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

job no: GEOTSGTE20248AA

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 TEA GARDENS* tested by: *SB*

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*

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | $pH$ Change (ie $pH_F$-$pH_{FOX}$) | Additional comments |
| *TP39* | *0.5-0.6* | | *Clay* | *7.47* | *20* | *4.38* | *20.6* | *B* | *A* | | 3.09 | |
| *TP39* | *1.0-1.1* | | *Clay* | *6.75* | *25* | *3.86* | *20.7* | *B* | *A* | | 2.89 | |
| *TP39* | *1.5-1.6* | | *Sand* | *7.29* | *15* | *5.46* | *20.3* | *A* | *A* | | 1.83 | |
| *BH46* | *1.0-1.5* | | *Sand* | *6.57* | *22* | *2.28* | *20.3* | *B* | *B* | | 4.29 | |
| *BH46* | *2.5-3.0* | | *Sand* | *6.70* | *21* | *4.38* | *20.2* | *B* | *A* | | 2.32 | |
| *BH46* | *4.0-4.5* | | *Sand* | *7.67* | *20* | *4.66* | *20.2* | *A* | *A* | | 3.01 | |
| *BH46* | *5.5-6.0* | | *Sand* | *7.68* | *19* | *5.33* | *20.0* | *A* | *A* | | 2.35 | |
| *BH46* | *7.0-7.5* | | *Sand* | *7.25* | *18* | *5.77* | *19.9* | *A* | *A* | | 1.48 | |
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NOTES: 1. Observed Reaction: a. No visible effervescence b. Slight to moderate effervescence c. Vigorous effervescent reaction

2. Strong Odour:

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

job no: GEOTSGTE20248AA

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 TEA GARDENS* tested by: *SB*

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*

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | pH Change (ie $pH_F$-$pH_{FOX}$) | Additional comments |
| *TP41* | *0.5-0.6* | | *Clay* | *5.20* | *42* | *3.86* | *20.8* | *B* | *B* | | *1.34* | |
| *TP41* | *1.0-1.1* | | *Sandy Clay* | *5.18* | *43* | *4.06* | *20.8* | *B* | *A* | | *1.12* | |
| *TP41* | *1.5-1.6* | | *Clayey Sand* | *5.02* | *44* | *4.35* | *21.0* | *A* | *A* | | *0.67* | |
| *TP41* | *2.4-2.5* | | *Sand* | *6.02* | *46* | *4.67* | *20.7* | *A* | *A* | | *1.35* | |
| *TP40* | *0.5-0.6* | | *Clay* | *6.17* | *55* | *4.64* | *20.4* | *B* | *A* | | *1.53* | |
| *TP40* | *1.0-1.1* | | *Clay* | *5.65* | *56* | *4.50* | *20.4* | *A* | *A* | | *1.15* | |
| *TP40* | *1.5-1.6* | | *Sand* | *5.90* | *57* | *4.73* | *20.3* | *A* | *A* | | *1.17* | |
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NOTES: 1. Observed Reaction: a. No visible effervescenceb. Slight to moderate effervescence c. Vigorous effervescent reaction

2. Strong Odour:

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

job no: GEOTSGTE20248AA

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 TEA GARDENS* tested by: *SB*

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*

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | pH Change (ie $pH_F$-$pH_{FOX}$) | Additional comments |
| *TP43* | *0.5-0.6* | | *Sand* | *4.09* | *15* | *4.94* | *21.2* | *B* | *A* | | - | |
| *TP43* | *1.0-1.1* | | *Sand* | *5.26* | *16* | *4.90* | *20.9* | *A* | *A* | | *0.36* | |
| *TP43* | *1.7-1.8* | | *Sand* | *5.83* | *18* | *5.18* | *20.7* | *A* | *A* | | *0.65* | |
| *TP42* | *0.5-0.6* | | *Clay* | *5.71* | *30* | *4.24* | *20.7* | *B* | *A* | | *1.47* | |
| *TP42* | *1.0-1.1* | | *Sandy Clay* | *5.25* | *30* | *4.19* | | *A* | *A* | | *1.06* | |
| *TP42* | *1.5-1.6* | | *Sand* | *5.44* | | *4.15* | *20.8* | *B* | *A* | | *1.29* | |
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NOTES: 1. Observed Reaction: a. No visible effervescenceb. Slight to moderate effervescence c. Vigorous effervescent reaction

2. Strong Odour:

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

job no: GEOTSGTE20248AA

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 TEA GARDENS* tested by: *SB*

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*

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | pH Change (ie $pH_F$-$pH_{FOX}$) | Additional comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *TP44* | *0.5-0.6* | | *Sand* | *4.70* | *28* | *4.57* | *20.4* | *B* | *B* | | *0.13* | |
| *TP44* | *1.0-1.1* | | *Silty Sand* | *4.95* | *30* | *4.75* | *20.4* | *B* | *A* | | *0.20* | |
| *TP44* | *1.5-1.6* | | *Sand* | *5.04* | *31* | *5.07* | *20.5* | *A* | *A* | | | |
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NOTES: 1. Observed Reaction: a. No visible effervescence b. Slight to moderate effervescence c. Vigorous effervescent reaction

2. Strong Odour:

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

job no: GEOTSGTE20248AA

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 TEA GARDENS* tested by: *SB*

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: *5.46* hydrogen peroxide temperature prior to use: *20.3*

| sample location | depth (m) | RL (mAHD) | soil description | $pH_F$ pH in 1:5 distilled water | $pH_{FOX}$ (oxidation in 30% hydrogen peroxide) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | time (mins) | pH FOX | temp (°C) | Effervescence (see note below) | Odour | Colour change during reaction | $pH$ Change (ie $pH_F$-$pH_{FOX}$) | Additional comments |
| *BH45* | *1.0-1.5* | | *Sand* | *6.35* | *15* | *5.21* | *20.3* | *A* | *A* | | *1.14* | |
| *BH45* | *2.5-3.0* | | *Sand* | *6.84* | *16* | *5.40* | *19.9* | *A* | *A* | | *1.44* | |
| *BH45* | *4.0-4.5* | | *Sand* | *6.16* | *17* | *4.72* | *19.9* | *A* | *A* | | *1.44* | |
| *BH45* | *4.0-4.5** | | *Sand* | *7.10* | *18* | *5.45* | *19.5* | *A* | *A* | | *1.65* | |
| *BH45* | *5.5-5.9* | | *Sand* | *6.17* | *20* | *4.80* | *20.1* | *A* | *A* | | *1.37* | |
| *BH45* | *7.0-7.4* | | *Sand* | *6.49* | *21* | *5.34* | *20.0* | *A* | *A* | | *1.15* | |
| *BH45* | *8.5-9.0* | | *Sand* | *6.68* | *21* | *5.20* | *20.0* | *A* | *A* | | *1.48* | |
| *BH45* | *10.0-10.5* | | *Sand* | *6.95* | *22* | *5.09* | *20.0* | *A* | *A* | | *1.85* | |
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NOTES: 1. Observed Reaction: a. No visible effervescenceb. Slight to moderate effervescence c. Vigorous effervescent reaction

2. Strong Odour:

# Appendix C

**Acid Sulfate Soils Management Plan**

coffey geotechnics
SPECIALISTS MANAGING THE EARTH

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

**Arthur Love**

Principal Geotechnical Engineer

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# 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 potential ASS. When the soils are exposed, the oxidation of pyrite occurs and sulphuric acids are generated, the soils are said to be actual 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 $H_2$ $SO_4$/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<br>18 mol $H^+$/tonne |
| Sandy loam to light clay | 0.06% oxidisable sulfur<br>36 mol $H^+$/tonne |
| Medium to heavy clay or silty clay | 0.1% oxidisable sulfur<br>62 mol $H^+$/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 $H^+$/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;
- 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 |
|---|---|---|
| pH | 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<br>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

**Arthur Love**

Principal Geotechnical Engineer