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**Date:** 30 August 2006

Development Services  
The City of Swan  
P.O Box 196  
Midland WA 6936

Dear Sir/Madam,

**Acid Sulfate Soils Investigation and Management Plan  
Lots 7, 19, 20 & 64 Copley Road and Lot 100 Great North Highway, Upper Swan**

Please find enclosed two copies of the following report prepared on behalf of Midland Brick.

RPS Bowman Bishaw Gorham. 2005. *Acid Sulfate Soils Investigation and Management Plan – Lots 7, 19, 20 & 64 Copley Road and Lot 100 Great Northern Highway*. Unpublished Report prepared for Midland Brick.

This document has been approved for implementation by the Department of Environment and Conservation (DEC). We have been requested by the Audit Branch of the DEC to make this document publicly available by providing copies to relevant libraries and organisations.

Thank you for your assistance with this matter. If you have any questions please contact the undersigned.

Yours sincerely

**RPS Bowman Bishaw Gorham**



**KRISTEN BENNETTS**

Managing Scientist

**ACID SULFATE SOILS INVESTIGATION  
AND MANAGEMENT PLAN –  
LOTS 7, 19, 20 & 64 COPLEY ROAD  
AND LOT 100 GREAT NORTHERN HIGHWAY**

**Prepared for:**

**Midland Brick**

102 Great Northern Highway

MIDDLE SWAN

WA 6056

**Prepared by:**

**RPS Bowman Bishaw Gorham**

290 Churchill Avenue

SUBIACO WA 6008

Report No: C05054

June 2005

## SUMMARY

### Background

Midland Brick Company Pty Ltd (Midland Brick) referred a proposal to the Environmental Protection Authority (EPA) in May 2002 to indefinitely extend the time limit of its environmental approval for clay excavation operations at Hallet and Copley Roads, Upper Swan and to expand working areas to encompass Lot 19 Copley Road, Lots 19, 45 and 46 St Albans Road and Lot 100 Great Northern Highway.

Relevant environmental factors to the proposed change of conditions identified by EPA included acid sulfate soils (ASS). Appendix 4 of Bulletin 1157 (EPA December 2004) presents the draft recommended environmental conditions and commitments to be discharged by Midland Brick on approval of the proposal by the Minister for the Environment. In relation to ASS, the draft conditions specify the following requirements:

Condition 6: Acid Sulfate Soils Investigation and Management Plan

6-1 *Prior to any ground-disturbing activities associated with the excavation and dewatering of areas classed as having a “high risk” of acid sulfate soils according to the Western Australian Planning Commission Bulletin No. 64, the proponent shall prepare an Acid Sulfate Soils Investigation and Management Plan to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.*

*The objectives of the Plan are:*

- *to ensure that any ground-disturbing activities which may disturb acid sulfate soils and/or contaminated waters are planned and managed to avoid adverse effects on the natural and built environment, human activities and health.*

*The Plan shall address:*

1. *Identification of acid sulfate soils in and near areas proposed to be disturbed,*

*and, in the event that the disturbance of acid sulfate soils is unavoidable, the plan shall also address:*

2. *Potential on-site and off-site effects of the disturbance of the acid sulfate soils and/or groundwater levels.*
3. *How drainage or soil extraction will be undertaken to minimise environmental impacts.*
4. *How any acid leachate generated as a result of ground-disturbing activities will be managed.*
5. *Management of areas, both on and off-site, used to store or treat extracted soil.*
6. *Comprehensive surface and groundwater quality monitoring both on and off-site, if applicable.*
7. *Establishment of agreed performance criteria and objectives in relation to environmental and social impacts, and*
8. *Contingency measures and procedures in the event that the agreed performance criteria may not be met.*

6-2 *The proponent shall implement the Acid Sulfate Soils Investigation and Management Plan required by Condition 6-1, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.*

6-3 *The proponent shall make the Acid Sulfate Soils Investigation and Management Plan, required by Condition 6-1, publicly available, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.*

This Acid Sulfate Soils Investigation and Management Plan (ASSIMP) has been prepared on behalf of Midland Brick by RPS Bowman Bishaw Gorham in fulfilment of the draft environmental conditions.

## Scope & Objectives

The principal objectives of the investigation were to assess (i) the presence, distribution and magnitude of Potential Acid Sulfate Soils (PASS) in and near areas proposed for disturbance per draft condition 6-1(1) and (ii) identify the need for management and monitoring measures during the clay excavation program per draft condition 6-1(2)-(8). Tasks undertaken in support of the preparation of the ASSIMP included:

- Compilation and review of existing environmental data and exploratory drill logs to characterise site features, including local soils, hydrology and hydrogeology.
- A comprehensive soil sampling and analysis program to investigate the presence, distribution and magnitude of PASS in areas proposed for direct disturbance as a consequence of clay excavation. Midland Brick has advised that dewatering is not conducted in support of clay excavation works and indirect disturbance of PASS due to groundwater drawdown is not expected. It is understood some pumping does occur to control surface water accumulations above the clay unit during the winter months.
- A baseline groundwater sampling and analysis program to (i) assess background groundwater quality prior to earthworks disturbance and (ii) to provide an indication of acid sulfate soil impacts at the watertable that may have occurred due to past mining activities.
- Comparison of field and laboratory acid sulfate soil test data with applicable Department of Environment (DoE) guidelines and action criteria to assess potential management implications associated with the proposed clay excavation program.

The completed field and laboratory program included the following:

- Inspected and sampled the soil profile at 11 locations to target depths varying between 6 and 14mbgl, yielding an average depth of investigation of 8.8mbgl. Soil investigation bores were sampled using a push-core drill rig and were generally terminated below the estimated base of excavation at each location. Combined soil and groundwater sampling sites were investigated using a drill rig with hollow-stem auger and split-spoon attachment. All locations were targeted within the Coondaree Swamp “*High ASS Risk*” zone mapped by DoE / WRC (2004), taking account of access constraints imposed by the remnant clay pits and main drainage corridor bisecting the site. Exploratory drilling records compiled by Midland Brick between 1982 and 1983 were reviewed in detail to assist in the planning phase of the investigation. The proposed sampling density was considered adequate to sufficiently characterise the ASS characteristics of soils within the site, based on the low geological and geomorphological variability within the identified risk zone.
- Installed permanent groundwater monitor bores at three of the soil investigation locations to enable assessment of baseline water quality characteristics prior to earthworks disturbance.
- Recovered 208 discrete soil samples for field  $pH_F$  and  $pH_{FOX}$  analysis in accordance with DoE requirements, to provide a preliminary indication of the presence of PASS, Actual Acid Sulfate Soils (AASS) and/or Non Acid Sulfate Soils (NASS).
- Conducted selective SPOCAS and/or CRS analysis on 34 samples to confirm the presence or absence of PASS, corresponding to approximately 17% of the total number of recovered samples.

## Findings

### *Field and Peroxide pH Data*

Field  $pH_F$  and peroxide  $pH_{FOX}$  data indicated the following:

- 198 of the 206 samples analysed in the field (approx. 96%) exhibited  $pH_F$  and  $pH_{FOX}$  results, which were indicative of NASS.
- 8 of the 206 samples analysed (approx. 4%) exhibited  $pH_F$  and  $pH_{FOX}$  results, which were indicative of PASS.
- No test results indicated the presence of AASS.

The identified PASS horizons largely corresponded to near-surface (<1.5mbgl) deposits of silty clay and/or silty sand, significantly above the watertable. Soils tested below the watertable did not indicate the presence of PASS.

#### *Laboratory SPOCAS and CRS Data*

Confirmatory laboratory assessment results are summarised below:

- All 34 samples analysed contained chromium reducible sulfur ( $S_{CR}$ ) concentrations below laboratory detection limits, confirming the absence of reduced inorganic sulfur in samples recovered from beneath the inferred high risk zone of Coondaree Swamp.
- Laboratory analysis results confirmed that the PASS characteristics observed in the field for samples CSA4-1A, CSA9-1A, CSMB1-1, CSMB1-1A, CMB2-11A, CSMB3-1, CSMB3-2 and CSMB3-1A were not attributable to reduced inorganic sulfur. pH drops reported in the field appear to be of organic origin and constitute a low overall environmental risk.
- The estimated average existing plus potential acidity ( $S_{TAA} + S_{CR}$ ) of soils subject to confirmatory laboratory analysis is 0.008%S, which is below the DoE's trigger criterion of 0.03%S (for sandy textured soils). Albeit, existing plus potential acidity in near surface sample CSMB2-1 marginally exceeded the trigger criterion of 0.03% by 1.06-fold, this exceedence was not attributable to reduced inorganic sulfur. Soils at this location should not require precautionary management, given the marginal nature of the exceedence, the inferred organic source and the clayey texture of the material.
- The estimated average titratable potential acidity ( $S_{TPA}$ ) of the analysed soils is 0.015%S, which is also below the DoE's 0.03%S trigger criterion. Whilst titratable potential acidity results ( $S_{TPA}$ ) above 0.03%S were reported in four samples (CSA4-2, CSA5-5A, CSMB3-2 & CSMB3-7A), Acid Neutralising Capacity (ANC) data indicates excess self-buffering capacity within these soils, which will counteract potential organic acidity if released during clay excavation.

#### *Groundwater*

In accordance with prevailing DoE requirements, a baseline groundwater investigation was conducted to assess water quality characteristics beneath the site prior to disturbance.

Reported concentrations of ASS indicator species (including total alkalinity, sulfate, chloride, manganese, aluminium, arsenic and pH) do not indicate groundwater is being affected by the oxidation of sulfides at the watertable.

#### **Conclusions**

Confirmatory laboratory results indicate that reduced inorganic sulfur (i.e.  $S_{CR}$ ) is absent from all soil type associations recovered from beneath Coondaree Swamp.

Slightly elevated titratable potential acidity (TPA) results in 4 of the 34 samples analysed appear attributable to organic acidity and should not require precautionary treatment or management measures. Excess buffering capacity also exists in these soil horizons.

The overall results indicate that clay excavation operations should be able proceed as proposed across the entire site without implementation of special treatment and/or management precautions.

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## 1.0 INTRODUCTION

### 1.1 Background

Midland Brick Company Pty Ltd (Midland Brick) referred a proposal to the Environmental Protection Authority (EPA) in May 2002 to indefinitely extend the time limit of its environmental approval for clay excavation operations at Hallet and Copley Roads, Upper Swan and to expand working areas to encompass Lot 19 Copley Road, Lots 19, 45 and 46 St Albans Road and Lot 100 Great Northern Highway.

Relevant environmental factors to the proposed change of conditions identified by EPA included acid sulfate soils (ASS). Appendix 4 of Bulletin 1157 (EPA December 2004, Appendix A) presents the draft recommended environmental conditions and commitments to be discharged by Midland Brick on approval of the proposal by the Minister for the Environment. In relation to ASS, the draft conditions specify the following requirements:

Condition 6: Acid Sulfate Soils Investigation and Management Plan

*6-1 Prior to any ground-disturbing activities associated with the excavation and dewatering of areas classed as having a “high risk” of acid sulfate soils according to the Western Australian Planning Commission Bulletin No. 64, the proponent shall prepare an Acid Sulfate Soils Investigation and Management Plan to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.*

*The objectives of the Plan are:*

- *to ensure that any ground-disturbing activities which may disturb acid sulfate soils and/or contaminated waters are planned and managed to avoid adverse effects on the natural and built environment, human activities and health.*

*The Plan shall address:*

1. *Identification of acid sulfate soils in and near areas proposed to be disturbed,*

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*and, in the event that the disturbance of acid sulfate soils is unavoidable, the plan shall also address:*

- 2. Potential on-site and off-site effects of the disturbance of the acid sulfate soils and/or groundwater levels.*
  - 3. How drainage or soil extraction will be undertaken to minimise environmental impacts.*
  - 4. How any acid leachate generated as a result of ground-disturbing activities will be managed.*
  - 5. Management of areas, both on and off-site, used to store or treat extracted soil.*
  - 6. Comprehensive surface and groundwater quality monitoring both on and off-site, if applicable.*
  - 7. Establishment of agreed performance criteria and objectives in relation to environmental and social impacts, and*
  - 8. Contingency measures and procedures in the event that the agreed performance criteria may not be met.*
- 6-2 The proponent shall implement the Acid Sulfate Soils Investigation and Management Plan required by Condition 6-1, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.*
- 6-3 The proponent shall make the Acid Sulfate Soils Investigation and Management Plan, required by Condition 6-1, publicly available, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.*

This Acid Sulfate Soils Investigation and Management Plan (ASSIMP) has been prepared on behalf of Midland Brick by RPS Bowman Bishaw Gorham in fulfilment of (draft) environmental conditions 6-1 to 6-3. A completed copy of the WAPC Acid Sulfate Soils Applicant Self-Assessment Form is included at Appendix B.

## 1.2 Report Format

The remainder of the ASSIMP report comprises four main sections, described as follows:

Section 2, Objectives and Scope of Work: Summarises the specific objectives of the assessment and the tasks performed to achieve them.

Section 3, Site Description: Details the relevant environmental characteristics of the site.

Section 4, Soils: Assesses the presence, distribution and magnitude of Potential Acid Sulfate Soils (PASS) within the site and requirements for management.

Section 5, Groundwater: Provides a baseline assessment of groundwater quality prior to earthworks disturbance.

Preparation of the ASSIMP report was undertaken with reference to the following key guidance documents on acid sulfate soils:

- Department of Environment, 2004. *Acid Sulfate Soils Guideline Series. Identification and investigation of acid sulfate soils*, (October, 2004)
- Department of Environment, 2004. *Acid Sulfate Soils Guideline Series. Guideline for groundwater management in urban areas on acid sulfate soils*, (October, 2004).
- Ahern C. R. et al., 2002. *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines (Draft v3.8)*. QASSIT, Department of Natural Resources and Mines, Indooroopilly, Queensland.
- C.R. Ahern, M.R. Ahern and B. Powell, 1998. *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998*. Queensland Acid Sulfate Soils Investigation Team (QASSIT), Queensland Department of Natural Resources and Mines.
- McElnea A. E. and Ahern C. R., 2000. *How to Interpret Acid Sulfate Soil (AAS) Laboratory Chemical Data*. QASSIT, Department of Natural Resources and Mines, Indooroopilly, Queensland.

## **2.0 OBJECTIVES AND SCOPE OF WORK**

The principal objectives of the investigation were to assess (i) the presence, distribution and magnitude of PASS in and near areas proposed for disturbance per draft condition 6-1(1) and (ii) identify the need for management and monitoring measures during the clay excavation program per draft condition 6-1(2)-(8).

Tasks undertaken in support of the preparation of the ASSIMP included:

- Compilation and review of existing environmental data and exploratory drill logs to characterise site features, including local soils, hydrology and hydrogeology.
- A comprehensive soil sampling and analysis program to investigate the presence, distribution and magnitude of PASS in areas proposed for direct disturbance as a consequence of clay excavation. Midland Brick has advised that dewatering is not conducted in support of clay excavation works and indirect disturbance of PASS due to groundwater drawdown is not expected. It is understood some pumping does occur to control surface water accumulations above the clay unit during the winter months.
- A baseline groundwater sampling and analysis program to (i) assess background groundwater quality prior to earthworks disturbance and (ii) to provide an indication of acid sulfate soil impacts at the watertable that may have occurred due to past mining activities.
- Comparison of field and laboratory acid sulfate soil test data with applicable Department of Environment (DoE) guidelines and action criteria to assess potential management implications associated with the proposed clay excavation program.

### **3.0 SITE DESCRIPTION**

#### **3.1 Location and Land-uses**

The site is located in Upper Swan, approximately 300m east of the junction of Great Northern Highway and Copley Road (Figure 1). For the purposes of acid sulfate soil assessment, the site is taken to comprise Lots 7, 19, 20 & 64 Copley Road and Lot 100 Great Northern Highway, which form part of Coondaree Swamp (Figure 2). The Swan River flows past the site in a general westerly direction approximately 150m south of the southern boundary of Lot 64.

Coondaree Swamp occupies approximately 31ha of land and encompasses part of Lots 7, 19 and 100 and the northernmost sections of Lots 20 and 64. Most of Lot 19 and the eastern half of Lot 100 have been partially worked for clay by a previous operator. The remnant clay pits extend over approximately 10ha and comprise a series of un-rehabilitated steep-sided voids varying in depth between 3m and 15m. Standing water was present in all pits at the time of inspection in March 2005. The balance of land within the footprint of Coondaree Swamp has not been worked to date.

A large surface water diversion drain bisects the central part of the site along a general north-east to south-west alignment. The drain previously discharged to the Swan River but is understood to be no longer in-use.

#### **3.2 Topography**

Topographical survey data for the site and its environs is presented in Figure 3. With the exception of the historical clay pits, ground elevation generally varies between 19 and 22mAHD in the locality of Coondaree Swamp.

#### **3.3 Geology and Hydrogeology**

##### **3.3.1 Geological Mapping**

Figure 4 presents the published 1:50,000 geological mapping for the site and its environs (Gozzard, 1986).

The Coondaree Swamp zone is mapped as  $M_1$  – *Holocene swamp deposits (Qhw) comprising grey mottled yellowish brown, blocky, firm SILT of variable clay content.* Soils immediately surrounding the Coondaree Swamp boundary are mapped as  $Mgs_1$  – *Guildford Formation deposits of Pleistocene age, comprising strong brown PEBBLY SILT, with common, fine to occasionally coarse grained laterite quartz, weathered granite pebble and some fine to medium grained sand of alluvial origin.* Both geological units are recorded as plastic clay resources for brick, pipe and tile manufacture.

All soil investigation locations were targeted within the higher risk zone associated with Coondaree Swamp.

### 3.3.2 Groundwater

Current groundwater mapping (DoE, 2005) does not provide coverage of the site. Indicative geological mapping data for the site suggests an approximate depth to groundwater of 10mbgl (Gozzard, 1986). This concurs with anecdotal data collected during previous investigations of the site (Bowman Bishaw Gorham, 1997), which suggests watertable levels vary between 10 and 15mbgl in the locality.

Groundwater flow is expected to occur in a general southerly direction towards the Swan River.

## 3.4 DoE Acid Sulfate Soil Risk Mapping

DoE acid sulfate soil risk mapping is presented in Figure 5. Coondaree Swamp is classified according to the West Australian Planning Commission Bulletin No. 64 as having a “*high risk of actual acid sulfate soil and potential acid sulfate soil occurring <3m from the surface*”. Soils surrounding the high risk zone are mapped as having a “*low to no risk of AASS and PASS occurring generally at depths >3m from the surface*”

## 3.5 Drainage and Wetlands

The site lies on an alluvial plain between the Ellen Brook to the north and the Swan River to the south.

Coondaree Swamp is located within the northern portion of the site. Anecdotal information supplied by local residents (Bowman Bishaw Gorham, 1997) indicates that Coondaree Swamp was completely drained and the wetland cleared of all vegetation for agricultural purposes during the 1950s and 1960s. In addition Midland Brick stripped topsoil from the swamp area in Lot 7 as early as 1978.

The western section of Coondaree Swamp is now classified as a Resource Enhancement Wetland under the *Geomorphic Wetlands Swan Coastal Plain Classification* (DoE, 2004). This portion of the swamp is highly modified and has been extensively degraded by the previous clay excavation works.

Albeit the eastern section of the swamp is identified under the *Environmental Protection (Swan Coastal Plain) Policy 1992* and the *Environmental Protection (Swan Coastal Plain Wetlands) Policy and Regulations 2004*, this area has already been approved for excavation under the original ministerial conditions.

EPA Bulletin 1157 recommends approval of the excavation of the balance of Coondaree Swamp subject to preparation of a Wetland Rehabilitation Plan by Midland Brick prior to recommencement of ground-disturbing activities.

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## 4.0 SOILS

### 4.1 Acid Sulfate Soil Investigations

The following field and laboratory program was completed by RPS Bowman Bishaw Gorham in March 2005:

- Inspected and sampled the soil profile at 11 locations (Figure 6) to target depths varying between 6 and 14mbgl, yielding an average depth of investigation of 8.8mbgl. Soil investigation bores were sampled using a push-core drill rig and were generally terminated below the estimated base of excavation at each location. Combined soil and groundwater sampling sites were investigated using a drill rig with hollow-stem auger and split-spoon attachment. All locations were targeted within the Coondaree Swamp “*High ASS Risk*” zone mapped by DoE / WRC (2004), taking account of access constraints imposed by the remnant clay pits and main drainage corridor bisecting the site. Exploratory drilling records compiled by Midland Brick between 1982 and 1983 were reviewed in detail to assist in the planning phase of the investigation. The proposed sampling density was considered adequate to sufficiently characterise the ASS characteristics of soils within the site, based on the low geological and geomorphological variability within the identified risk zone.
- Installed permanent groundwater monitor bores at three of the soil investigation locations (Figure 6), to enable assessment of baseline water quality characteristics prior to earthworks disturbance.
- Recovered 208 discrete soil samples for field  $pH_F$  and  $pH_{FOX}$  analysis in accordance with DoE requirements, to provide a preliminary indication of the presence of PASS, Actual Acid Sulfate Soils (AASS) and/or Non Acid Sulfate Soils (NASS).
- Conducted selective SPOCAS and/or CRS analysis on 34 samples to confirm the presence or absence of PASS, corresponding to approximately 17% of the total number of recovered samples.

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The sample selection rationale for CRS and SPOCAS assessment is summarised below:

- At each location, conduct confirmatory analysis on any horizon displaying  $pH_F$  and  $pH_{FOX}$  results indicative of PASS, taking account of applicable DoE interpretative criteria (including pH changes on oxidation, reaction vigour and the absolute  $pH_{FOX}$  value after oxidation).
- Amortised across all locations, conduct selective confirmatory analysis on all major soil-type associations to ensure adequate ASS characterisation in all encountered lithology types.
- At selected locations, conduct selective confirmatory analysis on soils that are likely to remain exposed after the cessation of clay extraction (i.e. those at or close to the watertable or sands that underlie shallower clay profiles).

Soil samples collected for laboratory ASS analysis were placed into glass jars and immediately sealed to minimise potential moisture loss and exposure to air. All samples were stored in a clean esky cooler containing ice packs to abate potential sulfide oxidation. Samples were kept frozen until oven dried and analysed.

#### **4.2 General Soil Description**

Soil profile / acid sulfate soil testing logs are presented in Appendix C.

The soil profile at all locations typically comprised grey to brown clay with variable orange to yellow mottling. Silty clay bands were encountered at several locations, with sandy clay horizons occurring less frequently. The base of the clay unit (where intercepted) was underlain by off-white to grey silty sands. Clayey sand bands were also present at variable depths within the profile at a few locations.

Groundwater was encountered at four locations only, approximately 10mbgl, which is consistent with mapped contour data (Gozzard, 1986) and historical findings.

## 4.4 Acid Sulfate Soil Findings

### 4.4.1 pH Test Results (pH<sub>F</sub> and pH<sub>FOX</sub>)

Field pH<sub>F</sub> and peroxide pH<sub>FOX</sub> data for all soil investigation locations are presented in Table 1 and summary statistics for PASS, AASS and NASS behaviour are shown in Table 2. A review of the field data presented in Table 2 indicates the following:

- 198 of the 206 samples analysed in the field (approx. 96%) exhibited pH<sub>F</sub> and pH<sub>FOX</sub> results, which were indicative of NASS.
- 8 of the 206 samples analysed (approx. 4%) exhibited pH<sub>F</sub> and pH<sub>FOX</sub> results, which were indicative of PASS.
- No test results indicated the presence of AASS.

The identified PASS horizons largely corresponded to near-surface (<1.5mbgl) deposits of silty clay and/or silty sand, significantly above the watertable. Soils tested below the watertable did not indicate the presence of PASS.

### 4.4.2 Laboratory SPOCAS and CRS Test Results

Appendix D presents the completed chain of custody documentation for those samples submitted for laboratory SPOCAS and CRS analysis. Appendix E presents the associated laboratory certificates. Table 3 summarises the results of the SPOCAS and CRS analyses.

The DoE's guidelines for ASS investigation and management (DoE, 2004) provide action criteria (Table 4) which define when disturbance of PASS and/or AASS at a site should be managed. The action criteria are based on the sum of the existing plus potential acidity, which is usually calculated as equivalent sulfur ( $S_{TAA} + S_{CR}$  in %S units) or equivalent acidity (eg. TAA + a- $S_{CR}$ ). The following conclusions are drawn from comparison of the SPOCAS and CRS data presented in Table 3 with DoE criteria:

- All 34 samples analysed contained chromium reducible sulfur ( $S_{CR}$ ) concentrations below laboratory detection limits, confirming the absence of reduced inorganic sulfur in samples recovered from beneath the inferred high risk zone of Coondaree Swamp.

- Laboratory analysis results confirmed that the PASS characteristics observed in the field for samples CSA4-1A, CSA9-1A, CSMB1-1, CSMB1-1A, CMB2-11A, CSMB3-1, CSMB3-2 and CSMB3-1A were not attributable to reduced inorganic sulfur. pH drops reported in the field appear to be of organic origin and constitute a low overall environmental risk.
- The estimated average existing plus potential acidity ( $S_{TAA} + S_{CR}$ ) of soils subject to confirmatory laboratory analysis is 0.008%S, which is below the DoE's trigger criterion of 0.03%S (for sandy textured soils). Albeit, existing plus potential acidity in near surface sample CSMB2-1 marginally exceeded the trigger criterion of 0.03% by 1.06-fold, this exceedence was not attributable to reduced inorganic sulfur. Soils at this location should not require precautionary management, given the marginal nature of the exceedence, the inferred organic source and the clayey texture of the material.
- The estimated average titratable potential acidity ( $S_{TPA}$ ) of the analysed soils is 0.015%S, which is also below the DoE's 0.03%S trigger criterion. Whilst titratable potential acidity results ( $S_{TPA}$ ) above 0.03%S were reported in four samples (CSA4-2, CSA5-5A, CSMB3-2 & CSMB3-7A), Acid Neutralising Capacity (ANC) data indicates excess self-buffering capacity within these soils, which will counteract potential organic acidity if released during clay excavation.

#### 4.4.3 Conclusions and Management Implications

Confirmatory laboratory results indicate that reduced inorganic sulfur (i.e.  $S_{CR}$ ) is absent from all soil type associations recovered from beneath Coondaree Swamp.

Slightly elevated titratable potential acidity (TPA) results in 4 of the 34 samples appear attributable to organic acidity and should not require precautionary treatment or management measures. Excess buffering capacity also exists in these soil horizons to neutralise the release of any organic acidity.

The overall results indicate that clay excavation operations should be able proceed as proposed across the entire site without implementation of special treatment and/or management precautions.

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## **5.0 GROUNDWATER**

### **5.1 Baseline Investigation**

#### **5.1.1 Groundwater Sampling and Analysis Program**

In accordance with prevailing DoE requirements, a baseline groundwater investigation was conducted to assess water quality characteristics beneath the site prior to earthworks disturbance. Groundwater bore construction and sampling logs are presented in Appendix F and G respectively.

Baseline groundwater monitoring was performed at all three monitor bore locations (Figure 6) on the 6<sup>th</sup> April 2005. Groundwater levels were measured at each bore location using an electronic probe prior to sample recovery. Monitor bores were subsequently sampled after stabilisation using a low-flow bladder pump fitted with a multi-parameter meter that measures pH, electrical conductivity (EC) and temperature. Groundwater samples were recovered and selectively analysed for metals (including aluminium, arsenic, manganese and selenium), chloride, sulfate, alkalinity and ammoniacal nitrogen, which are key indicator species associated with disturbance of acid sulfate soils. Certificates of laboratory analysis are presented in Appendix H.

#### **5.1.2 Quality Assurance and Control**

Groundwater sampling and analysis was undertaken with reference to the DoE (2001-2003) Contaminated Sites Management Series guidelines and Australian/New Zealand Standard AS/NZS 5667.11:1998 (Part 11). Strict hygiene procedures were applied throughout to assure sample integrity and quality. Quality control samples included the analysis of a field duplicate sample, a field blank sample and a rinsate sample. Quality control results for the groundwater monitoring program are tabulated in Appendix I.

### **5.2 Groundwater Assessment Guidelines**

Groundwater analysis results were compared with Drinking Water Guidelines (DWG), Long-term Irrigation Water Guidelines (LIWG) and Freshwater Ecosystem Guidelines (FWG) presented in DoE (2003) *Assessment Levels for Soil, Sediment and Water*.

The DWG recommend contaminant levels which, based on present knowledge, will not result in any significant risk to the health of consumers over a lifetime. Contaminant levels below the DWG would confer no risk to human health via long-term routine ingestion. The application of the DWG is a conservative approach to the assessment of human health risks from exposure to onsite groundwater contaminants because residential development is typically serviced by reticulated scheme water and the most likely exposure route to groundwater is via parks and garden irrigation. The LIWG recommend values that should protect plant growth and provide long-term protection against soil toxicity from contaminant accumulation. The FWG recommend values for toxicants that are protective of aquatic organisms.

Groundwater analysis results were also compared to indicator criteria applied to the assessment of acid sulfate soils (DoE, 2004).

### **5.3 Groundwater Quality**

Table 5 compares the baseline groundwater analysis results with DWG, FWG and LIWG levels.

Groundwater beneath the site is generally fresh, aerobic and moderately alkaline. Background pH at all bores met DWG, FWG and LIWG. Baseline trace metal concentrations met applicable health-based DWG and LIWG at all bore locations. Background aluminium slightly exceeded the aesthetic-DWG at bore CSMB2 by 2.35-fold only. Aluminium (max. 8.5-fold), copper (max. 3.6-fold) and zinc (max. 15-fold) exceeded FWG at bores CSMB2 and CSMB3. Elevated aluminium concentrations may partly be attributable to the breakdown of clay colloids during laboratory analysis.

Total alkalinity and pH results indicate a low vulnerability to groundwater acidification. All sulfate:chloride ratios were significantly below 0.5.

### **5.4 Conclusions and Management Implications**

Baseline concentrations of ASS indicator species (including total alkalinity, sulfate:chloride, manganese, aluminium, arsenic and pH) do not indicate that groundwater is being affected by the oxidation of sulfides at the watertable.

## 6.0 REFERENCES

Department of Environment, 2004. *Acid Sulfate Soils Guideline Series. Identification and investigation of acid sulfate soils*, (October, 2004)

Department of Environment, 2004. *Acid Sulfate Soils Guideline Series. Guideline for groundwater management in urban areas on acid sulfate soils*, (October, 2004).

Bowman Bishaw Gorham, 1997. *Environmental Management Programme – Clay Excavation Lots 60, 63, 64, 20 & 7 Copley Road Area, Upper Swan*. Report Ref. MI6274.

Bowman Bishaw Gorham, 2001. *Upper Swan Clay Excavations Regional Development, Drainage and Rehabilitation Strategy*. Report Ref. M99194/95.

Ahern C. R. et al., 2002. *Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines (Draft v3.8)*. QASSIT, Department of Natural Resources and Mines, Indooroopilly, Queensland.

C.R. Ahern, M.R. Ahern and B. Powell, 1998. *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998*. Queensland Acid Sulfate Soils Investigation Team (QASSIT), Queensland Department of Natural Resources and Mines.

McElnea A. E. and Ahern C. R., 2000. *How to Interpret Acid Sulfate Soil (AAS) Laboratory Chemical Data*. QASSIT, Department of Natural Resources and Mines, Indooroopilly, Queensland.

Standards Australia. 1998. AS/NZS 5667.11. *Water Quality – Sampling, Part 11: Guidance on sampling of Groundwaters*.

United States Environmental Protection Agency. 1996. *Region I – Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells*. Revision 2. USEPA, Washington, D.C.

VEPA. Victorian Environmental Protection Agency. 2000. *Groundwater Sampling Guidelines*. EPA Victoria.

## **TABLES**

**Table 1**  
**Field pHF and Peroxide pHFOX Results**

Location ID Sample Interval Ref	CSA1		CSA2		CSA3		CSA4		CSA5		CSA6		CSA8		CSA9		CSMB1		CSMB2		CSMB3	
	pH <sub>F</sub>	pH <sub>FOX</sub>	pH <sub>F</sub>	pH <sub>FOX</sub>	pH <sub>F</sub>	pH <sub>FOX</sub>	pH <sub>F</sub>	pH <sub>FOX</sub>	pH <sub>F</sub>	pH <sub>FOX</sub>	pH <sub>F</sub>	pH <sub>FOX</sub>	pH <sub>F</sub>	pH <sub>FOX</sub>	pH <sub>F</sub>	pH <sub>FOX</sub>	pH <sub>F</sub>	pH <sub>FOX</sub>	pH <sub>F</sub>	pH <sub>FOX</sub>	pH <sub>F</sub>	pH <sub>FOX</sub>
1	7.51	4.85	5.89	5.31	6.62	5.15	5.91	5.61	6.92	5.24	5.88	4.80	7.39	6.25	5.89	5.01	5.71	2.40	6.09	2.53	6.41	2.67
2	6.75	5.70	5.84	4.82	7.62	5.41	5.20	3.70	6.84	5.18	6.24	5.14	7.41	6.12	5.48	3.22	6.40	3.70	7.14	4.63	6.56	3.30
3	6.96	4.94	6.28	4.68	7.63	6.52	5.70	6.72	6.84	5.23	6.30	5.26	6.86	5.28	5.62	5.29	6.86	6.29	7.26	5.39	6.54	3.42
4	6.99	4.51	6.31	6.63	7.30	5.31	6.18	5.45	7.40	5.24	6.46	5.46	6.74	5.36	5.67	5.54	7.01	6.31	7.08	5.10	6.68	5.32
5	6.90	4.94	6.97	4.58	7.46	5.48	6.16	5.38	7.84	5.38	6.74	5.37	7.18	5.37	6.09	5.21	7.59	6.97	7.10	5.30	6.97	5.36
6	6.91	5.10	7.02	4.64	7.25	6.96	6.21	5.24	7.82	5.36	7.05	5.44	7.47	5.44	6.09	4.54	8.02	5.76	7.46	5.43	6.91	5.19
7	7.28	5.36	7.23	4.71	7.57	5.64	7.18	5.23	7.45	5.28	7.18	5.26	7.78	5.51	6.38	5.30	8.40	7.26	8.01	5.51	6.99	5.28
8	4.42	7.18	7.29	4.71	7.64	5.82	6.95	5.56	7.21	5.20	5.85	5.50	7.68	5.52	6.47	5.24	8.00	7.45	7.93	5.40	7.01	5.11
9	7.62	5.19	6.19	4.53	7.55	5.49	6.91	5.37	7.04	5.24	6.23	5.25	7.82	5.67	6.36	5.35	7.92	5.64	7.84	5.40	6.98	5.06
10	7.62	5.20	6.33	4.6	7.58	5.51	6.85	5.43	7.40	7.65	6.36	5.82	7.71	5.51	6.33	6.81	8.06	5.50	7.82	5.27	7.37	5.25
11	7.74	5.08	6.48	4.68	7.50	5.59	6.79	5.27	7.34	5.40	6.27	5.27	7.64	5.48	5.21	5.09	7.84	7.02	7.95	5.47	7.68	5.43
12	6.56	5.07	6.69	4.85	7.64	5.50	6.94	5.28	7.19	5.25	6.23	5.20	7.60	7.16	6.06	5.12	8.14	5.35	7.96	5.49	7.55	5.17
13	4.77	4.77	5.40	4.76	7.40	5.53	EOH		7.04	5.27	EOH		7.68	6.81	6.17	7.37	7.88	5.65	7.88	5.35	7.48	5.20
14	5.36	4.78	6.06	4.61	7.30	5.49	EOH		7.25	5.27	EOH		7.70	5.42	6.44	5.26	7.81	5.52	7.84	5.41	7.62	7.95
15	EOH		6.30	4.69	7.20	5.39	EOH		EOH		EOH		7.84	5.70	6.65	5.23	7.76	5.45	7.87	5.32	7.49	5.40
16	EOH		6.45	4.86	7.43	5.44	EOH		EOH		EOH		7.96	6.85	6.66	5.27	7.80	5.48	7.84	5.34	7.78	5.47
17	EOH		5.53	4.94	7.10	5.43	EOH		EOH		EOH		EOH		6.94	5.31	7.75	5.60	7.95	5.38	7.85	5.64
18	EOH		7.40	5.48	7.29	5.44	EOH		EOH		EOH		EOH		6.96	5.34	7.55	5.19	7.89	5.52	7.98	5.39
19	EOH		7.82	5.39	7.45	5.45	EOH		EOH		EOH		EOH		6.90	5.17	7.82	5.31	7.70	5.31	7.76	5.28
20	EOH		EOH		7.56	5.50	EOH		EOH		EOH		EOH		6.87	5.19	7.48	5.24	7.70	5.50	7.70	5.27
21	EOH		EOH		6.88	5.52	EOH		EOH		EOH		EOH		6.98	5.21	7.16	5.34	7.77	5.31	7.68	5.26
22	EOH		EOH		7.63	5.36	EOH		EOH		EOH		EOH		7.13	5.39	EOH		7.81	5.32	7.64	5.32
23	EOH		EOH		7.55	5.37	EOH		EOH		EOH		EOH		6.99	5.35	EOH		EOH		EOH	
24	EOH		EOH		7.26	5.35	EOH		EOH		EOH		EOH		7.08	5.25	EOH		EOH		EOH	
25	EOH		EOH		7.42	5.25	EOH		EOH		EOH		EOH		7.58	5.27	EOH		EOH		EOH	
26	EOH		EOH		7.31	5.27	EOH		EOH		EOH		EOH		7.41	5.29	EOH		EOH		EOH	
27	EOH		EOH		7.25	5.26	EOH		EOH		EOH		EOH		EOH		EOH		EOH		EOH	
28	EOH		EOH		7.27	5.15	EOH		EOH		EOH		EOH		EOH		EOH		EOH		EOH	
29	EOH		EOH		EOH		EOH		EOH		EOH		EOH		EOH		EOH		EOH		EOH	

**Notes:**  
 Denotes combined groundwater and ASS test location  
 Denotes Actual Acid Sulfate Soil (AASS)  
 Denotes Potential Acid Sulfate Soil (PASS)  
 Denotes Non Acid Sulfate Soil (NASS)  
EOH Denotes end of hole

**Table 2**  
**Field pHF and Peroxide pHFOX Summary Statistics**

Sampling Location ID	No.of Tests	NASS	PASS	AASS
CSA1	14	14	0	0
CSA2	19	19	0	0
CSA3	28	28	0	0
CSA4	12	11	1	0
CSA5	14	14	0	0
CSA6	12	12	0	0
CSA8	16	16	0	0
CSA9	26	25	1	0
CSMB1	21	19	2	0
CSMB2	22	21	1	0
CSMB3	22	19	3	0
Totals	206	198	8	0
<b>Notes:</b> NASS denotes field results indicate Non Acid Sulfate Soil PASS denotes field results indicate Potential Acid Sulfate Soil AASS denotes field results indicate Actual Actual Sulfate Soil				

**Table 3**  
**Laboratory SPOCAS and CRS Analysis Results**

Sample ID	Date	Depth	Sample Description	pH <sub>F</sub>	pH <sub>FOX</sub>	ΔpH	23A	23B	23F	s23F	23G	s23G	23H	s23H	23Ce	23De	23E	22B	S <sub>TAA</sub> + S <sub>CR</sub>	Excess ANC
							pH	pH <sub>FOX</sub>	TAA	S <sub>TAA</sub>	TPA	S <sub>TPA</sub>	TSA	S <sub>TSA</sub>	S <sub>KCl</sub>	S <sub>P</sub>	S <sub>POS</sub>	S <sub>CR</sub>		
									mol(H <sup>+</sup> /tonne)	%S	mol(H <sup>+</sup> /tonne)	%S	mol(H <sup>+</sup> /tonne)	%S	%S	%S	%S	%S	%S	%S
CSA1 - 2A	10/03/2005	1.50 - 2.00	CLAY, grey/ brown, moderate plasticity, moist	6.99	4.51	2.48	5.8	6.7	6	0.010	18	0.029	12	0.019	0.02	0.02	0.000	0.02	0.010	0.05
CSA1 - 4A	10/03/2005	3.50 - 4.00	CLAY, grey/ brown, moderate plasticity, moist	4.42	7.18	0.00	6.4	7.0	2	0.003	18	0.029	16	0.026	0.02	0.02	0.000	0.02	0.003	0.09
CSA1 - 7	10/03/2005	6.00 - 6.50	Silty SAND, off white / pale grey, fine to medium grained, moist	4.77	4.77	0.00	6.0	5.5	2	0.003	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.003	0
CSA2 - 3A	10/03/2005	2.50 - 3.00	Sandy CLAY, grey / brown with orange mottles, moderate plasticity, moist	7.02	4.64	2.38	6.0	6.5	5	0.008	2	0.003	0	0.000	0.03	0.02	0.000	0.02	0.008	0
CSA2 - 10A	10/03/2005	9.00 - 9.50	SAND, pale grey, medium to coarse grained, moist.	7.82	5.39	2.43	6.0	5.7	4	0.006	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.006	0
CSA3 - 2	11/03/2005	1.00 - 1.50	CLAY, pale grey / brown, high plasticity, moist	7.63	6.52	1.11	6.2	7.2	4	0.006	15	0.024	11	0.018	0.02	0.02	0.000	0.02	0.006	0.03
CSA3 - 12A	11/03/2005	11.50 - 12.00	CLAY, brown with black mottles, moderate plasticity, moist. (fibric peat inclusions)	7.26	5.35	1.91	6.2	6.4	2	0.003	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.003	0
CSA3 - 14	11/03/2005	13.00 - 13.50	Sandy CLAY, brown with grey mottles, moderate plasticity, wet.	7.25	5.26	1.99	6.2	6.3	2	0.003	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.003	0
CSA4 - 1A	9/03/2005	0.50 - 1.00	Silty CLAY, grey / brown with orange mottles, moderate plasticity, dry.	5.20	3.70	1.50	6.1	6.9	9	0.014	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.014	0.09
CSA4 - 2	9/03/2005	1.00 - 1.50	Silty CLAY, pale brown with orange mottles, moderate plasticity, dry.	5.70	6.72	0.00	5.9	7.4	2	0.003	80	0.128	78	0.125	0.02	0.02	0.000	0.02	0.003	0.02
CSA5 - 2	10/03/2005	1.00 - 1.50	CLAY, grey / brown with orange mottles, moderate plasticity, moist.	6.84	5.23	1.61	5.7	6.7	6	0.010	18	0.029	12	0.019	0.02	0.02	0.000	0.02	0.010	0.03
CSA5 - 4	10/03/2005	3.00 - 3.50	Clayey SAND, pale brown with grey / green mottles, fine grained, moist.	7.45	5.28	2.17	5.9	6.5	4	0.006	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.006	0
CSA5 - 5A	10/03/2005	4.50 - 5.00	Silty SAND, pale brown, fine grained, moist.	7.40	7.65	0.00	6.3	7.6	2	0.003	27	0.043	25	0.040	0.02	0.02	0.000	0.02	0.003	0.06
CSA5 - 7A	10/03/2005	6.50 - 7.00	Silty SAND, off white with yellow mottles, fine grained, moist.	7.25	5.27	1.98	6.6	6.1	2	0.003	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.003	0
CSA6 - 4	11/03/2005	3.00 - 3.50	Silty CLAY, pale brown with orange mottles, low plasticity, dry.	7.18	5.26	1.92	6.2	6.4	4	0.006	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.006	0
CSA6 - 6A	11/03/2005	5.50 - 6.00	SAND, off white, fine grained, dry.	6.23	5.20	1.03	6.9	6.2	2	0.003	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.003	0
CSA8 - 1	21/03/2005	0.00 - 0.50	Silty CLAY, grey / brown, weak to moderate plasticity, dry.	7.39	6.25	1.14	5.8	7.2	6	0.010	5	0.008	0	0.000	0.02	0.02	0.000	0.02	0.010	0.17
CSA8 - 5	21/03/2005	4.00 - 4.50	CLAY, pale brown with orange mottles, high plasticity, moist.	7.82	5.67	2.15	6.3	6.8	2	0.003	18	0.029	16	0.026	0.02	0.02	0.000	0.02	0.003	0.05
CSA8 - 8A	21/03/2005	7.50 - 8.00	CLAY, grey / brown, high plasticity, moist.	7.96	6.85	1.11	6.6	6.8	2	0.003	6	0.010	4	0.006	0.02	0.02	0.000	0.02	0.003	0.03
CSA9 - 1A	9/03/2005	0.00 - 0.50	Silty CLAY, brown, low plasticity, dry.	5.48	3.22	2.26	5.5	6.9	8	0.013	5	0.008	0	0.000	0.02	0.02	0.000	0.02	0.013	0.03
CSA9 - 7	9/03/2005	6.00 - 6.40	CLAY, pale brown with orange mottles, mod. cohesive, dry. (mod. plastic when moist)	6.17	7.37	0.00	6.4	6.8	2	0.003	4	0.006	2	0.003	0.02	0.02	0.000	0.02	0.003	0.05
CSA9 - 13A	9/03/2005	12.50 - 13.00	Clayey SAND, brown, med/ fine grained, wet	7.41	5.29	2.12	6.3	6.1	2	0.003	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.003	0
CSMB1 - 1	22/03/2005	0.00 - 0.50	Silty CLAY, dark grey / brown, low plasticity, dry.	5.71	2.40	3.31	5.2	4.8	16	0.026	2	0.003	0	0.000	0.02	0.02	0.020	0.02	0.026	0
CSMB1 - 1A	22/03/2005	0.50 - 1.00	Silty CLAY, dark grey / brown, low plasticity, dry.	6.40	3.70	2.70	5.4	6.0	10	0.016	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.016	0
CSMB1 - 6A	22/03/2005	5.50 - 6.00	Clayey SAND, pale grey, fine grained, moist.	8.14	5.35	2.79	6.6	7.0	2	0.003	18	0.029	16	0.026	0.02	0.02	0.000	0.02	0.003	0.03
CSMB1 - 11	22/03/2005	10.00 - 10.50	SAND, pale brown, fine grained, wet.	7.16	5.34	1.82	6.4	6.3	2	0.003	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.003	0
CSMB2 - 1	23/03/2005	0.00 - 0.50	Silty CLAY, brown, moderate plasticity, dry.	6.09	2.53	3.56	5.0	5.0	20	0.032	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.032	0
CSMB2 - 11A	23/03/2005	10.50 - 11.00	CLAY, brown with grey mottles, high plasticity, moist.	7.81	5.32	2.49	5.9	6.6	4	0.006	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.006	0.02
CSMB3 - 1	22/03/2005	0.00 - 0.50	Silty SAND, grey / brown with red brick fragments, fine to medium grained, dry.	6.41	2.67	3.74	5.7	4.4	4	0.006	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.006	0
CSMB3 - 2	23/03/2005	1.00 - 1.40	CLAY, dark brown, high plasticity, dry. (trace organics / peat)	6.54	3.42	3.12	5.9	6.8	11	0.018	20	0.032	9	0.014	0.02	0.02	0.000	0.02	0.018	0.04
CSMB3 - 7A	23/03/2005	6.50 - 7.00	CLAY, orange / brown with grey and black mottles, moderate plasticity, moist.	7.62	7.95	0.00	6.3	7.0	2	0.003	20	0.032	18	0.029	0.02	0.02	0.000	0.02	0.003	0.03
CSMB3 - 11A	23/03/2005	10.50 - 11.00	Sandy CLAY, grey / green, low plasticity, moist.	7.64	5.32	2.32	6.2	6.2	2	0.003	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.003	0
CSA3 - 12A	11/03/2005	11.50 - 12.00	PEAT, black	-	-	-	5.8	6.0	5	0.008	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.008	0
CSMB3-1A	23/03/2005	0.00 - 0.50	Silty SAND, grey / brown with red brick fragments, fine to medium grained, dry.	6.41	2.67	3.74	5.6	6.2	8	0.013	2	0.003	0	0.000	0.02	0.02	0.000	0.02	0.013	0

Notes:

Denotes field pH<sub>F</sub> and pH<sub>FOX</sub> data indicates Potential Acid Sulfate Soil (PASS)

No shading denotes field pH<sub>F</sub> and pH<sub>FOX</sub> data indicates Non Acid Sulfate Soil (NASS)

Denotes exceeds 0.03% DoE Trigger Criterion for Sandy Textured Soils

Denotes less than laboratory detection limit

**Table 4**  
**DoE ASS Management Action Criteria**

Type of Material		Action Criteria (<1000 tonnes)		Action Criteria (>1000 tonnes)	
		Existing + Potential Acidity		Existing + Potential Acidity	
Texture	Approx. Clay Content	Equivalent Sulfur	Equivalent Acidity	Equivalent Sulfur	Equivalent Acidity
	(%<0.002mm)	(%S)	(H <sup>+</sup> /tonne)	(%S)	(H <sup>+</sup> /tonne)
Coarse Texture (sands to loamy sands)	≤5	0.03	18	0.03	18
Medium Texture (sandy loams to light clays)	5-40	0.06	36	0.03	18
Fine Texture (medium to heavy clays and silty clays)	≥40	0.10	62	0.03	18
Reference: DoE, (2004). Acid Sulfate Soils Guideline Series. Identification and investigation of acid sulfate soils, (October, 2004)					

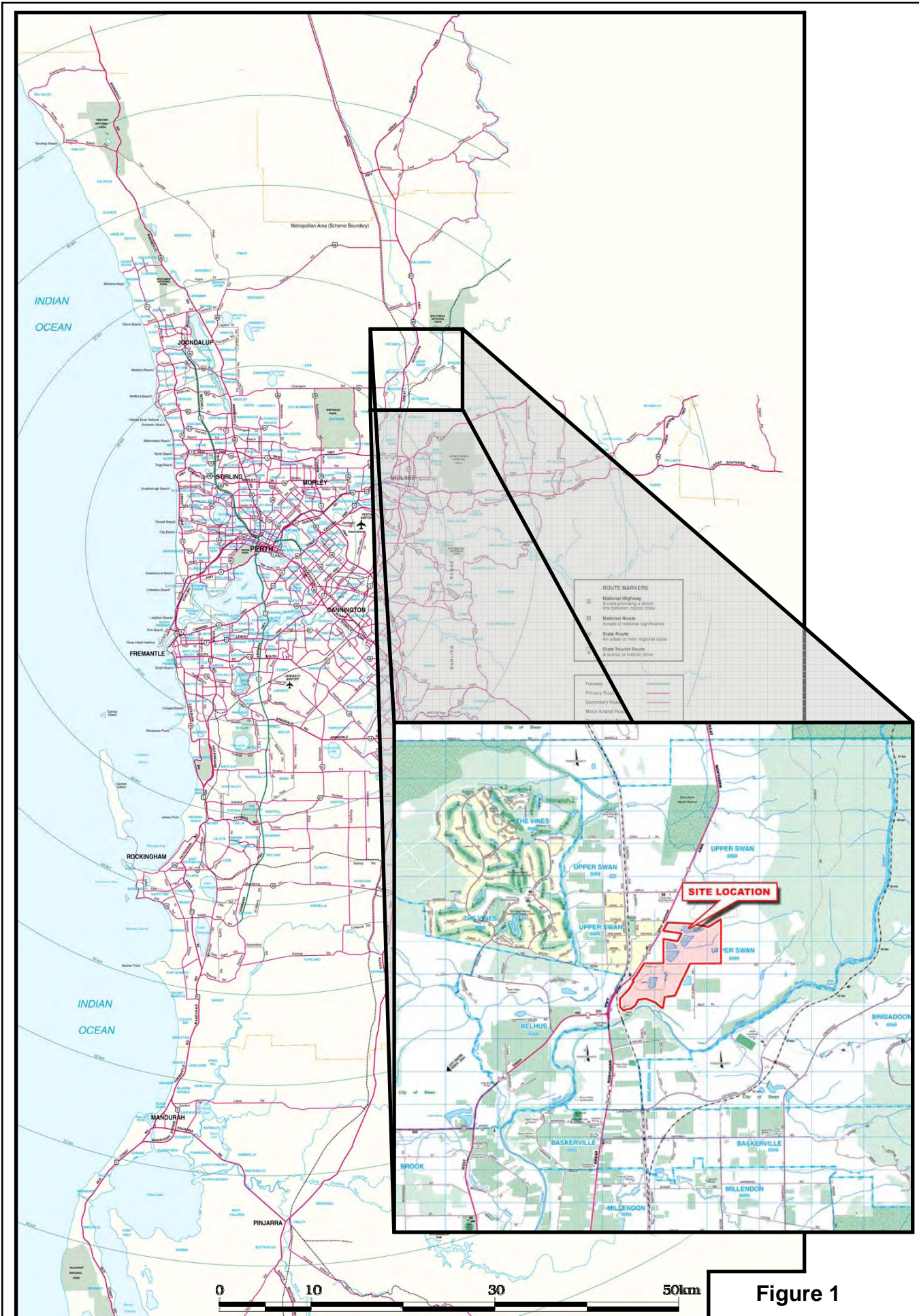
**Table 5  
Baseline Groundwater Quality Results**

Sample ID	Date	Trace Metals											Potability & ASS Parameters									
		Aluminium	Arsenic	Cadmium	Chromium	Copper	Lead	Manganese	Mercury	Nickel	Selenium	Zinc	Sulfate	Chloride	Iron	Total acidity	Ammoniacal Nitrogen	Alkalinity	pH	Electrical Conductivity	Redox	DO
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	Units	uS/cm	mV	ppm
	LIWG	5	0.1	0.01	0.1	0.2	2	0.2	0.002	0.2	0.02	2	NG	40-700	0.2	NG	NG	NG	6.5-8.5	NG	NG	NG
	DWG	0.2#	0.007	0.002	0.05	2	0.01	0.5	0.001	0.02	0.01	3#	NG	250#	0.3#	NG	NG	NG	6.5-8.5	NG	NG	NG
	FWG	0.055	0.013	0.0002	0.01	0.0014	0.0034	1.9	0.00006	0.011	0.005	0.008	NG	NG	NG	NG	3.1	NG	6.5-8.5	NG	NG	NG
CSMB1	6/04/2005	0.01	0.001	0.0002	0.001	0.001	0.001	0.024	0.0002	0.001	0.001	0.008	40	370	NT	NT	0.2	170	7.36	1571	129	5.22
CSMB2	6/04/2005	0.47	0.002	0.0002	0.003	0.005	0.002	0.003	0.0002	0.004	0.001	0.120	35	120	NT	NT	0.2	100	7.31	625	96	1.87
CSMB3	6/04/2005	0.19	0.002	0.0002	0.002	0.002	0.002	0.009	0.0002	0.003	0.001	0.005	50	160	NT	NT	0.2	250	7.50	990	117	5.96

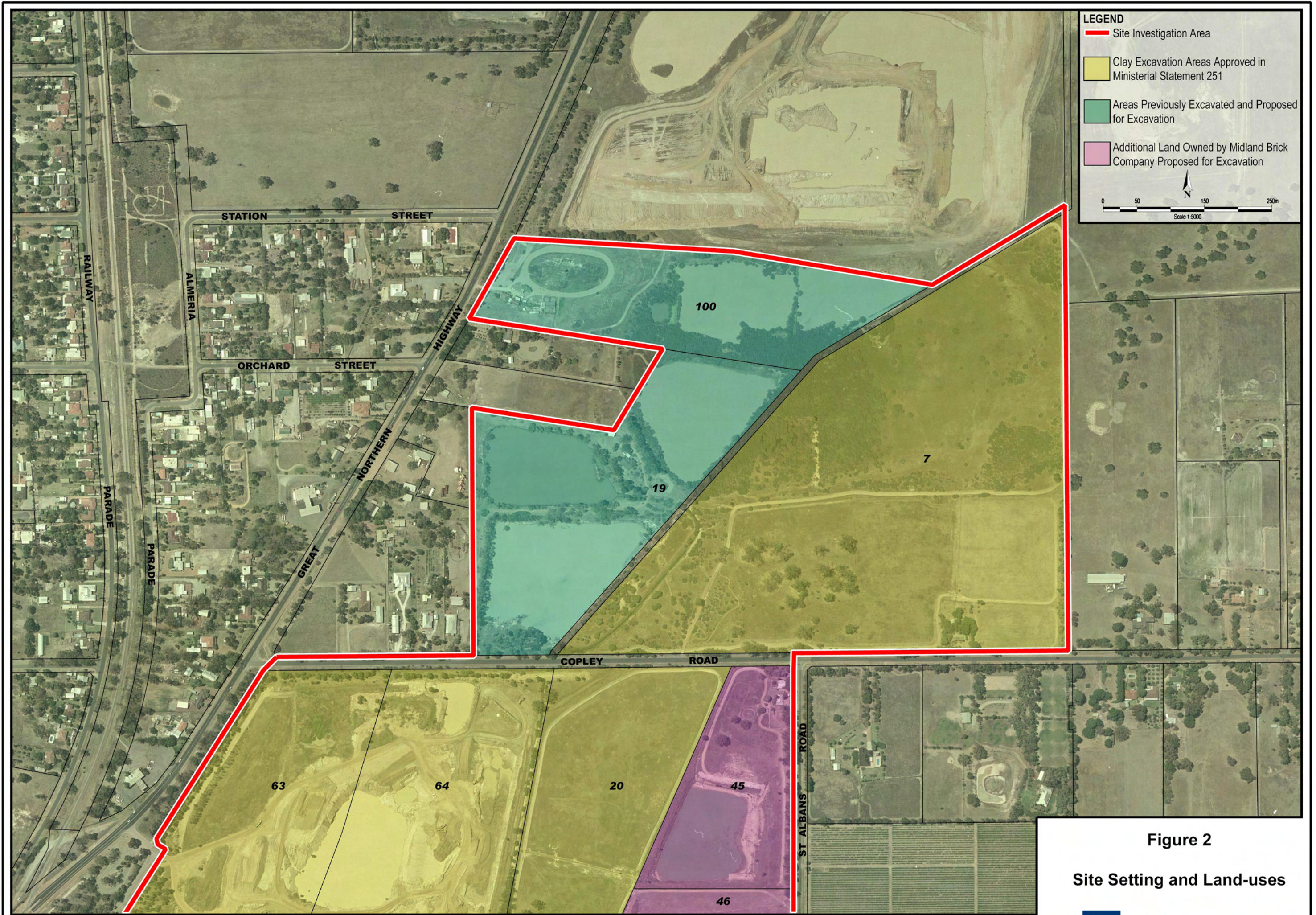
Notes:  
 NG denotes no guideline.  
 Denotes exceeds Long-term Irrigation Water Guidelines (LIWG)  
 Denotes exceeds Drinking Water Guidelines (DWG) # denotes aesthetic-DWG only.  
 Denotes exceeds Fresh Water Guidelines (FWG)  
 Below detection limit



**FIGURES**



**Figure 1**  
**Site Location**



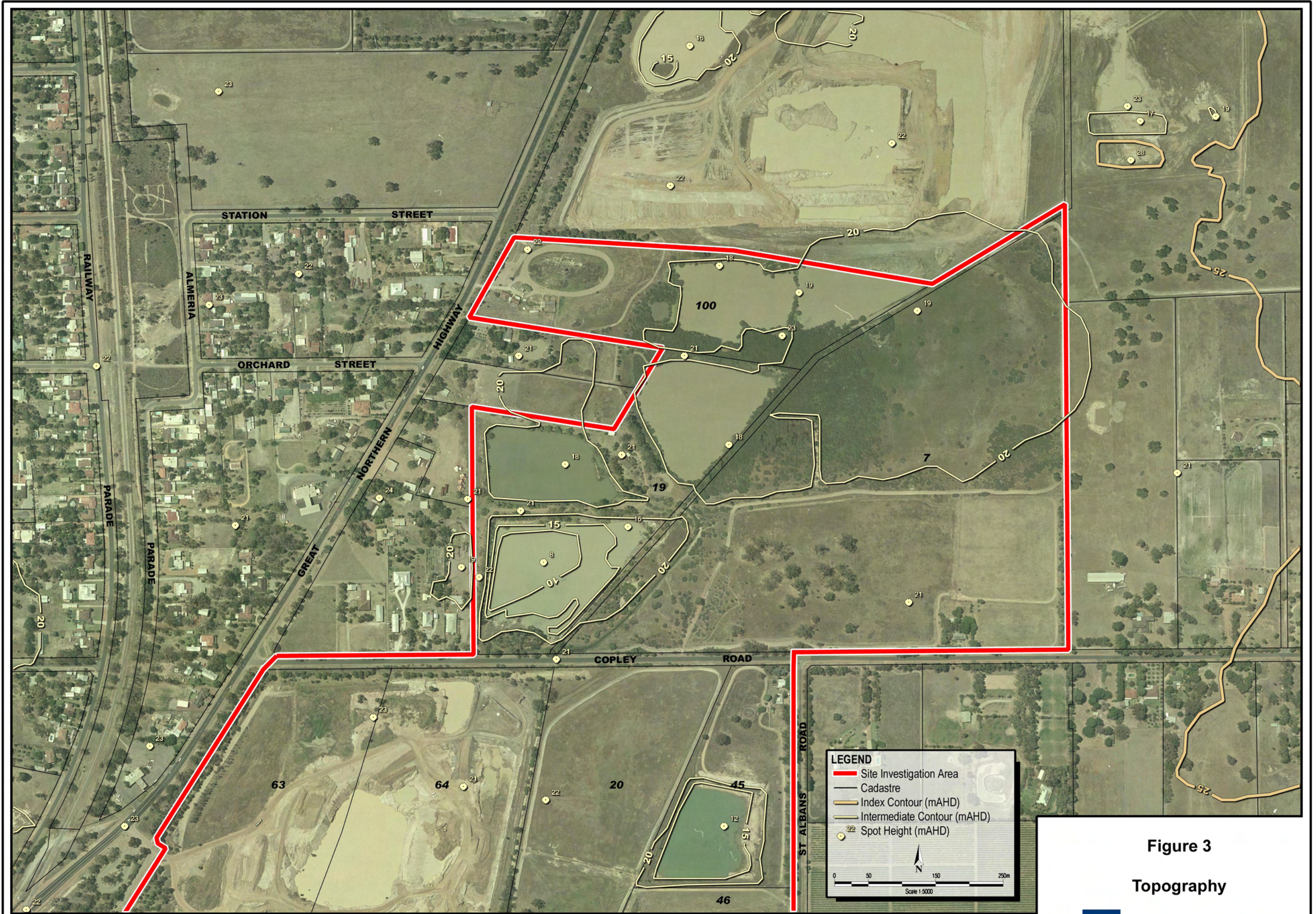
**LEGEND**

- █ Site Investigation Area
- Clay Excavation Areas Approved in Ministerial Statement 251
- Areas Previously Excavated and Proposed for Excavation
- Additional Land Owned by Midland Brick Company Proposed for Excavation

0 50 150 250m  
 Scale 1:5000  
 N

**Figure 2**  
**Site Setting and Land-uses**

C05054 07.06.05



**Figure 3**  
**Topography**

C05054 07.06.05

Source: Mosaic - Metro North West 2004 - Date : December 2003

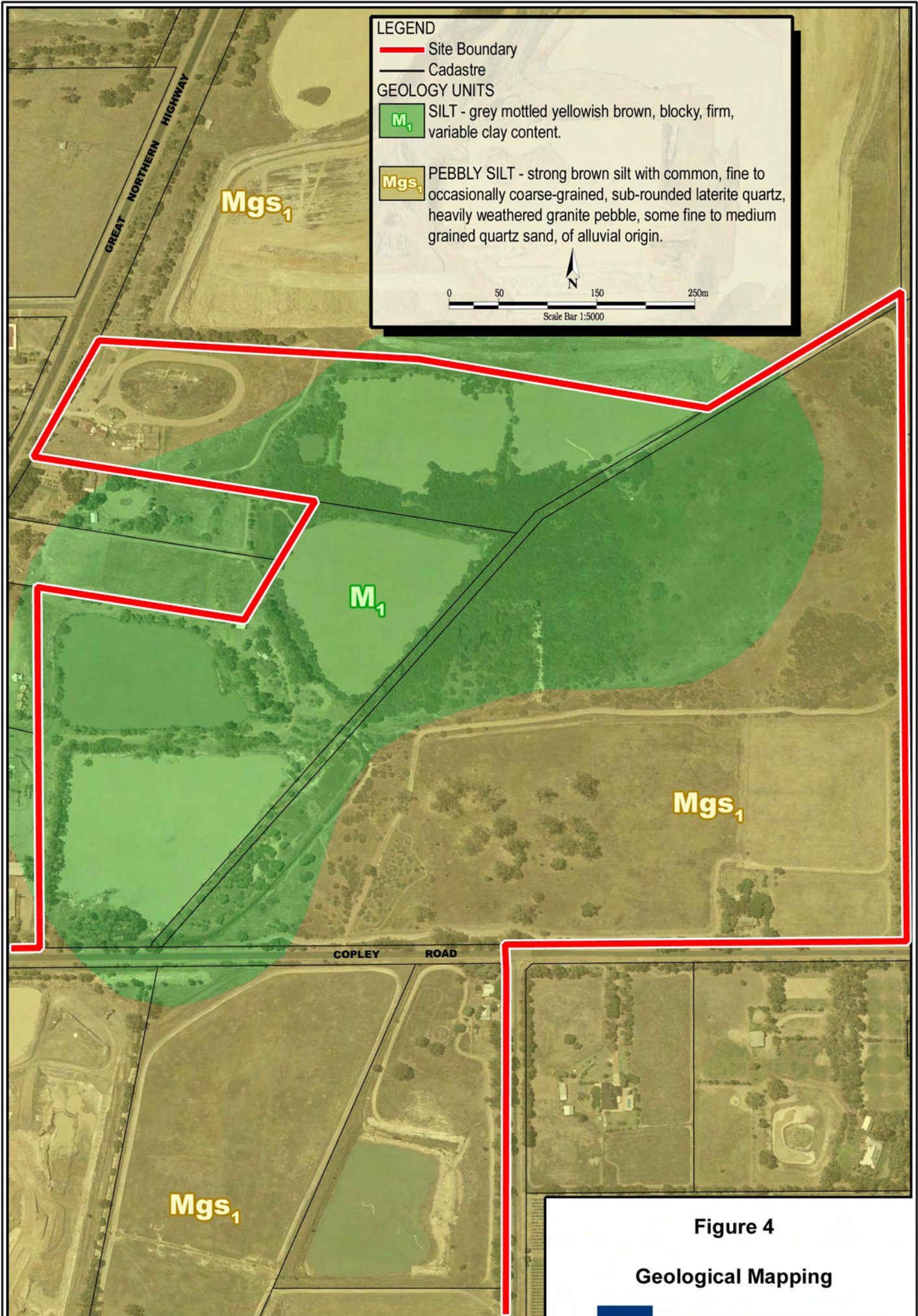
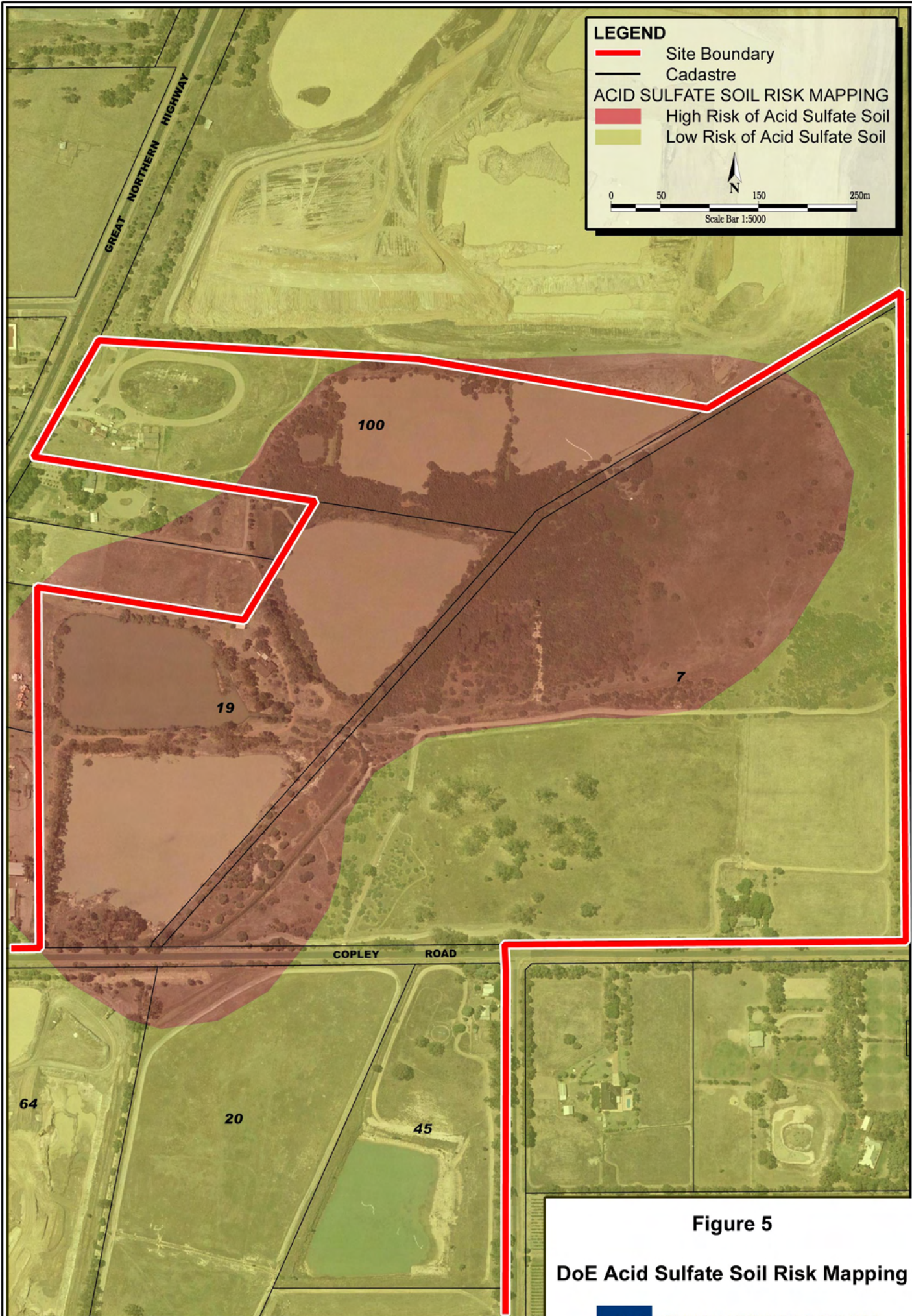


Figure 4

Geological Mapping

C05054 15.04.05



**LEGEND**

- Site Boundary
- Cadastre

**ACID SULFATE SOIL RISK MAPPING**

- High Risk of Acid Sulfate Soil
- Low Risk of Acid Sulfate Soil

N

0 50 150 250m

Scale Bar 1:5000

**Figure 5**

**DoE Acid Sulfate Soil Risk Mapping**

C05054 15.04.05

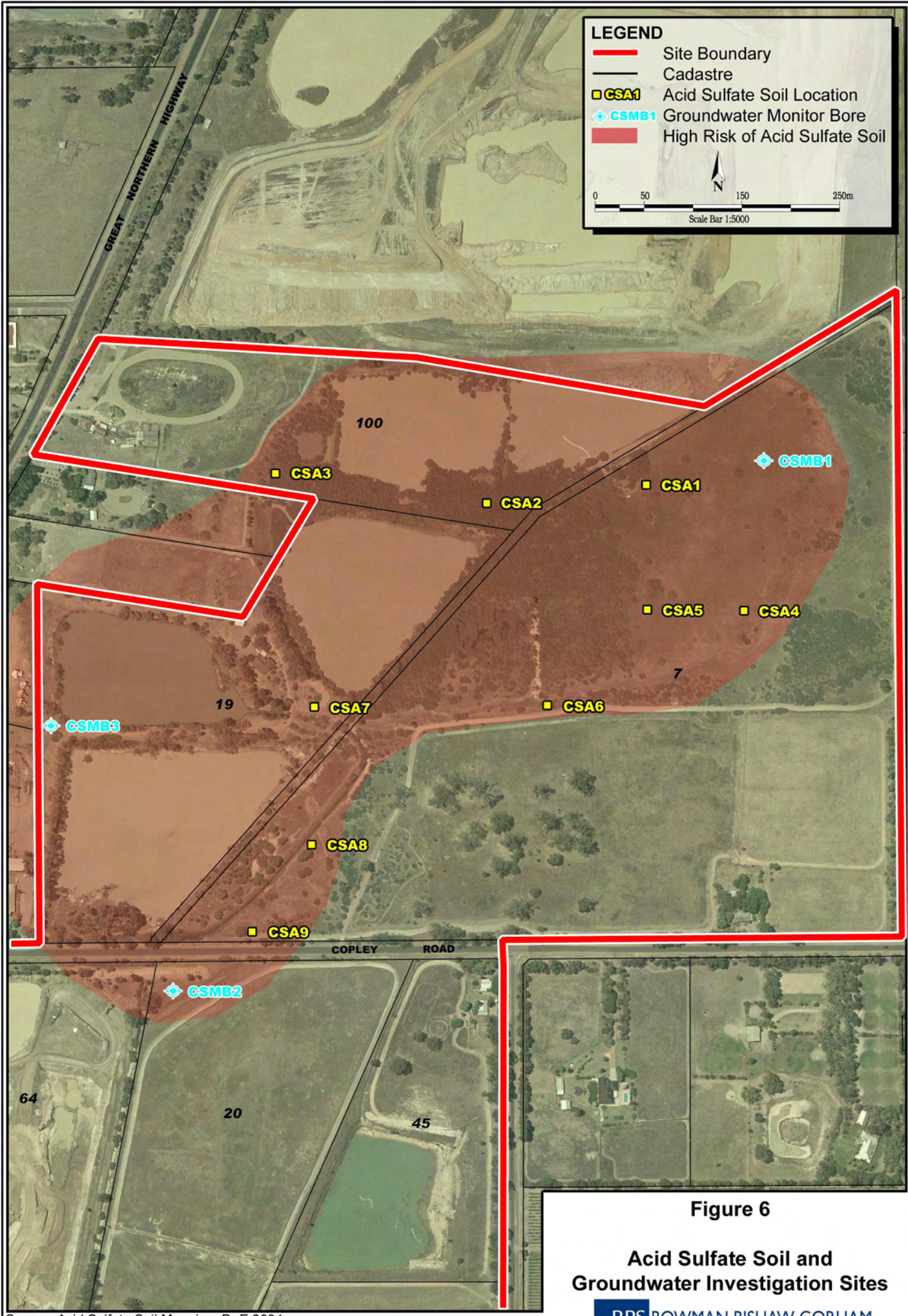


Figure 6

**Acid Sulfate Soil and Groundwater Investigation Sites**

C05054 15.04.05

Source: Acid Sulfate Soil Mapping, DoE 2004

**APPENDIX A**

**EPA BULLETIN 1157 (DECEMBER 2004)**

**Clay Excavation  
Lots 7, 20, 60, 63, and 64 (previously part lot 1  
and lots 222, 27, 26, 25, 28 and 7) Hallett and  
Copley Roads, Upper Swan  
Change to Environmental Conditions**

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**Midland Brick Company Pty Ltd**

**Section 46 Report and recommendations  
of the Environmental Protection Authority**

**Environmental Protection Authority  
Perth, Western Australia  
Bulletin 1157  
December 2004**

### **Environmental Impact Assessment Process Timelines**

<b>Date</b>	<b>Progress stages</b>	<b>Time (weeks)</b>
<b>10/06/2002</b>	<b>Level of Assessment set</b>	<b>2</b>
<b>05/10/2004</b>	<b>Assessment re-commenced</b>	<b>9</b>
<b>09/12/2004</b>	<b>EPA report to the Minister for the Environment/ Proponent Document Released for Targeted Stakeholder Comment</b>	<b>2</b>
<b>23/12/2004</b>	<b>Targeted Stakeholder Comment Period Closed</b>	<b>2</b>

## Summary and recommendations

Midland Brick Company Pty Ltd (Midland Brick) referred a proposal to the Environmental Protection Authority (EPA) on 3 May 2002 to indefinitely extend the time limit of its environmental approval for its clay excavation operation at Hallet and Copley Roads, Upper Swan and to expand the environmental approval to include Lot 19 Copley Road, Lots 19, 45 and 46 St Albans Road and Lot 100 Great Northern Highway, Upper Swan for further clay excavation operations. The new areas to be included in the clay excavation operation include a portion of Coondaree Swamp classified as a resource enhancement wetland.

The existing clay excavation operation was assessed by the EPA at Consultative Environmental Review (CER) level in December 1991. The Minister for the Environment issued approval for the existing operation on 23 April 1992 subject to conditions and commitments as described in Ministerial Statement 251.

In accordance with Section 46(3) of the *Environmental Protection Act 1986* (EP Act), this report provides the EPA's advice to the Minister for the Environment on proposed changes to conditions for the project.

### Relevant environmental factors

It is the EPA's opinion that the following are the environmental factors relevant to the proposed change to conditions, which require detailed evaluation in the report:

- (a) extension to the duration of the approval;
- (b) Coondaree Swamp - resource enhancement wetland; and
- (c) acid sulfate soils.

### Conclusion

The EPA has considered the change to conditions proposed by Midland Brick and has concluded that it can be managed to meet the EPA's objectives for the relevant environmental factors.

The EPA believes that the 14-year period since the original proposal was assessed has given rise to three relevant environmental issues that cause the EPA to reconsider its previous recommendations as to the environmental acceptability of the project and provide advice on the mitigation of these issues. In particular the EPA has concluded that the proposed excavation of Coondaree Swamp (a resource enhancement wetland) is acceptable in view of the proposed rehabilitation of the area to form an artificial wetland and the environmental offset proposed by the proponent, namely donation of land to be added to Ellen Brook Nature Reserve to provide additional protected habitat for the endangered Western Swamp Tortoise.

In addition to the above, the EPA considers that conditions attached to the environmental approval should be updated. It has therefore also reported on the updating of conditions.

### Recommendations

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that this report is pursuant to Section 46(3) of the *Environmental Protection Act 1986*.
2. That the Minister notes that the proposed change includes extending the time limit for the existing approved Lots of the excavation and expanding the project to include Lot

19 Copley Road, Lots 19, 45 and 46 St Albans Road and Lot 100 Great Northern Highway, Upper Swan.

3. The EPA recommends that the Minister considers the report on the relevant environmental factors as set out in Section 3.
4. That the Minister notes that the EPA has concluded that the proposed change to conditions can be managed to meet the EPA's objectives, and thus not impose an unacceptable impact on the environment provided there is satisfactory implementation by the proponent of the amended conditions and commitments, as set out in Section 4.
5. The Minister imposes the amended conditions, commitments and procedures recommended in Appendix 4 of this report.

### **Conditions**

The EPA recommends that, if the proposed change to conditions by Midland Brick Company Pty Ltd is approved for implementation, the existing Environmental Conditions applied to the project (Ministerial Statement 251 published in April 1992), be subject to modifications necessary to:

- indefinitely extend the time limit of environmental approval, subject to a 5-yearly environmental review;
- allow for the expansion of the existing location approvals to include the new locations, Lot 19, 45 and 46 St Albans road, Lot 19 Copley Road and Lot 100 Great Northern Highway;
- update the statement into the current format;
- require the production of a wetland rehabilitation program for Coondaree Swamp and surrounding areas;
- require an acid sulfate soil (ASS) investigation and (if necessary) production of an ASS Management Plan on areas deemed "high risk" before the commencement of excavation works within the high risk areas; and
- provide for the transfer to the Crown of approximately half of Lot 12 Lexia Avenue to be added to Ellen Dale Nature Reserve to provide additional protected habitat for the endangered Western Swamp Tortoise;

The proposed changes to conditions are set out in detail in Appendix 4.

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2. References
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4. Recommended Environmental Conditions and Proponent's Consolidated Commitments

## **1. Introduction and background**

The Minister for the Environment has requested the Environmental Protection Authority (EPA) to consider and provide advice under Section 46(3) of the *Environmental Protection Act 1986* on Midland Brick's proposed change to conditions to extend the time limit for its existing approved clay excavation operation at Hallett and Copley Roads, Upper Swan, and to expand the project to include Lot 19 Copley Road, Lots 19, 45 and 46 St Albans Road and Lot 100 Great Northern Highway, Upper Swan.

The current operations were originally assessed by way of a Consultative Environmental Review (CER) in December 1991 (Bulletin 599) after an application for Renewal of Excavation Licence was referred to the EPA in August 1990 by the Shire of Swan (now City of Swan).

Condition 3 of the Minister's statement (251) of approval set a time limit for the proposal of 10 years. After that time the EPA would need to review the proposal in light of the proponent's environmental performance on the site. The original time of approval expired in April 2002 and the proponent referred a proposed change to conditions to the EPA for an extension of the time limit approval as well as an expansion of the excavation area.

Further details of the proposed change to conditions are presented in Section 2 of this Report. Section 3 discusses environmental factors relevant to the proposed change to conditions. The Conditions and procedures to which the project should be subject, if the Minister determines that it may be implemented, are set out in Section 4. Section 5 presents the EPA's conclusions and Section 6, the EPA's Recommendations.

A list of stakeholders who were consulted during preparation of the proponent's Section 46 report is in Appendix 1 and References are listed in Appendix 2. Environmental Condition Statement No 251, published on 23 April 1992, is presented in Appendix 3. The recommended conditions and procedures and proponent's commitments are provided in Appendix 4. The proponent's section 46 report is attached to this bulletin in CD-ROM form.

## **2. Proposed Change to Conditions**

Midland Brick Company Pty Ltd proposes to extend the time limit of approval for its existing clay excavation in Upper Swan, 30km north-east of Perth. The project currently spans Lots 60, 63, 64, 20 and 7 Hallett and Copley Roads and Midland Brick proposes to expand the project area to include Lot 19 Copley Road, Lot 100 Great Northern Highway and Lots 19, 45 and 46 St Albans Road (Figure 1).

Clay excavation is a relatively simple mining process and involves the removing and stockpiling of the topsoil which can later be used for rehabilitation and then the removal of overburden for boundary bunding. The excavated clay is then taken to a manufacturing process. The clay excavation in this project is a relatively small scale, low impact activity which results in little disturbance to the surrounding areas. The operation does not involve dewatering.

Of the lots that are part of the proposed extension, Lots 19 Copley Road and 100 Great Northern Highway (which form part of Coondaree Swamp) have been partly excavated in the past by another company. These lots now contain a series of un-rehabilitated steep-sided pits varying in depth from around 3m – 15m deep which cover approximately half of the swamp's original extent, (Midland Brick, 2004). The rest of the swamp falls on the already approved Lot 7 Copley Road.

Table 1 summarises the key characteristics of the approved project and proposed extension. A detailed description of the proposed change to conditions is provided in Sections 4 and 6 of the Section 46 review document (Midland Brick, 2004).

**Table 1: Summary of proposed project extension.**

Project characteristic	Current project	Proposed extension
Location	Lots 60, 63, 64, 20 and 7 Hallett and Copley Roads	Lots 19 Copley Road, Lot 100 Great Northern Highway and lots 19, 45 and 46 St Albans Road
Offset	-	The Proponent has committed to donating approximately 4.7ha of Lot 12 Lexia Avenue (eastern side) to the State.
<b>Total for Expanded Project</b>		
*Size of Clay Body	Approximately 4 million tonnes	
*#Total Area of Disturbance	Approximately 109 ha	
*Rate of Extraction	Approximately 180,000 tonnes per year	
Major Infrastructure	nil	
Overburden	Between 1 and 6 million tonnes	

# will also be rehabilitated.

\* estimated at present usage.

### 3. Relevant environmental factors

Section 46(3) of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on whether or not the proposed changes to conditions or procedures should be allowed. In addition, the EPA may make recommendations as it sees fit.

The relevant environmental factors identified in the EPA's previous assessment (April 1991) of the proposal were the:

- (a) proximity to Ellenbrook Nature Reserve the habitat of the declared rare Western Swamp Tortoise;
- (b) local environmental impacts;
- (c) drainage impacts on Ellen Brook Nature Reserve;
- (d) Aboriginal sites; and
- (e) regional development, drainage and rehabilitation.

The EPA's assessment of these factors has not changed as a result of the proponent's current proposal to extend the duration of approval and to expand the location of excavation works.

However, it is the EPA's opinion that the following issues should be considered in relation the proposed change to conditions:

- (a) extension to the duration of the approval;

- (b) Coondaree Swamp – resource enhancement wetland; and
- (c) acid sulfate soils.

These matters are considered below.

### **3.1 Extension to the Duration of the Approval**

#### **Description**

Approval for this project was initially for a maximum period of ten years with subsequent applications to be reviewed in light of the proponent's environmental performance at the site. This time period was set to allow for changes in environmental regulations, standards guidelines and accepted practices.

The area considered for assessment of this factor are the lots originally approved in Bulletin 599, Lots 60, 63, 64, 20 and 7 Hallett and Copley Roads and the proposed new excavation areas Lot 19 Copley Road, Lot 19, 45 and 46 St Albans Road and Lot 100 Great Northern Highway.

#### **Assessment**

The EPA sought advice from the Department of Environment regarding whether the proposed extension of the time limit on the approval should be granted and any new environmental issues which should be considered if the time extension was granted.

Issues in relation to excavation of Coondaree Swamp and acid sulfate soils are considered in sections 3.2 and 3.3 below and it is considered that these issues can be managed so as to meet the EPA's environmental objectives.

Changes in environmental standards can be addressed through amendments to the conditions and procedures of environmental approval.

The EPA's assessment of the proposed change to conditions has not given rise to any other matters relevant to the acceptability of the proposal.

It is therefore the EPA's opinion that the proposed extension to the duration of approval can be managed to meet the EPA's environmental objectives and should be allowed.

#### **Conclusion**

Having particular regard to:

- (a) the fact that issues in relation to excavation of Coondaree Swamp and acid sulfate soils can be managed so as to meet the EPA's environmental objectives;
- (b) the fact that changes in environmental standards that can be addressed through amendments to the conditions and procedures of environmental approval; and that,
- (c) the EPA's assessment of the proposed change to conditions has not given rise to any other matters relevant to the acceptability of the proposal.

it is the EPA's opinion that the proposed extension to the duration of approval can be managed to meet the EPA's environmental objectives and should be allowed.

### **3.2 Coondaree Swamp – Resource Enhancement Wetland**

#### **Description**

Coondaree Swamp covers part of Lots 7 and 19 Copley Road and Lot 100 Great Northern Highway (Figure 2).

The proponent now proposes to excavate on the western half of the swamp, on Lot 19 Copley road and Lot 100 Great Northern Highway. The *Geomorphic Wetlands Swan Coastal Plain Classification* (Department of Environment, 2004) identifies that portion of the swamp as a Resource Enhancement Wetland. That portion of the swamp has been previously partly excavated by another company and now consists of a series of un-rehabilitated steep-sided pits varying in depth from 3m –15m.

The remainder of the swamp (the eastern part) is identified under the *Environmental Protection (Swan Coastal Plain) Policy 1992* and the *Environmental Protection (Swan Coastal Plain Wetlands) Policy and Regulations 2004*. However, that remaining portion of the swamp has already been approved for excavation under the existing Ministerial Statement. It therefore falls outside the area to be considered under the proposed change to environmental conditions.

### **Stakeholder and proponent comments**

The proponent's Section 46 report (Midland Brick, 2004) contends that, since the original clearing 25 years ago, a monoculture of vegetation has regrown at the site, and is now limited to relatively mature specimens of *Melaleuca terretifolia*. Through the uniform height and size of the specimens, all plants appear to be of very similar age and are most likely to be regrowth from root stock left at the time of clearing. A site inspection carried out by the consultants and the EPA in September 2003 identified very few, if any, juvenile specimens of the species, and it is logical to assume that (in the absence of rehabilitation) once these specimens expire the vegetation of the swamp will be significantly and permanently reduced.

The Resource Management Branch of the DoE has advised that the rehabilitation of Coondaree Swamp should be undertaken by Midland Brick in accordance with an approved Wetland Rehabilitation Plan with the aim of restoring the original (pre-disturbance) water regime and habitats. The Resource Management Branch has further advised that revegetation of the wetland area should utilise plant species of local provenance appropriate to sumplands and palusplains in the local vicinity and suitable for the soil type.

### ***Policy Framework***

The primary documents applicable to this relevant environmental factor are:

- Position Statement No. 4 *Environmental Protection of Wetlands* (EPA, 2004); and,
- Preliminary Position Statement No. 9 *Environmental Offsets* (EPA, 2004).

As noted above the *Environmental Protection (Swan Coastal Plain Lakes) Policy* and the Draft *Environmental Protection (Swan Coastal Plain Wetlands) Policy* are not relevant to the proposed change to conditions and are therefore not considered further here.

### ***Position Statement No. 4***

Position Statement No. 4 provides the EPA's principles for environmental protection of wetlands which include an overarching statement of goals as follows:

- to protect the environmental values and functions of wetlands in Western Australia;
- to protect, sustain and, where possible, restore the biological diversity of wetland habitats in Western Australia;

- to protect the environmental quality of the wetland ecosystems of Western Australia through sound management in accordance with the concept of "wise use", as described in the Ramsar Convention, and ecologically sustainable development principles, regardless of land use or activity; and
- to have as an aspirational goal no net loss of wetland values and functions.

This statement of goals relates directly to the significant environmental values of wetlands established by Position Statement No. 4 including:

- primary production;
- recreational and landscape amenity;
- hydrological balance;
- water quality protection; and
- wildlife habitat.

#### ***Preliminary Position Statement No. 9 Environmental Offsets***

The recently released Preliminary Position Statement No. 9 has been developed to provide overarching guidance and to establish a consistent policy approach to the issue of environmental offsets.

Section 5. Scope, states that this Position Statement applies to all environmental issues, matters and advice for which the EPA has jurisdiction. However it must be recognised that this is a preliminary document.

In considering the Preliminary Position Statement, because Coondaree Swamp has already been extensively modified and degraded, it is not considered to meet the criteria for a Critical Asset for which the EPA is unlikely to approve a proposal.

An evaluation of the mitigation sequence established by Preliminary Position Statement No. 9 is therefore considered appropriate for this assessment.

#### **Assessment**

The area considered for assessment of this factor is Coondaree Swamp, including Lots 7 and 19 Copley Road and Lot 100 Great Northern Highway.

The EPA's environmental objective for this factor is to maintain the integrity, ecological functions and environmental values of wetlands.

#### ***Position Statement No. 4***

The proposed operation is for extraction of clay. It is therefore unrealistic to try to restore the original re-disturbance landforms, habitats and hydrology of Coondaree Swamp. Rather, the aim should be to ensure that rehabilitation is carried out in a planned and sequential manner so as to provide a range of habitat types to maximize the values of the area for biodiversity.

While modification of the wetland is proposed, it is not considered inconsistent with the EPA's Position Statement No.4 for the following reasons:

- the swamp has been extensively degraded by previous excavation and human disturbance and the present vegetation is a mono-culture of *Melaleuca terretifolia*. Through planned and progressive rehabilitation this can be replaced with a range of vegetation endemic to the area and provision of an array of habitats for wildlife;

- rehabilitation to create an artificial wetland will enhance primary production and can be carried out in such a way as to protect water quality (see discussion under section 3.3); and
- the proposal will result in improved landscape amenity through creation of a planned artificial wetland system in place of the existing un-rehabilitated steep sided pits.

***Preliminary Position Statement No. 9***

The proposed offset package of the transfer to the State of Western Australia, at no charge, of approximately 4.7ha of the eastern side of Lot 12 Lexia Avenue (Figure 1) for addition to Ellen Brook Nature Reserve will provide additional protected habitat for the endangered Western Swamp Tortoise. This initiative has been developed through extensive consultation with the Department of Conservation and Land Management (CALM) and is fully supported by CALM. The EPA is of the view that proposed environmental offset is commendable and will provide a valuable addition to the conservation estate.

**Conclusion**

It is the EPA’s view that the proposed change to conditions can be managed to meet the EPA’s environmental objective for this factor provided that:

- a condition is imposed requiring the preparation of a progressive wetland rehabilitation plan before the excavation of Coondaree Swamp occurs; and that,
- the proposed donation of land for addition to Ellen Brook Nature Reserve proceeds.

**3.3 Acid Sulfate Soils**

**Description**

Acid sulfate soils are naturally occurring soils and sediments containing sulfide minerals, predominantly pyrite (an iron sulfide). In an undisturbed state below the watertable, these soils are benign and not acidic. However if the soils are drained, excavated or exposed by lowering of the water table, the sulfides will react with oxygen to form sulphuric acid (Department of Environment, 2004).

One section of the proposed extension to the excavation area includes Coondaree Swamp, Lot 19 Copley Road and Lot 100 Great Northern Highway. This area as detailed in the West Australian Planning Commission Bulletin No. 64 is classified as having a “high risk of actual acid sulfate soil and potential acid sulfate soil < 3m from surface,” (WAPC, 2003).

**Stakeholder comments**

The Department of Environment’s Land and Water Quality Branch recommended that the requirements of WAPC Planning Bulletin No 64 should be enforced. That is, that an acid sulfate soil investigation is required when land disturbance is planned in high risk areas.

The proponent has indicated its intention that, before excavations proceed in high risk areas, there will be a full ASS investigation with results notified to the EPA.

**Assessment**

The area considered for assessment of this factor is those areas classed as high risk for ASS, namely Coondaree Swamp (Lots 7 and 19 Copley Road and Lot 100 Great Northern Highway).

The EPA's environmental objective for this factor is to ensure that the environment is protected from pollution from disturbed acid sulfate soils.

Acid sulfate soils can generate sulphuric acid if they are exposed to the air. The risk of ASS pollution can be managed in this case since the operation will not involve dewatering. Furthermore the proposed closure strategy is to create an artificial wetland system thereby providing the opportunity to place any potentially acid-forming materials so that they will be permanently submerged underwater. However it must be emphasised that it will be critical to ensure that any potential ASS material is identified, segregated and placed to ensure that it will remain submerged. In particular it must not be placed on the upper parts of bund walls or in other areas where it will be exposed to air.

The EPA also notes the advice of the Department of Environment that the proposed areas to be excavated are not hydrologically linked to the Ellen Brook Nature Reserve and that there is therefore no possibility of acid impacts on the nature reserve or on the habitat of the Western Swamp Tortoise.

### **Conclusion**

It is the EPA's opinion that the proposed change to conditions can be managed to meet the EPA's environmental objective for this factor provided that:

- a condition is imposed to require the appropriate identification and management of acid sulfate soils.

## **4. Conditions and commitments**

Section 46(3) of the *Environmental Protection Act 1986* requires the EPA to report to the Minister for the Environment on whether or not the proposed changes to conditions or procedures should be allowed. In addition, the EPA may make recommendations as it sees fit.

In developing recommended conditions for each project, the EPA's preferred course of action is to have the proponent provide an array of commitments to ameliorate the impacts of the proposed change to conditions on the environment. The commitment made by Midland Brick is considered by the EPA as part of its assessment of the proposal.

### **4.1 Recommended commitments**

Midland Brick has made changes its commitment to reflect discussions with the Department of Environment which have been part of the assessment process. The proponent's commitments as set out in the Section 46 document (Midland Brick, 2004) and subsequently modified, as shown below (Table 2), should be made enforceable conditions.

**Table 2: Summary of proponent’s commitments**

No.	Topic	Objective	Action	Timing	Advice
1.	Transfer of land	To increase the size of Ellen Brook Nature Reserve and provide additional protected habitat for the Western Swamp Tortoise	The proponent will transfer approximately 4.7ha of the eastern side of Lot 12 Lexia Avenue to the Crown.  The area includes Bush Forever site 301B	Transfer should commence within 6 months following the issue of the Section 45(7) notice to the Decision - Making Authorities.  Transfer should be finalised as soon as possible after the process begins	CALM  DPI

## 4.2 Changes to other Environmental Conditions

Assessment of the proposed changes to conditions under Section 46 of the *Environmental Protection Act 1986* allows the EPA the opportunity to amend other environmental conditions in addition to the time limit condition (Condition 3, Appendix 4)

The EPA has reviewed the existing environmental conditions with a view to:

- (a) updating the statement into the current format;
- (b) ensuring compatibility with current environmental protection regulations; and
- (c) applying conditions which are now routinely applied to proposals of this type.

The EPA’s proposed changes to the environmental conditions are set out in Appendix 4. These conditions should be examined in conjunction with the original environmental conditions in Appendix 3.

## 4.3 Recommended conditions

The EPA recommends that, if the proposed change to conditions by Midland Brick Company Pty Ltd is approved for implementation, the existing Environmental Conditions applied to the project (Ministerial Statement 251 published in April 1992), be subject to modifications necessary to:

- indefinitely extend the time limit of environmental approval, subject to a 5-yearly environmental review;
- allow for the expansion of the existing location approvals to include the new locations, Lot 19, 45 and 46 St Albans road, Lot 19 Copley Road and Lot 100 Great Northern Highway;
- update the statement into the current format;
- require the production of a wetland rehabilitation program for Coondaree Swamp and surrounding areas;
- require an acid sulfate soil (ASS) investigation and (if necessary) production of an ASS Management Plan on areas deemed “high risk” before the commencement of excavation works within the high risk areas; and
- provide for the transfer to the Crown of approximately half of Lot 12 Lexia Avenue to be added to Ellen Dale Nature Reserve to provide additional protected habitat for the endangered Western Swamp Tortoise.

The proposed changes to conditions are set out in detail in Appendix 4.

## **5. Conclusions**

The EPA has considered the change to conditions proposed by Midland Brick and has concluded that it can be managed to meet the EPA's objectives for the relevant environmental factors.

The EPA believes that the 14-year period since the original proposal was assessed has given rise to three relevant environmental issues that cause the EPA to reconsider its previous recommendations as to the environmental acceptability of the project and provide advice on the mitigation of these issues. In particular the EPA has concluded that the proposed excavation of Coondaree Swamp (a resource enhancement wetland) is acceptable in view of the proposed rehabilitation of the area to form an artificial wetland and the environmental offset proposed by the proponent, namely donation of land to be added to Ellen Brook Nature Reserve to provide additional protected habitat for the endangered Western Swamp Tortoise.

In addition to the above, the EPA considers that conditions attached to the environmental approval should be updated. It has therefore also reported on the updating of conditions.

## **6. Recommendations**

The EPA submits the following recommendations to the Minister for the Environment:

1. That the Minister notes that this report is pursuant to Section 46(3) of the *Environmental Protection Act 1986*.
2. That the Minister notes that the proposed change includes extending the time limit for the existing approved Lots of the excavation and expanding the project to include Lot 19 Copley Road, Lots 19, 45 and 46 St Albans Road and Lot 100 Great Northern Highway, Upper Swan.
3. The EPA recommends that the Minister considers the report on the relevant environmental factors as set out in Section 3.
4. That the Minister notes that the EPA has concluded that the proposed change to conditions can be managed to meet the EPA's objectives, and thus not impose an unacceptable impact on the environment provided there is satisfactory implementation by the proponent of the amended conditions and commitments, as set out in Section 4.
5. The Minister imposes the amended conditions, commitments and procedures recommended in Appendix 4 of this report.

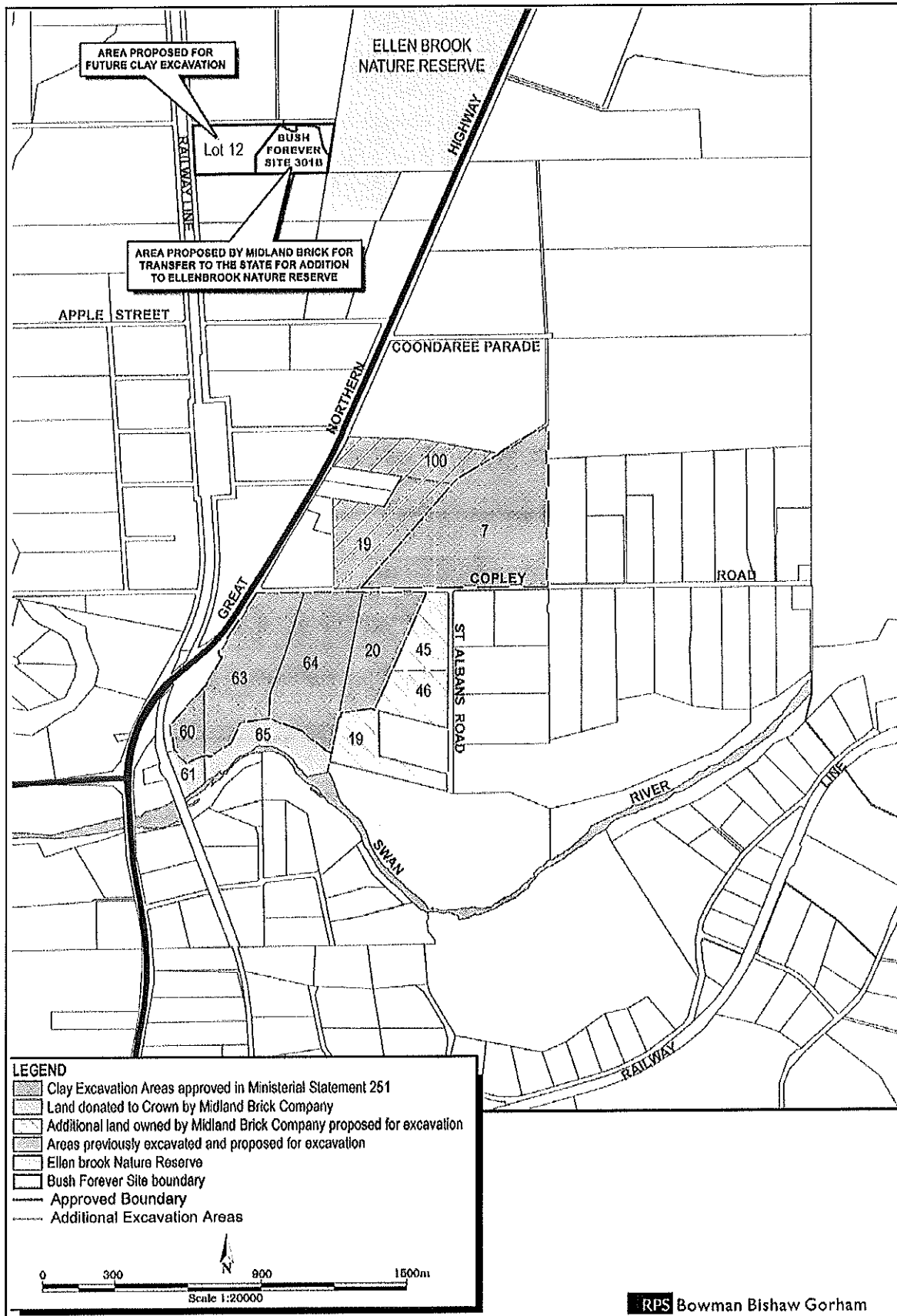


Figure 1: Location of Existing and Proposed Clay Excavation Areas

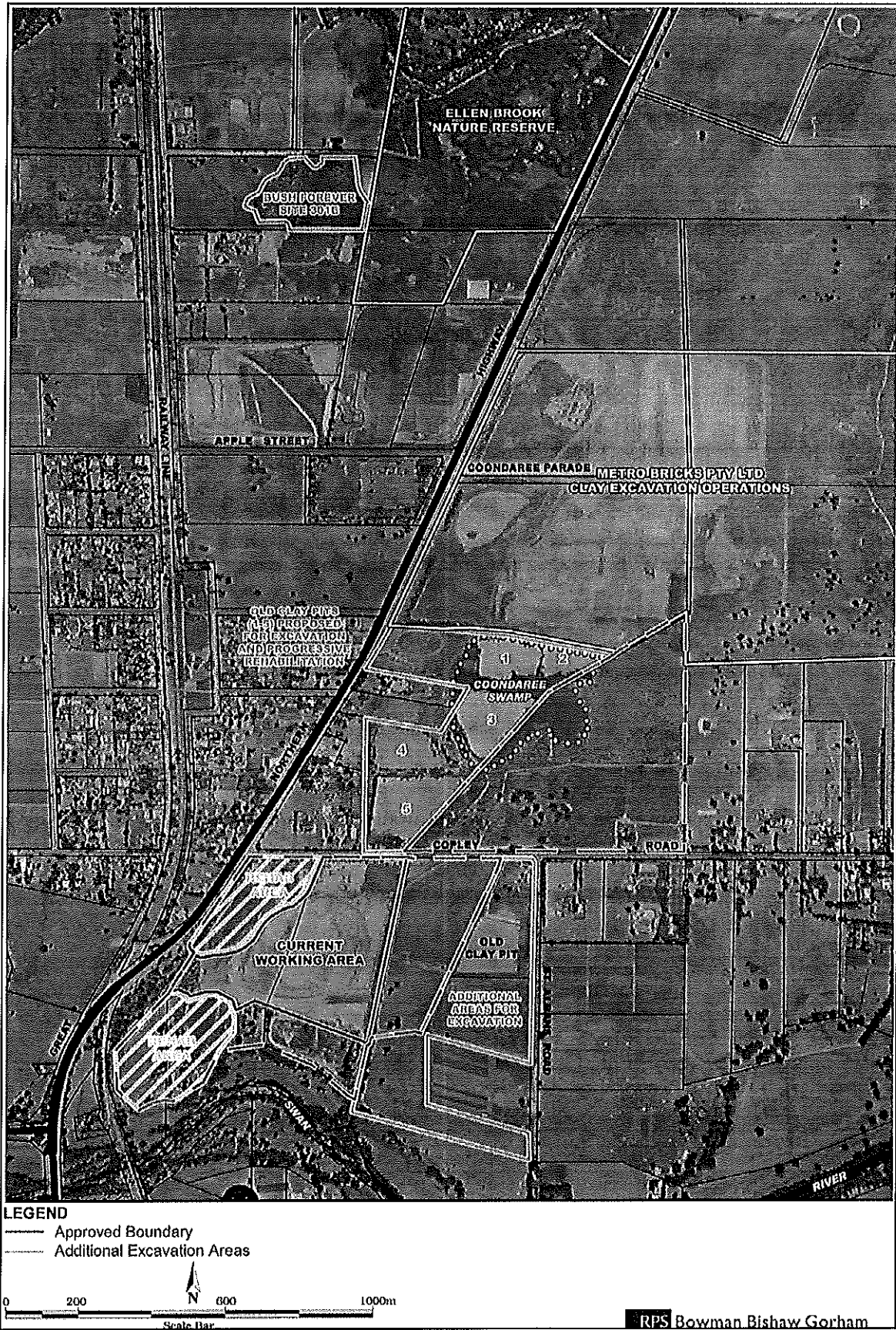


Figure 2: Aerial View of Clay Excavation Site showing the Location of Coondaree Swamp



## **Appendix 1**

### **List of Stakeholders**

- Department of Environment
- Department of Conservation and Land Management
- City of Swan
- Swan River Trust

## **Appendix 2**

### **References**

- Department of Environment (2003) *Guidance on Managing Acid Sulfate Soils*, Department of Environment, Perth, Western Australia.
- Environmental Protection Authority (1991) *Clay Excavation, part lot 1 and lots 222, 27, 26, 25, 28 and 7 Hallett and Copley Roads, Upper Swan*, Bulletin 599, Environmental Protection Authority, Perth, Western Australia
- Environmental Protection Authority (1992) *Environmental Protection (Swan Coastal Plain Lakes) Policy Approval Order 1992*, Environmental Protection Authority, Perth, Western Australia
- Environmental Protection Authority (2004) *Environmental Protection (Swan Coastal Plain Wetlands) Policy and Regulations 2004*, Environmental Protection Authority, Perth, Western Australia
- Environmental Protection Authority (2004) *Environmental Protection of Wetlands*, Environmental Protection Authority, Perth, Western Australia
- Environmental Protection Authority (2004) *Preliminary Positions Statement No. 9 Environmental Offsets*, Environmental Protection Authority, Perth, Western Australia
- Midland Brick Company Pty Ltd (2004) *Section 46 Review Midland Brick Clay Excavation Hallett and Copley Roads, Upper Swan*
- Western Australian Planning Commission (2003) *Acid Sulfate Soils* Western Australian Planning Commission, Perth, Western Australia

## **Appendix 3**

**Statement of Environmental Conditions of Approval (23 April 1992)**



WESTERN AUSTRALIA  
MINISTER FOR THE ENVIRONMENT

Ass # 504  
Bull # 599  
State # 251

**STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT  
TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT  
1986)**

**CLAY EXCAVATION, PART LOT 1 & LOTS 222,27,26,25,28 & 7 HALLETT & COPLEY  
ROADS, UPPER SWAN (504)**

**MIDLAND BRICK COMPANY PTY LTD**

This proposal may be implemented subject to the following conditions:

**1. Commitments**

In implementing the proposal, the proponent shall fulfil the commitments (which are not inconsistent with the conditions or procedures contained in this statement) made in the Consultative Environmental Review and included in Environmental Protection Authority Bulletin 599 as Appendix 1. (A copy of the commitments is attached).

**2. Detailed Implementation**

Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal. Where, in the course of that detailed implementation, the proponent seeks to change those designs, specifications, plans or other technical material in any way that the Minister for the Environment determines on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

**3. Length of Tenure**

Approval for the proposal shall be for a maximum of ten years from the date of this statement. Subsequent applications will be reviewed in the light of the proponent's environmental performance at the site.

**4. Environmental Management Programme**

A comprehensive environmental management programme should be prepared to enable the proponent to detect, report on and manage any impacts on the environment.

- 4-1 Prior to the start of quarrying activities, the proponent shall prepare an Environmental Management Programme, following consultation with the appropriate government departments, to the satisfaction of the Minister for the Environment on advice of the Environmental Protection Authority. Plans to be prepared as part of the Environmental Management Programme shall include, but not necessarily be limited to:

Published on

23 APR 1992

- (1) a staged quarrying strategy;
- (2) drainage management;
- (3) lakewater management;
- (4) groundwater management and protection;
- (5) excavation and rehabilitation procedures;
- (6) end-use and progressive rehabilitation of the site;
- (7) procedures to minimise noise, dust and visual impacts associated with the quarrying and transportation operations;
- (8) periodic reporting of monitoring results; and
- (9) consequential changes to project management to remedy unacceptable environmental impacts.

4-2 The proponent shall implement the Environmental Management Programme required by condition 4-1 to the satisfaction of the Environmental Protection Authority.

4-3 The proponent shall periodically review the Environmental Management Programme required by condition 4-1 to the satisfaction of the Environmental Protection Authority.

## **5. Regional Development, Drainage and Rehabilitation**

The proponent shall contribute, to the satisfaction of the Environmental Protection Authority, to the preparation of a regional development, drainage and rehabilitation strategy for the Upper Swan locality in consultation with the appropriate government departments, including the Main Roads Department, the Department of Conservation and Land Management and the Department of Planning and Urban Development, the Shire of Swan and other current and known proposed clay producers in the area, such that the plan can be prepared within two years of the date of this statement.

## **6. Decommissioning**

The proponent shall be responsible for decommissioning and removal of the plant and installations and rehabilitating the site and its environs, to the satisfaction of the Environmental Protection Authority. At least six months prior to decommissioning, the proponent shall prepare and subsequently implement a decommissioning and rehabilitation plan, to the satisfaction of the Environmental Protection Authority.

## **7. Proponent**

No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

## **8. Time Limit on Approval**

If the proponent has not substantially commenced the project within five years of the date of this statement, then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced. Any application to extend the period of five years referred to in this condition shall be made before the expiration of that period, to the Minister for the Environment by way of a request for a change in the condition under Section 46 of the Environmental Protection Act. (On expiration of the five year period, further consideration of the proposal can only occur following a new referral to the Environmental Protection Authority).

## **9. Compliance Auditing**

The proponent is responsible for complying with the environmental conditions and commitments.

9-1 The proponent shall prepare an "Audit Programme" in consultation with and to the satisfaction of the Environmental Protection Authority. The programme shall include, but not be limited to, the preparation of regular "Compliance Reports" to show the progress of the proposal, any changes to the original proposal, and how the proponent has complied with the environmental conditions.

9-2 Subsequent to condition 9-1, the proponent shall implement the approved Audit Programme to the satisfaction of the Environmental Protection Authority.

Bob Pearce, MLA  
MINISTER FOR THE ENVIRONMENT

22 APR 1992

## **Proponent's Environmental Management Commitments (504)**

In addition to the conditions of their existing approval, Midland Brick Company Pty Ltd agree to:

- (1) Consult with planning authorities to facilitate the derivation of a long term strategic plan for the Upper Swan locality which recognizes and accepts the interim priority land use of clay extraction.
- (2) Ensure that the company's present rehabilitation concept is consistent with the overall rehabilitation goal for the locality once this has been formally agreed by the parties concerned.
- (3) Comply with excavation licence conditions negotiated with the Shire of Swan and in consultation with the Environmental Protection Authority and the Swan River Trust.

## **Appendix 4**

### **Recommended Environmental Conditions and Proponent's Consolidated Commitments**

DRAFT RECOMMENDED ENVIRONMENTAL CONDITIONS

**STATEMENT TO AMEND CONDITIONS APPLYING TO A PROPOSAL  
(PURSUANT TO THE PROVISIONS OF SECTION 46 OF THE  
ENVIRONMENTAL PROTECTION ACT 1986)**

CLAY EXCAVATION

Part lot 1 and lots 222, 27, 26, 25, 28, and 7 Hallett and Copley Roads, Upper Swan.

**Proposal:** The operation of a clay excavation facility in Upper Swan, as documented in schedule 1 of this statement.

**Proponent:** Midland Brick Company Pty Ltd

**Proponent Address:** 102 Great Northern Highway, Middle Swan, WA, 6056

**Assessment Number:** 1432

**Previous Assessment Number:** 504

**Previous Statement Number:** 251 (Published on 23 April 1992)

**Report of the Environmental Protection Authority:** Bulletin 1157

**Previous Report of the Environmental Protection Authority:** Bulletin 599

The implementation of the proposal to which the above reports of the Environmental Protection Authority relate is subject to the following conditions and procedures, which replace all previous conditions and procedures:

**1 Implementation**

1.1 The proponent shall implement the proposal as documented in schedule 1 of this statement subject to the conditions of this statement.

**2 Proponent Commitments**

2-1 The proponent shall implement the environmental management commitments documented in schedule 2 of this statement.

**3 Proponent Nomination and Contact Details**

3-1 The proponent for the time being nominated by the Minister for the Environment under section 38(6) or (7) of the *Environmental Protection Act 1986* is responsible for the implementation of the proposal until such time as the Minister for the Environment has exercised the Minister's power under section 38(7) of the Act to revoke the nomination of that proponent and nominate another person as the proponent for the proposal.

- 3-2 If the proponent wishes to relinquish the nomination, the proponent shall apply for the transfer of proponent and provide a letter with a copy of this statement endorsed by the proposed replacement proponent that the proposal will be carried out in accordance with this statement. Contact details and appropriate documentation on the capability of the proposed replacement proponent to carry out the proposal shall also be provided.
- 3-3 The nominated proponent shall notify the Department of Environment of any change of contact name and address within 60 days of such change.

#### **4 Commencement and Time Limit of Approval**

- 4-1 The proponent shall substantially commence the proposal within five years of the date of the statement published on 23 April 1992 or the approval granted in that statement shall lapse and be void.

Note: The Minister for the Environment will determine any dispute as to whether the proposal has been substantially commenced.

- 4-2 The proponent shall make application for any extension of approval for the substantial commencement of the proposal beyond five years from the date of the statement published on 23 April 1992 to the Minister for the Environment, prior to the expiration of the five-year period referred to in condition 4-1.

The application shall demonstrate that:

- 1 the environmental factors of the proposal have not changed significantly;
- 2 new, significant, environmental issues have not arisen; and
- 3 all relevant government authorities have been consulted.

Note: The Minister for the Environment may consider the grant of an extension of the time limit of approval not exceeding five years for the substantial commencement of the proposal.

#### **5 Compliance Audit and Performance Review**

- 5-1 The proponent shall prepare an audit program and submit annual compliance reports to the Department of Environment which address:
- 1 the status of implementation of the proposal as defined in schedule 1 of this statement;
  - 2 evidence of compliance with the conditions and commitments; and
  - 3 the performance of the environmental management plans and programs.

The next annual compliance report shall be submitted to the Department of Environment no later than the 1 June 2005.

Note: Under sections 48(1) and 47(2) of the *Environmental Protection Act 1986*, the Chief Executive Officer of the Department of Environment is empowered to monitor the compliance of the proponent with the statement and should directly receive the compliance documentation, including environmental management plans, related to the conditions, procedures and commitments contained in this statement.

- 5-2 The proponent may excavate clay indefinitely, subject to the acceptability of performance review reports which shall be submitted every five years after the start of the operations phase, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

The performance review reports shall address the following:

- 1 the major environmental issues associated with the project; the targets for those issues; the methodologies used to achieve these; and the key indicators of environmental performance measured against those targets;
- 2 the level of progress in the achievement of sound environmental performance, including industry benchmarking, and the use of best available technology where practicable;
- 3 significant improvements gained in environmental management, including the use of external peer reviews;
- 4 stakeholder and community consultation about environmental performance and the outcomes of that consultation, including a report of any on-going concerns being expressed; and
- 5 the proposed environmental targets over the next five years, including improvements in technology and management processes.

## **6 Acid Sulfate Soils Investigation and Management Plan**

- 6-1 Prior to any ground-disturbing activities associated with the excavation and dewatering of areas classed as having a "high risk" of Acid Sulfate Soils according to the Western Australian Planning Commission Bulletin No. 64, the proponent shall prepare an Acid Sulfate Soils Investigation and Management Plan to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

The objectives of the Plan are:

- to ensure that any ground-disturbing activities which may disturb acid sulfate soils and/or contaminated waters are planned and managed to avoid adverse effects on the natural and built environment, human activities and health.

The Plan shall address:

- 1 identification of acid sulfate soils in and near areas proposed to be disturbed,  
and,

in the event that the disturbance of acid sulfate soils is unavoidable, the plan shall also address:

- 2 potential on-site and off-site effects of the disturbance of the acid sulfate soils and/or groundwater levels;
- 3 how drainage or soil extraction will be undertaken to minimise environmental impacts;
- 4 how any acid leachate generated as a result of ground-disturbing activities will be managed;
- 5 management of areas, both on and off-site, used to store or treat extracted soil;
- 6 comprehensive surface and ground water quality monitoring both on and off-site, if applicable;
- 7 establishment of agreed performance criteria and objectives in relation to environmental and social impacts; and
- 8 contingency measures and procedures in the event that the agreed performance criteria may not be met.

6-2 The proponent shall implement the Acid Sulfate Soils Investigation and Management Plan required by condition 6-1, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

6-3 The proponent shall make the Acid Sulfate Soils Investigation and Management Plan, required by condition 6-1, publicly available, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

## **7 Wetland Rehabilitation Plan**

7-1 Prior to the re-commencement of ground-disturbing activities, the proponent shall prepare a Wetland Rehabilitation Plan, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

This Plan shall include:

- 1 a report of a detailed vegetation and flora survey of the areas likely to be impacted by the proposal;
- 2 characterisation of the habitats likely to be impacted by the proposal;
- 3 an integrated and progressive mining and landscaping plan designed to optimise rehabilitation outcomes and provide a range of habitats in the final landform;
- 4 proposed final landforms and the identification of areas to be revegetated;
- 5 a rehabilitation and revegetation management plan for areas of vegetation to be disturbed during excavation;
- 6 agreed timelines and progressive performance criteria;

- 7 monitoring against the agreed progressive performance criteria;
- 8 contingency measures in the event that the rehabilitation or revegetation fails to meet agreed performance criteria; and
- 9 responsibilities for continued maintenance of rehabilitated and landscaped areas.

Note: In the preparation of advice to the Minister for the Environment, the Environmental Protection Authority expects to obtain advice of the Department of Environment and the Swan River Trust.

- 7-2 The proponent shall implement the Wetland Rehabilitation Plan, required by condition 7-1, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.
- 7-3 The proponent shall make the Wetland Rehabilitation Plan, required by condition 6-1, publicly available, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

## **8 Environmental Management Programme**

- 8-1 The proponent shall prepare, make publicly available and subsequently implement an updated Environmental Management Programme also addressing the requirements of conditions 6 and 7 and the new locations (see table 1), to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

The plans, strategies or reports to be prepared as part of the Environmental Management Programme shall include the following:

- 1 a staged excavation strategy;
- 2 Acid Sulfate Investigation and Management Plan (see condition 6);
- 3 groundwater management and protection;
- 4 progressive rehabilitation of the site;
- 5 Wetland Rehabilitation Plan (see condition 7);
- 6 weed management;
- 7 identification, management and protection of archaeological material;
- 8 procedures to minimise noise, dust and visual impacts associated with the quarrying and transport operations;
- 9 public safety and mosquito control;
- 10 periodic reporting of monitoring results;

- 11 consequential changes to project management to remedy unacceptable impacts; and
- 12 clearly indicated timeframes for implementation of each stage.

## **9 Decommissioning Plans**

- 9-1 Within two years following the date of the statement published on 23 April 1992, the proponent shall prepare a Preliminary Decommissioning Plan, which provides the framework to ensure that the site is left in an environmentally acceptable condition to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

The Preliminary Decommissioning Plan shall address:

- 1 rationale for the siting and design of plant and infrastructure as relevant to environmental protection, and conceptual plans for the removal or, if appropriate, retention of plant and infrastructure;
  - 2 long-term management of ground and surface water systems;
  - 3 a conceptual rehabilitation plan for all disturbed areas and a description of a process to agree on the end land use(s) with all stakeholders;
  - 4 a conceptual plan for a care and maintenance phase; and
  - 5 management of noxious materials to avoid the creation of contaminated areas.
- 9-2 At least 12 months prior to the anticipated date of decommissioning, or at a time agreed with the Environmental Protection Authority, the proponent shall prepare a Final Decommissioning Plan designed to ensure that the site is left in an environmentally acceptable condition to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

The Final Decommissioning Plan shall address:

- 1 removal or, if appropriate, retention of plant and infrastructure in consultation with relevant stakeholders;
  - 2 long-term management of ground and surface water systems;
  - 3 rehabilitation of all disturbed areas to a standard suitable for the agreed new land use(s); and
  - 4 identification of contaminated areas, including provision of evidence of notification and proposed management measures to relevant statutory authorities.
- 9-3 The proponent shall implement the Final Decommissioning Plan required by condition 9-2 until such time as the Minister for the Environment determines, on advice of the

Environmental Protection Authority, that the proponent's decommissioning responsibilities have been fulfilled.

- 9-4 The proponent shall make publicly available the Final Decommissioning Plan required by condition 9-2 to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority.

### **Procedures**

- 1 Where a condition states "to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority", the Environmental Protection Authority will provide that advice to the Department of Environment for the preparation of written notice to the proponent.
- 2 The Environmental Protection Authority may seek advice from other agencies or organisations, as required, in order to provide its advice to the Department of Environment.
- 3 The City of Swan will adjust the bond on the proponent, as appropriate, commensurate with the expanded area of the excavation.

### **Notes**

- 1 The Minister for the Environment will determine any dispute between the proponent and the Environmental Protection Authority or the Department of Environment over the fulfilment of the requirements of the conditions.

## Schedule 1

### The Proposal (Assessment No. 1432)

The proponent conducts clay excavation operations.

The Key Proposal Characteristics are shown in Table 1.

**Table 1 – Key Proposal Characteristics**

Element	Quantities/Description
Offset	Transfer to the State of Western Australia, at no charge, of approximately half of Lot 12 Lexia Avenue (eastern side) for addition to Ellen Brook Nature Reserve to provide additional habitat for the endangered Western Swamp Tortoise.
Existing extraction areas	A change to the numbering of the lots has occurred. The new numbers are Lots 7, 60, 63, 64 and 20 Hallett and Copley Roads, Upper Swan (Replacing Part lot 1 and lots 222, 27, 26, 25, 28, and 7 Hallett and Copley Roads, Upper Swan).
Areas for extension of clay extraction	Lot 19 Copley Road, Lot 100 Great Northern Highway and Lots 19, 45 and 46 St Albans Road, Upper Swan.
*Size of Clay Body	Approximately 4 million tonnes
*#Total Area of Disturbance	Approximately 109 hectares
*Rate of Extraction	Approximately 180,000 tonnes per year
Major Infrastructure	nil
Overburden	Between 1 and 6 million tonnes
Water Usage	nil

# will also be rehabilitated.

\* estimated at present usage.

**Figures (attached).**

Figure 1 – Location of current and proposed Midland Brick Clay excavation.

Figure 2 - Aerial Photo of Location and current works.

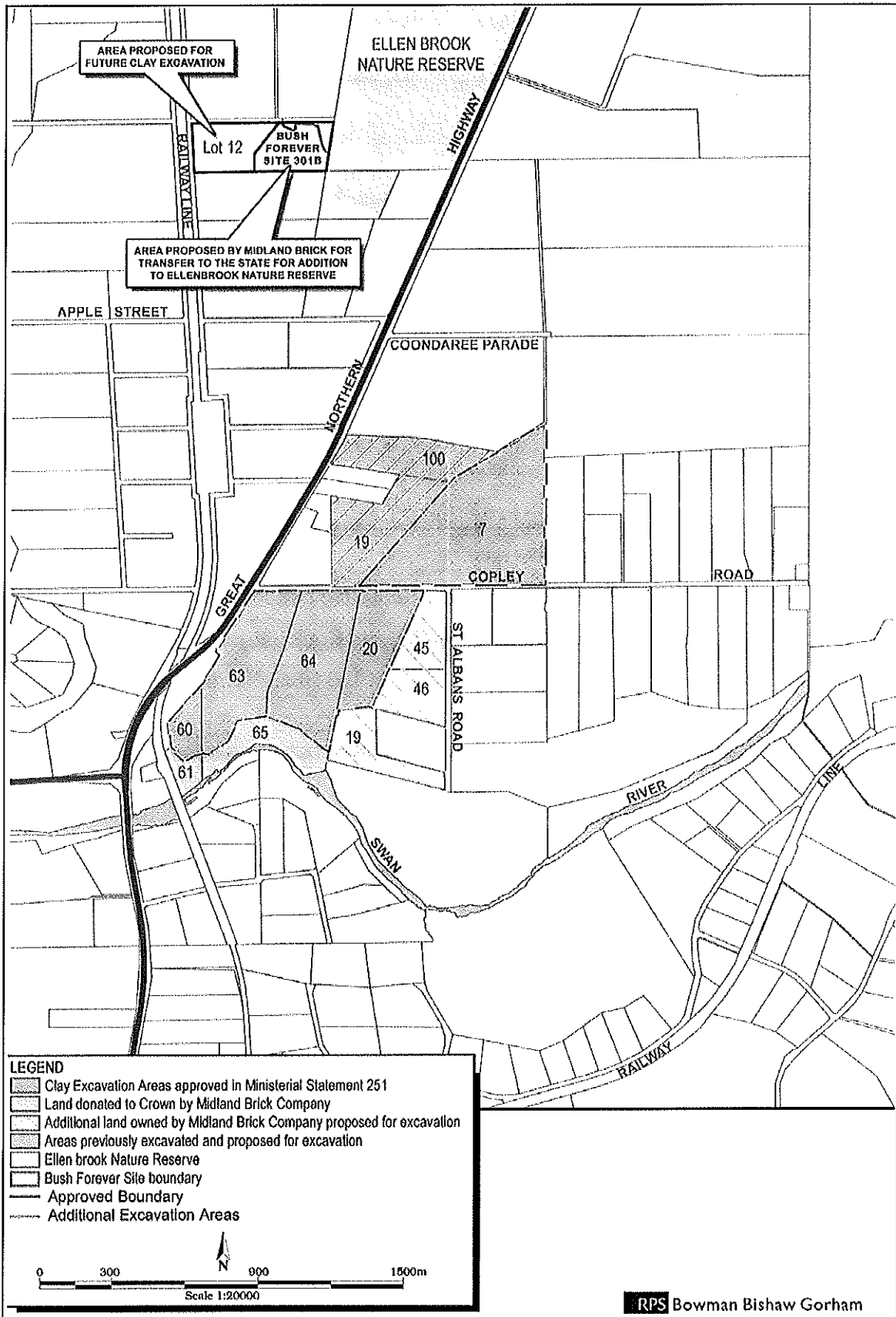
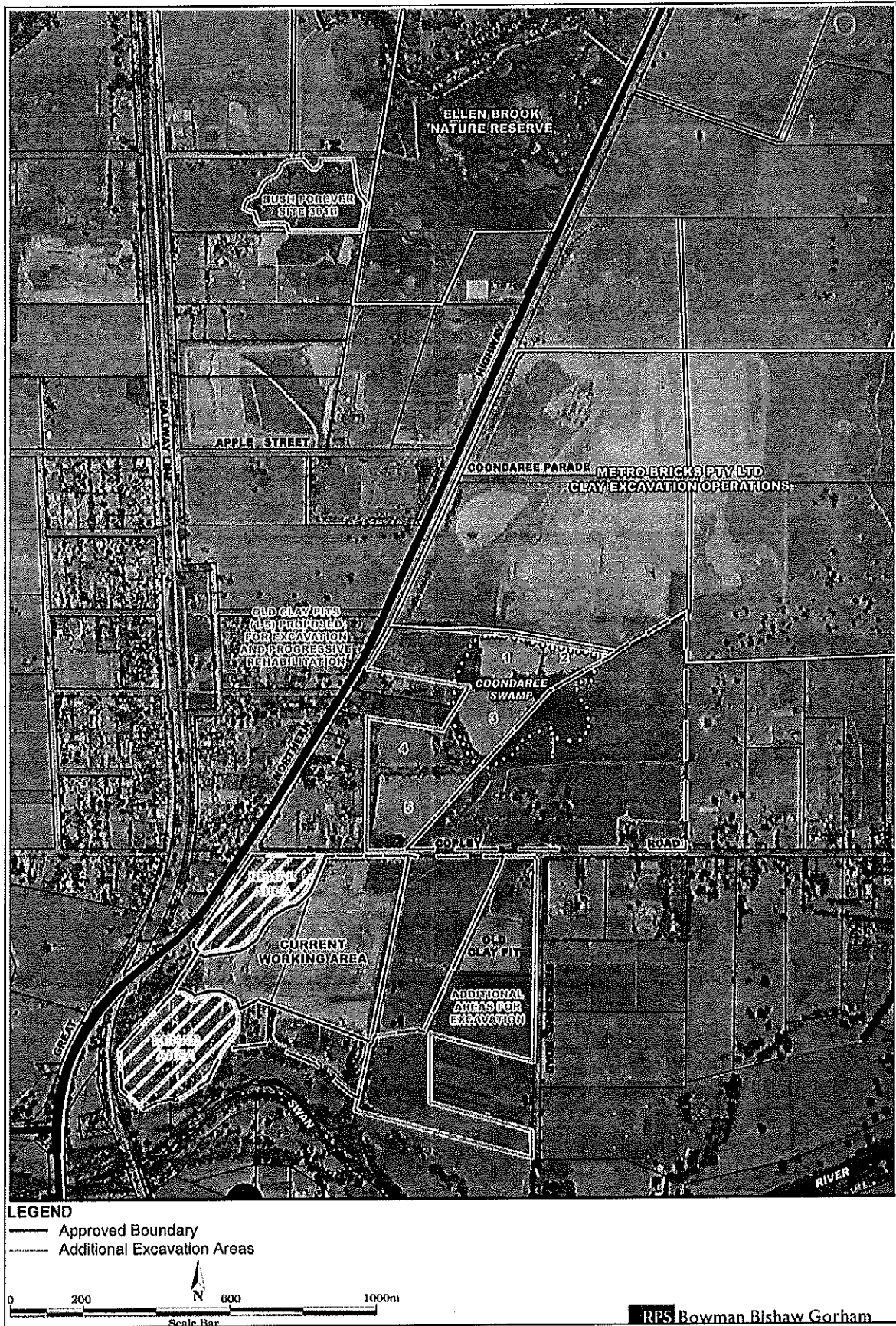


Figure 1: Location of current and proposed Midland Brick Clay excavation.



**Figure 2:** Aerial photo of current and proposed Midland Brick Clay excavation works and rehabilitation areas.

**Proponent's Environmental Management Commitments**

1992, as amended

**CLAY EXCAVATION**

**Lots 7, 20, 60, 63 and 64**

*(Previously Part Lot 1 and Lots 222, 27, 26, 25, 28 and 7)*

**Hallett and Copley Roads, Upper Swan**

(Assessment No. 1432)

**MIDLAND BRICK COMPANY PTY LTD**

## Proponent's Environmental Management Commitments (consistent with commitments detailed in 1992)

### CLAY EXCAVATION

LOTS 7, 20, 60, 63, AND 64 (PREVIOUSLY PART LOT 1 AND LOTS 222, 27, 26, 25, 28  
AND 7) HALLETT AND COPLEY ROADS, UPPER SWAN

Note: The term "commitment" as used in this schedule includes the entire row of the table and its six separate parts as follows:

- commitment number;
- a commitment topic;
- the objective of the commitment;
- the 'action' to be undertaken by the proponent;
- the timing requirements of the commitment; and
- the body/agency to provide the technical advice to the Department of Environment.

### MIDLAND BRICK CLAY EXCAVATION

#### PROPONENT'S ENVIRONMENTAL MANAGEMENT COMMITMENTS

No.	Topic	Objective	Action	Timing	Advice
1.	Transfer of land	To increase the size of the Ellen Brook Nature Reserve and provide additional protected habitat for the Western Swamp Tortoise.	The proponent will transfer approximately 4.7ha of the eastern side of Lot 12 Lexia Avenue to the Crown.  The area includes Bush Forever site number 301B.	Transfer should commence within 6 months following the issue of the Section 45(7) notice to the decision-making authorities.  Transfer should be finalised as soon as possible after the process begins.	CALM DPI

**APPENDIX B**

**ACID SULFATE SOILS -  
WAPC APPLICANT SELF-ASSESSMENT FORM**



# ACID SULFATE SOILS

## APPLICANT SELF - ASSESSMENT FORM

**PLEASE COMPLETE THIS SELF-ASSESSMENT FORM AND ANSWER THE FOLLOWING:**

### **STEP 1:** **IS THERE EVIDENCE OF A SIGNIFICANT RISK OF DISTURBING ACID SULFATE SOILS AT THIS LOCATION?**

#### **Question 1:**

Is the land depicted in Figures 1 - 11 of the Western Australian Planning Commission's Planning Bulletin No. 64: Acid Sulfate Soils as having a 'high risk of Actual Acid Sulfate Soil (AASS) & Potential Acid Sulfate Soil (PASS) < 3m from surface'?

Note: Planning Bulletin No. 64: Acid Sulfate Soils can be downloaded from:  
<http://www.wapc.wa.gov.au/publications/policies/bulletins/PB64/64Nov03.html>



**TICK BOX AS APPROPRIATE:**

YES

NO

#### **Question 2:**

Is the land located in an area, whether depicted in Figures 1 - 10 or not, where site characteristics and local knowledge lead you to form the view that there is a significant risk of disturbing acid sulfate soils at this location?



**TICK BOX AS APPROPRIATE:**

YES

NO

**If YES to either of these two questions go to Step 2.**

**If NO to both of these questions no further investigation is required. Sign this form and submit it with your application.**

## **STEP 2: ARE ANY OF THE FOLLOWING WORKS PROPOSED, OR LIKELY TO BE CARRIED OUT, ON THE LAND?**

---

### **Question 3:**

Are any dewatering works proposed to be undertaken?



**TICK BOX AS APPROPRIATE:**

YES

NO

### **Question 4:**

Is the surface elevation  $\leq$  5m AHD and is excavation of  $\geq 100\text{m}^3$  of soil (i.e. 10 standard dump truck loads) proposed?



**TICK BOX AS APPROPRIATE:**

YES

NO

### **Question 5:**

Is the surface elevation  $>$  5m AHD and is excavation of  $\geq 100\text{m}^3$  of soil (i.e. 10 standard dump truck loads) with an excavation depth of  $\geq 2\text{m}$  proposed?



**TICK BOX AS APPROPRIATE:**

YES

NO

If YES to any of these three questions go to Step 3.

If NO to all of these questions no further investigation is required.  
Sign this form and submit it with your application.

## **STEP 3:**

### **CARRY OUT PRELIMINARY SITE ASSESSMENT IN ACCORDANCE WITH DEPARTMENT OF ENVIRONMENT GUIDELINES.**

Note: Copies of documents in the Acid Sulfate Soils Guidelines Series and further technical advice and information can be obtained from the Contaminated Sites page on the Department of Environment's website at <http://www.environ.wa.gov.au/contaminatedsites>.

---

### **Question 6:**

Did the Preliminary Site Assessment reveal the presence of acid sulfate soils?



**TICK BOX AS APPROPRIATE:**

YES

NO

If YES to this question go to Step 4.

If NO to this question then no further investigation is required.  
Sign this form and submit it with your application together with the written results of the Preliminary Site Assessment.

# STEP 4:

## **CARRY OUT DETAILED SITE ASSESSMENT IN ACCORDANCE WITH DEPARTMENT OF ENVIRONMENT GUIDELINES.**

### Question 7:

Did the Detailed Site Assessment reveal the presence of acid sulfate soils?



**TICK BOX AS APPROPRIATE:**

YES

NO

If YES to this question you should consider modifying the design of the proposal to ensure that there is no disturbance to acid sulfate soils at this location. Regardless of whether you modify the design or not, sign this form and submit it with your application together with the written results of the Preliminary and Detailed Site Assessments.

If NO to this question then no further investigation or work is required. Sign this form and submit it with your application together with the written results of the Preliminary and Detailed Site Assessments.

### **APPLICANT SIGNATURE:**



.....  
Full Name



.....  
Signature



.....  
Date

### **TICK BOX FOR ATTACHMENTS AS APPROPRIATE:**

Preliminary site Assessment Results

Detailed site Assessment Results

The proposal has been designed to avoid disturbance of Acid Sulfate Soils at this location

**APPENDIX C**

**POTENTIAL ACID SULFATE SOILS TEST LOGS**



# POTENTIAL ACID SULFATE SOILS FIELD TESTING LOG

PROJECT NUMBER:		C05054		DATE:		10/03/2005	
SITE NAME:		Midland Brick		WEATHER:		Overcast	
SAMPLING AREA:		North of site on lake edge		METHOD:		Push Core	
SAMPLING LOCATION ID:		CSA2		TOTAL DEPTH (m):		9.50	
SCIENTIST(S):		James Holthouse & Shae Miller-White		DEPTH TO WATER (mbgl):		NA	
QA/QC SAMPLE IDs:		-		STORAGE:		Acetate tubing with end caps in ice/esk	
SOIL PROFILE			SAMPLE DATA				
DEPTH (mbgl)	DESCRIPTION ( SOIL TYPE, Colour, Texture)	SAMPLE ID	DEPTH (mbgl)	pH <sub>F</sub>	pH <sub>FOX</sub>	REACTION VIGOUR	
0.00 - 1.00	Sandy CLAY, grey / brown, moderate plasticity, dry to 0.3 mbgl	CSA2-1	0.00 - 0.50	5.89	5.31	X	
		CSA2-1A	0.50 - 1.00	5.84	4.82	L	
1.00 - 2.80	Sandy CLAY, grey / brown, moderate plasticity, moist.	CSA2-2	1.00 - 1.50	6.28	4.68	L	
		CSA2-2A	1.50 - 2.00	6.31	6.63	X	
		CSA2-3	2.00 - 2.50	6.97	4.58	L	
2.80 - 3.00	Sandy CLAY, grey / brown with orange mottles, moderate plasticity, moist	CSA2-3A	2.50 - 3.00	7.02	4.64	L	
3.00 - 3.60	Silty CLAY, off white / pale grey, low plasticity, moist.	CSA2-4	3.00 - 3.50	7.23	4.71	L	
3.60 - 4.40	Silty CLAY, brown / orange, low plasticity, moist	CSA2-4A	3.50 - 4.00	7.29	4.71	L	
4.40 - 4.50	Silty SAND, pale grey / brown, fine grained, moist.	CSA2-5	4.00 - 4.50	6.19	4.53	L	
4.50 - 5.50	Silty CLAY, pale grey / brown with orange mottles, moderately cohesive, moist	CSA2-6	4.50 - 5.00	6.33	4.6	L	
		CSA2-6A	5.00 - 5.50	6.48	4.68	L	
5.50 - 6.70	CLAY, pale grey / brown, high plasticity, moist	CSA2-7	5.50 - 6.00	6.69	4.85	L	
		CSA2-7A	6.00 - 6.50	5.40	4.76	L	
6.70 - 7.50	Sandy CLAY, pale grey, high plasticity, moist.	CSA2-8	6.50 - 7.00	6.06	4.61	L	
		CSA2-8A	7.00 - 7.50	6.30	4.69	L	
7.50 - 8.50	Gravelly CLAY, pale grey with orange and red mottles, highly plastic, moist. (coarse sand and laterite gravel inclusions)	CSA2-9	7.50 - 8.00	6.45	4.86	L	
		CSA2-9A	8.00 - 8.50	5.53	4.94	L	
8.50 - 9.35	CLAY, pale grey with orange and red mottles, very cohesive, moist	CSA2-10	8.50 - 9.00	7.40	5.48	L	
9.35 - 9.50	SAND, pale grey, medium to coarse grained, moist.	CSA2-10A	9.00 - 9.50	7.82	5.39	L	
<b>Notes / Comments:</b> Green shading denotes inferred Potential Acid Sulfate Soil (PASS) Orange shading denotes inferred Actual Acid Sulfate Soil (AASS)				Calibration		L - Low	
				pH 7.0 Cal:	√	M - Medium	
				pH 4.0 Cal:	√	H - High	
				pH peroxide:	5.02	X - Extreme	
EASTING:	408726	NORTHING:	6484764				

# POTENTIAL ACID SULFATE SOILS FIELD TESTING LOG

PROJECT NUMBER:		C05054		DATE:		11/03/2005	
SITE NAME:		Midland Brick		WEATHER:		Overcast	
SAMPLING AREA:		South East of Trotting track		METHOD:		Push Core	
SAMPLING LOCATION ID:		CSA3		TOTAL DEPTH (m):		14.0	
SCIENTIST(S):		James Holthouse & Shae Miller-White		DEPTH TO WATER (mbgl):		NA	
QA/QC SAMPLE IDs:		-		STORAGE:		Acetate tubing with end caps in ice/eski	
SOIL PROFILE		SAMPLE DATA					
DEPTH (mbgl)	DESCRIPTION ( SOIL TYPE, Colour, Texture)	SAMPLE ID	DEPTH (mbgl)	pH <sub>F</sub>	pH <sub>Fox</sub>	REACTION VIGOUR	
0.00 - 0.60	CLAY, dark brown / black, moderately plastic, dry	CSA3-1	0.00 - 0.50	6.62	5.15	L	
0.60 - 3.60	CLAY, pale grey / brown, high plasticity, moist	CSA3-1A	0.50 - 1.00	7.62	5.41	M	
		CSA3-2	1.00 - 1.50	7.63	6.52	X	
		CSA3-2A	1.50 - 2.00	7.30	5.31	L	
		CSA3-3	2.00 - 2.50	7.46	5.48	L	
		CSA3-3A	2.50 - 3.00	7.25	6.96	X	
		CSA3-4	3.00 - 3.50	7.57	5.64	L	
3.60 - 4.00	Silty CLAY, grey / brown with orange mottles, low plasticity, moist	CSA3-4A	3.50 - 4.00	7.64	5.82	M	
4.00 - 5.00	CLAY, grey / brown with orange mottles, moderate plasticity, moist	CSA3-5	4.00 - 4.50	7.55	5.49	L	
		CSA3-5A	4.50 - 5.00	7.58	5.51	L	
5.00 - 7.00	Silty CLAY, grey / brown with orange mottles, low plasticity, moist.	CSA3-6	5.00 - 5.50	7.50	5.59	L	
		CSA3-6A	5.50 - 6.00	7.64	5.50	L	
		CSA3-7	6.00 - 6.50	7.40	5.53	L	
		CSA3-7A	6.50 - 7.00	7.30	5.49	L	
7.00 - 8.00	CLAY, grey / brown with orange mottles, mod. to strong plasticity, moist	CSA3-8	7.00 - 7.50	7.20	5.39	L	
		CSA3-8A	7.50 - 8.00	7.43	5.44	L	
8.00 - 11.00	CLAY, grey / brown with orange mottles, moderate plasticity, moist.	CSA3-9	8.00 - 8.50	7.10	5.43	L	
		CSA3-9A	8.50 - 9.00	7.29	5.44	L	
		CSA3-10	9.00 - 9.50	7.45	5.45	L	
		CSA3-10A	9.50 - 10.00	7.56	5.50	L	
		CSA3-11	10.00 - 10.50	6.88	5.52	L	
		CSA3-11A	10.50 - 11.00	7.63	5.36	L	
11.00 - 12.00	CLAY, brown with black mottles, moderate plasticity, moist. (fibric peat inclusions)	CSA3-12	11.00 - 11.50	7.55	5.37	L	
		CSA3-12A	11.50 - 12.00	7.26	5.35	L	
12.00 - 13.70	Sandy CLAY, brown with grey mottles, moderate plasticity, wet.	CSA3-13	12.00 - 12.50	7.42	5.25	L	
		CSA3-13A	12.50 - 13.00	7.31	5.27	L	
		CSA3-14	13.00 - 13.50	7.25	5.26	L	
13.70 - 14.00	Sandy CLAY, red / brown, moderate plasticity, wet.	CSA3-14A	13.50 - 14.00	7.27	5.15	L	
Notes / Comments: Green shading denotes inferred Potential Acid Sulfate Soil (PASS) Orange shading denotes inferred Actual Acid Sulfate Soil (AASS)				Calibration pH 7.0 Cal:     √ pH 4.0 Cal:     √ pH peroxide:   5.02		L - Low M - Medium H - High X - Extreme	
EASTING:	408510	NORTHING:	6484795				





# POTENTIAL ACID SULFATE SOILS FIELD TESTING LOG

PROJECT NUMBER:		C05054		DATE:		11/03/2005
SITE NAME:		Midland Brick		WEATHER:		Overcast
SAMPLING AREA:		South of protected area.		METHOD:		Push Core
SAMPLING LOCATION ID:		CSA6		TOTAL DEPTH (m):		6.0
SCIENTIST(S):		James Holthouse & Shae Miller-White		DEPTH TO WATER (mbgl):		NA
QA/QC SAMPLE IDs:		-		STORAGE:		Acetate tubing with end caps in ice/eski
SOIL PROFILE		SAMPLE DATA				
DEPTH (mbgl)	DESCRIPTION ( SOIL TYPE, Colour, Texture)	SAMPLE ID	DEPTH (mbgl)	pH <sub>F</sub>	pH <sub>Fox</sub>	REACTION VIGOUR
0.00 - 1.00	Silty CLAY, pale brown, low plasticity, dry. (trace grass roots / organics to 0.20 mbgl.)	CSA6-1	0.00 - 0.50	5.88	4.80	L
		CSA6-1A	0.50 - 1.00	6.24	5.14	L
1.00 - 3.00	CLAY, pale brown with orange mottles, moderate plasticity, dry.	CSA6-2	1.00 - 1.50	6.30	5.26	L
		CSA6-2A	1.50 - 2.00	6.46	5.46	L
		CSA6-3	2.00 - 2.50	6.74	5.37	L
		CSA6-3A	2.50 - 3.00	7.05	5.44	L
3.00 - 4.00	Silty CLAY, pale brown with orange mottles, low plasticity, dry.	CSA6-4	3.00 - 3.50	7.18	5.26	L
		CSA6-4A	3.50 - 4.00	5.85	5.50	L
4.00 - 5.00	Sandy CLAY, pale grey / brown with orange mottles, low plasticity, moist.	CSA6-5	4.00 - 4.50	6.23	5.25	L
		CSA6-5A	4.50 - 5.00	6.36	5.82	L
5.00 - 6.00	SAND, off white, fine grained, dry.	CSA6-6	5.00 - 5.50	6.27	5.27	L
		CSA6-6A	5.50 - 6.00	6.23	5.20	L
<u>Notes / Comments:</u> Green shading denotes inferred Potential Acid Sulfate Soil (PASS) Orange shading denotes inferred Actual Acid Sulfate Soil (AASS)				Calibration pH 7.0 Cal:     √ pH 4.0 Cal:     √ pH peroxide:   5.15		L - Low M - Medium H - High X - Extreme
EASTING:	408789	NORTHING:	6484557			





# POTENTIAL ACID SULFATE SOILS FIELD TESTING LOG

PROJECT NUMBER:	C05054	DATE:	09/03/05
SITE NAME:	Midland Brick	WEATHER:	Fine / hot
SAMPLING AREA:	North of Copley Rd	METHOD:	Push Core
SAMPLING LOCATION ID:	<b>CSA9</b>	TOTAL DEPTH (m):	13.0
SCIENTIST(S):	James Holthouse & Shae Miller-White	DEPTH TO WATER (mbgl):	~10.0
QA/QC SAMPLE IDs:	-	STORAGE:	Acetate tubing with end caps in ice/eski

SOIL PROFILE		SAMPLE DATA				
DEPTH (mbgl)	DESCRIPTION ( SOIL TYPE, Colour, Texture)	SAMPLE ID	DEPTH (mbgl)	pH <sub>F</sub>	pH <sub>FOX</sub>	REACTION VIGOUR
0.00 - 3.00	Silty CLAY, brown, low plasticity, dry. (trace grass roots / organics to 0.25 mbgl.)	CSA9-1	0.00 - 0.50	5.89	5.01	L
		CSA9-1A	0.50 - 1.00	5.48	3.22	M
		CSA9-2	1.00 - 1.50	5.62	5.29	L
		CSA9-2A	1.50 - 2.00	5.67	5.54	M
		CSA9-3	2.00 - 2.50	6.09	5.21	L
		CSA9-3A	2.50 - 3.00	6.09	4.54	L
3.00 - 3.70	Silty CLAY, brown, low to moderate plasticity, dry. (limestone gravels at 3.70 mbgl)	CSA9-4	3.00 - 3.50	6.38	5.30	L
3.70 - 4.00	CLAY, pale brown with orange mottles, moderate plasticity, dry.	CSA9-4A	3.50 - 4.00	6.47	5.24	L
4.00 - 6.00	CLAY, pale brown with orange mottles, high plasticity, dry (highly plastic when moist).	CSA9-5	4.00 - 4.50	6.36	5.35	L
		CSA9-5A	4.50 - 5.00	6.33	6.81	X
		CSA9-6	5.00 - 5.50	5.21	5.09	L
		CSA9-6A	5.50 - 6.00	6.06	5.12	L
6.00 - 6.40	CLAY, pale brown with orange mottles, mod. cohesive, dry. (mod. plastic when moist)	CSA9-7	6.00 - 6.40	6.17	7.37	X
6.40 - 7.80	CLAY, pale brown with orange mottles, high plasticity, moist.	CSA9-7A	6.40 - 6.80	6.44	5.26	L
		CSA9-8	6.80 - 7.30	6.65	5.23	L
		CSA9-8A	7.30 - 7.80	6.66	5.27	L
7.80 - 9.80	CLAY, pale grey / brown with orange mottles, high plasticity, moist.	CSA9-9	7.80 - 8.30	6.94	5.31	L
		CSA9-9A	8.30 - 8.70	6.96	5.34	L
		CSA9-10	8.80 - 9.30	6.90	5.17	L
		CSA9-10A	9.30 - 9.80	6.87	5.19	L
9.80 - 10.10	Sandy CLAY, pale grey / brown with orange mottles, moderate plasticity, moist.	CSA9-11	9.80 - 10.30	6.98	5.21	L
10.10 - 11.00	CLAY, pale grey / brown with orange mottles, high plasticity, moist.	CSA9-11A	10.30 - 11.00	7.13	5.39	L
11.00 - 11.90	CLAY, pale grey / brown, high plasticity, moist.	CSA9-12	11.00 - 11.50	6.99	5.35	L
11.90 - 12.00	Sandy CLAY, pale grey, low to moderate plasticity, wet.	CSA9-12A	11.50 - 12.00	7.08	5.25	L
12.00 - 12.30	Sandy CLAY, brown, low plasticity, wet.	CSA9-13	12.00 - 12.50	7.58	5.27	L
12.30 - 13.00	Clayey SAND, brown, med/ fine grained, wet	CSA9-13A	12.50 - 13.00	7.41	5.29	L

<b>Notes / Comments:</b> Green shading denotes inferred Potential Acid Sulfate Soil (PASS) Orange shading denotes inferred Actual Acid Sulfate Soil (AASS)				Calibration		L - Low
				pH 7.0 Cal:	√	M - Medium
				pH 4.0 Cal:	√	H - High
				pH peroxide:	5.17	X - Extreme
EASTING:	408486	NORTHING:	6484325			

# POTENTIAL ACID SULFATE SOILS FIELD TESTING LOG

PROJECT NUMBER:		C05054		DATE:		22/03/2005	
SITE NAME:		Midland Brick		WEATHER:		Fine / Hot	
SAMPLING AREA:		North east side of site.		METHOD:		HSA-SS	
SAMPLING LOCATION ID:		CSMB1		TOTAL DEPTH (m):		-12	
SCIENTIST(S):		James Holthouse		DEPTH TO WATER (mbgl):		~ 10.0	
QA/QC SAMPLE IDs:		-		STORAGE:		Zip lock bagged in ice / Esky	
SOIL PROFILE		SAMPLE DATA					
DEPTH (mbgl)	DESCRIPTION ( SOIL TYPE, Colour, Texture)	SAMPLE ID	DEPTH (mbgl)	pH <sub>F</sub>	pH <sub>FOX</sub>	REACTION VIGOUR	
0.00 - 1.00	Silty CLAY, dark grey / brown, low plasticity, dry.	CSMB1-1	0.00 - 0.50	5.71	2.40	M	
		CSMB1-1A	0.50 - 1.00	6.40	3.70	L	
1.0 - 3.00	CLAY, grey / brown, moderate plasticity, dry.	CSMB1-2	1.00 - 1.50	6.86	6.29	X	
		CSMB1-2A	1.50 - 2.00	7.01	6.31	X	
		CSMB1-3	2.00 - 2.50	7.59	6.97	X	
		CSMB1-3A	2.50 - 3.00	8.02	5.76	M	
3.00 - 4.00	CLAY, pale brown with limestone inclusions at 3.3 mbgl, moderate plasticity, dry.	CSMB1-4	3.00 - 3.50	8.40	7.26	X	
		CSMB1-4A	3.50 - 4.00	8.00	7.45	H	
4.00 - 5.50	Silty CLAY, pale brown with orange mottles, weak to moderate plasticity, moist.	CSMB1-5	4.00 - 4.50	7.92	5.64	L	
		CSMB1-5A	4.50 - 5.00	8.06	5.50	L	
		CSMB1-6	5.00 - 5.50	7.84	7.02	X	
5.50 - 6.00	Clayey SAND, pale grey, fine grained, moist.	CSMB1-6A	5.50 - 6.00	8.14	5.35	L	
6.00 - 8.00	CLAY, mixed red / brown and grey, moderate plasticity, moist.	CSMB1-7	6.00 - 6.50	7.88	5.65	L	
		CSMB1-7A	6.50 - 7.00	7.81	5.52	L	
		CSMB1-8	7.00 - 7.50	7.76	5.45	L	
		CSMB1-8A	7.50 - 8.00	7.80	5.48	L	
8.00 - 9.00	Clayey SAND, grey, fine grained, moist.	CSMB1-9	8.00 - 8.50	7.75	5.60	L	
		CSMB1-9A	8.50 - 9.00	7.55	5.19	L	
9.00 - 9.50	Sandy CLAY, red / brown and grey, moderate plasticity, moist.	CSMB1-10	9.00 - 9.50	7.82	5.31	L	
9.50 - 10.00	Sandy CLAY, grey / brown with orange mottles, weakly cohesive, wet. (gravel traces)	CSMB1-10A	9.50 - 10.00	7.48	5.24	L	
10.00 - 10.50	SAND, pale brown, fine grained, wet.	CSMB1-11	10.00 - 10.50	7.16	5.34	L	
Notes / Comments:				Calibration			
Green shading denotes inferred Potential Acid Sulfate Soil (PASS)				pH 7.0 Cal:	√	L - Low	
Orange shading denotes inferred Actual Acid Sulfate Soil (AASS)				pH 4.0 Cal:	√	M - Medium	
EASTING:	409010	NORTHING:	6484808	pH peroxide:	5.23	H - High	
						X - Extreme	

# POTENTIAL ACID SULFATE SOILS FIELD TESTING LOG

PROJECT NUMBER:		C05054		DATE:		23/03/2005	
SITE NAME:		Midland Brick		WEATHER:		Fine	
SAMPLING AREA:		North of Copley Rd		METHOD:		HSA-SS	
SAMPLING LOCATION ID:		CSMB2		TOTAL DEPTH (m):		~12.85	
SCIENTIST(S):		Troy Webster		DEPTH TO WATER (mbgl):		~ 10.0	
QA/QC SAMPLE IDs:		-		STORAGE:		Zip lock bagged in ice / Esky	
SOIL PROFILE		SAMPLE DATA					
DEPTH (mbgl)	DESCRIPTION ( SOIL TYPE, Colour, Texture)	SAMPLE ID	DEPTH (mbgl)	pH <sub>F</sub>	pH <sub>Fox</sub>	REACTION VIGOUR	
0.00 - 2.00	Silty CLAY, brown, moderate plasticity, dry.	CSMB2-1	0.00 - 0.50	6.09	2.53	M	
		CSMB2-1A	0.50 - 1.00	7.14	4.63	L	
		CSMB2-2	1.00 - 1.50	7.26	5.39	M	
		CSMB2-2A	1.50 - 2.00	7.08	5.10	L	
2.00 - 3.00	CLAY, brown, high plasticity, dry.	CSMB2-3	2.00 - 2.50	7.10	5.30	L	
		CSMB2-3A	2.50 - 3.00	7.46	5.43	L	
3.00 - 5.00	Silty CLAY, pale grey / brown, moderate plasticity, moist.	CSMB2-4	3.00 - 3.50	8.01	5.51	L	
		CSMB2-4A	3.50 - 4.00	7.93	5.40	L	
		CSMB2-5	4.00 - 4.50	7.84	5.40	L	
		CSMB2-5A	4.50 - 5.00	7.82	5.27	L	
5.00 - 6.00	CLAY, brown, moderate to high plasticity, moist.	CSMB2-6	5.00 - 5.50	7.95	5.47	L	
		CSMB2-6A	5.50 - 6.00	7.96	5.49	L	
6.00 - 8.50	CLAY, grey / brown, moderate plasticity, moist.	CSMB2-7	6.00 - 6.50	7.88	5.35	L	
		CSMB2-7A	6.50 - 7.00	7.84	5.41	L	
		CSMB2-8	7.00 - 7.50	7.87	5.32	L	
		CSMB2-8A	7.50 - 8.00	7.84	5.34	L	
		CSMB2-9	8.00 - 8.50	7.95	5.38	L	
8.50 - 9.00	Silty CLAY, grey / brown, moderate plasticity, moist.	CSMB2-9A	8.50 - 9.00	7.89	5.52	L	
9.00 - 10.00	CLAY, grey / brown, moderate to high plasticity, moist.	CSMB2-10	9.00 - 9.50	7.70	5.31	L	
		CSMB2-10A	9.50 - 10.00	7.70	5.50	L	
10.00 - 11.00	CLAY, brown with grey mottles, high plasticity, moist.	CSMB2-11	10.00 - 10.50	7.77	5.31	L	
		CSMB2-11A	10.50 - 11.00	7.81	5.32	L	
11.00 - 12.50	Clayey SAND, pale grey / brown, fine grained, wet.	Not sampled					
Notes / Comments: Green shading denotes inferred Potential Acid Sulfate Soil (PASS) Orange shading denotes inferred Actual Acid Sulfate Soil (AASS)				Calibration pH 7.0 Cal: √ pH 4.0 Cal: √ pH peroxide: 5.23		L - Low M - Medium H - High X - Extreme	
EASTING:	408405	NORTHING:	6484264				

# POTENTIAL ACID SULFATE SOILS FIELD TESTING LOG

PROJECT NUMBER:		C05054		DATE:		23/03/2005	
SITE NAME:		Midland Brick		WEATHER:		Overcast	
SAMPLING AREA:		West side of site.		METHOD:		HSA-SS	
SAMPLING LOCATION ID:		CSMB3		TOTAL DEPTH (m):		~12.5	
SCIENTIST(S):		James Holthouse		DEPTH TO WATER (mbgl):		~ 10.0	
QA/QC SAMPLE IDs:		-		STORAGE:		Zip lock bagged in ice / Esky	
SOIL PROFILE		SAMPLE DATA					
DEPTH (mbgl)	DESCRIPTION ( SOIL TYPE, Colour, Texture)	SAMPLE ID	DEPTH (mbgl)	pH <sub>F</sub>	pH <sub>FOX</sub>	REACTION VIGOUR	
0.00 - 1.40	Silty SAND, grey / brown with red brick fragments, fine to medium grained, dry. (trace grass roots / organics to 0.2 mbgl)	CSMB3-1	0.00 - 0.50	6.41	2.67	L	
		CSMB3-1A	0.50 - 1.00	6.56	3.30	L	
1.40 - 1.50	CLAY, dark brown, high plasticity, dry. (trace organics / peat)	CSMB3-2	1.00 - 1.40	6.54	3.42	M	
1.50 - 1.65	CLAY, brown, high plasticity, dry.	CSMB3-2A	1.50 - 2.00	6.68	5.32	L	
1.65 - 3.00	Silty CLAY, pale grey with yellow mottles, low plasticity, dry.	CSMB3-3	2.00 - 2.50	6.97	5.36	L	
		CSMB3-3A	2.50 - 3.00	6.91	5.19	L	
3.00 - 3.60	Silty CLAY, yellow / orange, low plasticity, dry.	CSMB3-4	3.00 - 3.50	6.99	5.28	L	
3.60 - 4.60	Silty CLAY, grey, low plasticity, dry.	CSMB3-4A	3.50 - 4.00	7.01	5.11	L	
		CSMB3-5	4.00 - 4.50	6.98	5.06	L	
4.60 - 5.00	CLAY, mixed grey and orange / brown, moderate plasticity, moist.	CSMB3-5A	4.50 - 5.00	7.37	5.25	L	
5.00 - 5.40	Sandy CLAY, grey, low plasticity, moist.	CSMB3-6	5.00 - 5.50	7.68	5.43	L	
5.40 - 6.60	Clayey SAND, grey, fine grained, moist.	CSMB3-6A	5.50 - 6.00	7.55	5.17	L	
		CSMB3-7	6.00 - 6.50	7.48	5.20	L	
6.60 - 9.60	CLAY, orange / brown with grey and black mottles, moderate plasticity, moist.	CSMB3-7A	6.50 - 7.00	7.62	7.95	X	
		CSMB3-8	7.00 - 7.50	7.49	5.40	L	
		CSMB3-8A	7.50 - 8.00	7.78	5.47	L	
		CSMB3-9	8.00 - 8.50	7.85	5.64	L	
		CSMB3-9A	8.50 - 9.00	7.98	5.39	L	
		CSMB3-10	9.00 - 9.50	7.76	5.28	L	
9.60 - 10.00	Sandy CLAY, grey with orange mottles, low to moderate plasticity, moist.	CSMB3-10A	9.50 - 10.00	7.70	5.27	L	
10.00 - 11.00	Sandy CLAY, grey / green, low plasticity, moist.	CSMB3-11	10.00 - 10.50	7.68	5.26	L	
		CSMB3-11A	10.50 - 11.00	7.64	5.32	L	
11.00 -12.50	Clayey SAND, pale grey / brown, fine grained, wet.	Not sampled					
Notes / Comments: Green shading denotes inferred Potential Acid Sulfate Soil (PASS) Orange shading denotes inferred Actual Acid Sulfate Soil (AASS)				Calibration		L - Low	
				pH 7.0 Cal:	√	M - Medium	
				pH 4.0 Cal:	√	H - High	
EASTING: 408280				NORTHING: 6484536	pH peroxide:	5.23	X - Extreme

**APPENDIX D**

**CHAIN OF CUSTODY DOCUMENTATION**



## ALS Environmental

### SAMPLE RECEIPT ADVICE (SRA)

#### Comprehensive report

#### Client Details

Client : RPS BOWMAN BISHAW GORHAM  
Contact : MR STEVE MORRISON  
Address : 290 CHURCHILL AVENUE SUBIACO WA  
AUSTRALIA 6008  
  
Project : CO5054  
Order number : - Not provided -  
C-O-C Number : - Not provided -  
Site : Midland  
Sampler : SMW & TW  
  
E-mail : [jsm@bbg.net.au](mailto:jsm@bbg.net.au)  
Telephone : (08)9382-4744  
Facsimile : (08)9382-1177

#### Laboratory Details

Laboratory : ALS Environmental Perth  
Manager : Shaun Crabb  
Address : 10 Hod Way Malaga WA Australia 6090  
  
Quote number : ----  
Work order : EP0500192  
  
E-mail : [Shaun.Crabb@alsenviro.com](mailto:Shaun.Crabb@alsenviro.com)  
Telephone : 61-8-9209-7655  
Facsimile : 61-8-9209-7600

#### Dates

Date Samples Received : 11 Apr 2005  
SRA Issue Date : 20 Apr 2005  
Scheduled Reporting Date : **3 May 2005**

#### Delivery Details

Mode of Delivery	: Carrier.	Temperature	: Frozen
No. of eskies/boxes	: 1 small hard	No. of samples - Received	34
Security Seal	: Not intact.	- Analysed	34

#### Comments

- Samples received in appropriately pretreated and preserved containers.

- When the sampling time is not supplied on the COC documentation, ALSE defaults the sampling time to that of the COC 'relinquishment' time (if supplied). If this also is not supplied, ALSE defaults the sampling time to the 'time of receipt at Laboratory'.

Disclaimer : This document contains privileged and confidential information intended only for the use of the addressee. If you are not the addressee, you are hereby notified that you must not disseminate, copy or take action of its contents. If you have received this document in error, please notify ALS immediately.

SAMPLE RECEIPT ADVICE (SRA) - continued

Client : RPS BOWMAN BISHAW GORHAM  
 Project : CO5054

Work Order : EP0500192  
 ALS Quote Reference : ----



Summary of Sample(s) / Container(s) and Requested Analysis

Some items described below may be packages. A package may contain additional analyses, such as moisture and preparation tasks, that form an implicit part of that package.

ALS Sample ID.	Client Sample ID - Sample Date	Requested Analysis									
		EA026 Chromium Reducible Sulphur	EA029 SPOCAS								
EP0500192-001	CSA1 - 2A - 11 Apr 2005	●	●								
EP0500192-002	CSA1 - 4A - 11 Apr 2005	●	●								
EP0500192-003	CSA1 - 7 - 11 Apr 2005	●	●								
EP0500192-004	CSA2 - 3A - 11 Apr 2005	●	●								
EP0500192-005	CSA2 - 10A - 11 Apr 2005	●	●								
EP0500192-006	CSA3 - 2 - 11 Apr 2005	●	●								
EP0500192-007	CSA3 - 12A - 11 Apr 2005	●	●								
EP0500192-008	CSA3 - 14 - 11 Apr 2005	●	●								
EP0500192-009	CSA4 - 1A - 11 Apr 2005	●	●								
EP0500192-010	CSA4 - 2 - 11 Apr 2005	●	●								
EP0500192-011	CSA6 - 2 - 11 Apr 2005	●	●								
EP0500192-012	CSA6 - 4 - 11 Apr 2005	●	●								
EP0500192-013	CSA6 - 6A - 11 Apr 2005	●	●								
EP0500192-014	CSA6 - 7A - 11 Apr 2005	●	●								
EP0500192-015	CSA6 - 4 - 11 Apr 2005	●	●								
EP0500192-016	CSA6 - 6A - 11 Apr 2005	●	●								
EP0500192-017	CSA8 - 1 - 11 Apr 2005	●	●								
EP0500192-018	CSA8 - 5 - 11 Apr 2005	●	●								
EP0500192-019	CSA8 - 8A - 11 Apr 2005	●	●								
EP0500192-020	CSA9 - 1A - 11 Apr 2005	●	●								
EP0500192-021	CSA9 - 7 - 11 Apr 2005	●	●								
EP0500192-022	CSA9 - 13A - 11 Apr 2005	●	●								
EP0500192-023	CSMB1 - 1 - 11 Apr 2005	●	●								
EP0500192-024	CSMB1 - 1A - 11 Apr 2005	●	●								
EP0500192-025	CSMB1 - 6A - 11 Apr 2005	●	●								
EP0500192-026	CSMB1 - 11 - 11 Apr 2005	●	●								
EP0500192-027	CSMB2 - 1 - 11 Apr 2005	●	●								
EP0500192-028	CSMB2 - 11A - 11 Apr 2005	●	●								
EP0500192-029	CSMB3 - 1 - 11 Apr 2005	●	●								
EP0500192-030	CSMB3 - 2 - 11 Apr 2005	●	●								
EP0500192-031	CSMB3 - 7A - 11 Apr 2005	●	●								
EP0500192-032	CSMB3 - 11A - 11 Apr 2005	●	●								
EP0500192-033	CSA3 - 12A PEAT SAMPLE - 11 Apr 2005	●	●								
EP0500192-034	CSMB3-1A - 18 Apr 2005	●	●								
Total(s) :		34	34								

*SAMPLE RECEIPT ADVICE (SRA) - continued*

Client : RPS BOWMAN BISHAW GORHAM  
Project : CO5054

Work Order : EP0500192  
ALS Quote Reference : ----



*Requested Reports*

● MR STEVE MORRISON		
- Certificate of Analysis (PDF)	Email	jsm@bbg.net.au
- Interpretive Quality Control Report - NEPM	Email	jsm@bbg.net.au
- Quality Control Report - NEPM	Email	jsm@bbg.net.au
- ENMRG Export Format	Email	jsm@bbg.net.au
- Chain of Custody Acknowledgement	Email	jsm@bbg.net.au
- Sample Receipt Advice - Comprehensive	Email	jsm@bbg.net.au
- Invoice	Email	jsm@bbg.net.au

*Sample Container(s) / Preservation Non-Compliance Log*

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- No sample container / preservation non-compliance exist.

CHEMICAL ANALYSIS

**RPS** Bowman Bishaw Gorham  
ENVIRONMENTAL MANAGEMENT CONSULTANTS

CLIENT Midland Bricks  
LOCATION Midland Super Swan  
PROJECT/NUMBER CO2054  
SAMPLED BY SMW + TW  
SAMPLE TYPE Soil  
OTHER ATT: Steve Morrison

290 Churchill Ave Subiaco 6008  
Tel: (618) 9382 4744  
Fax: (618) 9382 1177

SAMPLE ID.	DATE	Storage	SPOCAS SUITE	CRS (ONLY)	Total	REMARKS
CSA1-2A	11/4/05		X	X	1	Plastic Zip lock Bag
-4A			X	X	1	
-7			X	X	1	
CSA2-3A			X	X	1	
-10A			X	X	1	
CSA3-2			X	X	1	
-12A			X	X	1	
-14			X	X	1	
CSA4-1A			X	X	1	
-2			X	X	1	
CSA5-2			X	X	1	
-4			X	X	1	
-5A			X	X	1	
-7A			X	X	1	
CSA6-4			X	X	1	
-6A			X	X	1	
Total Number of Containers						

Relinquished by Shane Miller - White Organisation RPS - BGC  
Date 11/4/05 Time \_\_\_\_\_

Relinquished by Steve Morrison Organisation RPS - BGC  
Date 18/4/05 Time 15.40

Received by M. Vinci Organisation ALSE  
Date 11-14-05 Time 12.15 am

Received by \_\_\_\_\_ Organisation \_\_\_\_\_  
Date \_\_\_\_\_ Time \_\_\_\_\_

CLIENT Midland Brick  
 LOCATION Midland Upper Swan  
 PROJECT/NUMBER CS054  
 SAMPLED BY SHW + TW  
 SAMPLE TYPE Soil  
 OTHER A# : Steve Morrison

CHEMICAL ANALYSIS

**RPS** Bowman Bishaw Gorham  
 ENVIRONMENTAL MANAGEMENT CONSULTANTS

290 Churchill Ave Subiaco 6006  
 Tel: (618) 9382 4744  
 Fax: (618) 9382 1177

SAMPLE ID.	DATE	Storage	SPOCAS SUITE	CRS (ONLY)	Total Number of Containers	Total	REMARKS
CSA8-1	11/4/05		X	X	1	1	Plastic Zip lock Bag
-5			X	X	1	1	
-8A			X	X	1	1	
CSA9-1A			X	X	1	1	
-7			X	X	1	1	
-13A			X	X	1	1	
CSM1-1			X	X	1	1	
-1A			X	X	1	1	
-6A			X	X	1	1	
-11			X	X	1	1	
CSM2-1			X	X	1	1	
-11A			X	X	1	1	
CSM3-1			X	X	1	1	
-2			X	X	1	1	
-7A			X	X	1	1	
-11A			X	X	1	1	
CSA3-12A			X	X	1	1	

PEAT SAMPLE (extra sample) \* Also analyse CSM3-1A for SPOCAS suite & CRS only  
 Relinquished by Steve Miller-White Organisation RPS - BBG  
 Date 11/4/05 Time 15:40  
 Received by Steve Morris Organisation RPS - PBB  
 Date 18/4/05 Time 15:40

Received by M. Vind Organisation ALSE  
 Date 11-4-05 Time 12:15pm

CHEMICAL ANALYSIS

290 Churchill Ave Subiaco 6008  
Tel: (618) 9382 4744  
Fax: (618) 9382 1177

CLIENT Midland Brick  
LOCATION Midland Upper Swan  
PROJECT NUMBER C05054  
SAMPLED BY SAW + TW  
SAMPLE TYPE Soil  
OTHER ATT: Steve Morrison

SAMPLE ID.	DATE	Storage	Total	REMARKS
① CSA1 - 2A	11/4/05	x	1	Plastic Zip lock Bag
② - 4A		x	1	
③ - 7		x	1	
④ CSA2 - 3A		x	1	
⑤ - 10A		x	1	
⑥ CSA3 - 2		x	1	ALS Environmental Perth Work Order EP0500192
⑦ - 12A		x	1	
⑧ - 14		x	1	
⑨ CSA4 - 1A		x	1	Report Version: August 2001 1.07 Telephone : 61-8-9209-7655
⑩ - 2		x	1	
⑪ CSA5 - 2		x	1	
⑫ - 4		x	1	
⑬ - 5A		x	1	
⑭ - 7A		x	1	
⑮ CSA6 - 4		x	1	↓
⑯ - 6A		x	1	
Total Number of Containers				

Relinquished by Shae Miller-White Organisation RPS - BRC  
Date 11/4/05 Time \_\_\_\_\_

Received by M. Vinci Organisation ALSE  
Date 11-4-05 Time 12:15 am

Relinquished by \_\_\_\_\_ Organisation \_\_\_\_\_  
Date \_\_\_\_\_ Time \_\_\_\_\_

Received by \_\_\_\_\_ Organisation \_\_\_\_\_  
Date \_\_\_\_\_ Time \_\_\_\_\_

CHEMICAL ANALYSIS

290 Churchill Ave Subiaco 6008  
Tel: (618) 9382 4744  
Fax: (618) 9382 1177

CLIENT Midland Brick  
LOCATION Midland Upper Swan  
PROJECTNUMBER CS054  
SAMPLED BY SMW + TW  
SAMPLE TYPE Soil  
OTHER ATT: Steve Morrison

SAMPLE ID.	DATE	Storage	Total	REMARKS
CSA8-1	11/4/05	X	1	Plastic 2-p 10Lx Bag
-5		X	1	
-8A		X	1	
CSAA-1A		X	1	
-7		X	1	
-13A		X	1	
CSMB1-1		X	1	
-1A		X	1	
-6A		X	1	
-11		X	1	
CSMB2-1		X	1	
-11A		X	1	
CSMB3-1		X	1	
-2		X	1	
-7A		X	1	
-11A		X	1	
CSA3-12A		X	1	
PEAT SAMPLE (extra sample)				
Total Number of Containers				

Relinquished by Shee Miller-White Organisation RPS - BSC  
Date 11/4/05 Time \_\_\_\_\_

Received by M. Vinci Organisation ALSE  
Date 11/4/05 Time 12:15pm

Relinquished by \_\_\_\_\_ Organisation \_\_\_\_\_  
Date \_\_\_\_\_ Time \_\_\_\_\_

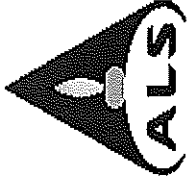
Received by \_\_\_\_\_ Organisation \_\_\_\_\_  
Date \_\_\_\_\_ Time \_\_\_\_\_

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- 31
- 32
- 33



**APPENDIX E**

**LABORATORY SPOCAS & CRS CERTIFICATES**

**CERTIFICATE OF ANALYSIS**

Client : RPS BOWMAN BISHAW GORHAM  
 Contact : MR STEVE MORRISON  
 Address : 290 CHURCHILL AVENUE SUBIACO WA  
 AUSTRALIA 6008

Laboratory : ALS Environmental Perth  
 Contact : Shaun Crabb  
 Address : 10 Hod Way Malaga WA Australia 6090

Page : 1 of 16

Work order : EP0500192

Amendment No. : 1

Date received : 11 Apr 2005

Date issued : 17 May 2005

Quote number : —

Project : CO5054  
 Order number : - Not provided -  
 C-O-C number : - Not provided -  
 Site : Midland  
 E-mail : jsm@bbg.net.au  
 Telephone : (08)9382-4744  
 Facsimile : (08)9382-1177

E-mail : Shaun.Crabb@alsenviro.com  
 Telephone : 61-8-9209-7655  
 Facsimile : 61-8-9209-7600

No. of samples  
 Received : 34  
 Analysed : 34

This final report for the ALSE work order reference EP0500192 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 control limits

ALSE - QUALITY, SERVICE and TECHNOLOGY provided GLOBALLY

NATA Accredited Laboratory - 825



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

Accredited for compliance with ISO/IEC 17025.

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

Signatory  
 Shaun Crabb

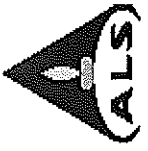
Department  
 Perth Inorganics - NATA 15847 (Perth)



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 insufficient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-Q/W/EN38 (in the absence of specified USEPA limits).  
Abbreviations: CAS number = Chemical Abstract Services number, LOR = Limit of Reporting, # Indicates a raised LOR, \* Indicates failed Surrogate Recoveries.  
When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes.

### Analytical Results

Analyze	CAS number	Client Sample ID :			
		CSA1 - 2A	CSA1 - 4A	CSA1 - 7	CSA2 - 3A
Sample Matrix Type / Description		SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
Sample Date / Time		11 Apr 2005	11 Apr 2005	11 Apr 2005	11 Apr 2005
Laboratory Sample ID :		EP0500192-001	EP0500192-002	EP0500192-003	EP0500192-004
LOR	Units				
EA026 : Chromium Reducible Sulphur		<0.02	<0.02	<0.02	<0.02
Chromium Reducible Sulphur	%				
EA029-A: pH Measurements					
pH KCl (23A)	0.1	5.8	6.4	6.0	6.0
pH OX (23B)	0.1	6.7	7.0	5.5	6.5
EA029-B: Acidity Trail					
Titratable Actual Acidity (23F)	2	6	<2	2	5
Titratable Peroxide Acidity (23G)	2	18	18	<2	<2
Titratable Sulfidic Acidity (23H)	2	11	16	<2	<2
sulfidic - Titratable Actual Acidity (s-23F)	0.02	<0.02	<0.02	<0.02	<0.02
sulfidic - Titratable Peroxide Acidity (s-23G)	0.02	0.03	0.03	<0.02	<0.02
sulfidic - Titratable Sulfidic Acidity (s-23H)	0.02	<0.02	0.03	<0.02	<0.02
EA029-C: Sulfur Trail					
KCl Extractable Sulfur (23Ce)	0.02	<0.02	<0.02	<0.02	0.03
Peroxide Sulfur (23De)	0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Oxidisable Sulfur (23E)	0.02	<0.02	<0.02	<0.02	<0.02
Acidity - Peroxide Oxidisable Sulfur (a-23E)	10	<10	<10	<10	<10
EA029-D: Calcium Values					
KCl Extractable Calcium (23Vh)	0.02	0.44	0.47	0.06	0.44
Peroxide Calcium (23Mh)	0.02	0.22	0.23	0.04	0.22
Acid Reacted Calcium (23X)	0.02	<0.02	<0.02	<0.02	<0.02
Acidity - Acid Reacted Calcium (a-23X)	10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	0.02	<0.02	<0.02	<0.02	<0.02
EA029-E: Magnesium Values					
KCl Extractable Magnesium (23Sm)	0.02	0.26	0.24	0.03	0.23
Peroxide Magnesium (23Tm)	0.02	0.13	0.13	<0.02	0.12
Acid Reacted Magnesium (23U)	0.02	<0.02	<0.02	<0.02	<0.02



Client : RPS BOWMAN BISHAW GORHAM  
 Project : CO5054

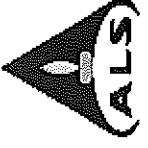
Work Order : EP0500192  
 ALS Quote Reference : —

Page Number : 3 of 16  
 Issue Date : 17 May 2005

ALS Environmental

### Analytical Results

Analyte	CAS number	Client Sample ID	Sample Matrix Type / Description			
			CSA1 - 2A	CSA1 - 4A	CSA1 - 7	CSA2 - 3A
Laboratory Sample ID		SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	
LOR		11 Apr 2005 12:00	11 Apr 2005 12:00	11 Apr 2005 12:00	11 Apr 2005 12:00	
Units		EP0500192-001	EP0500192-002	EP0500192-003	EP0500192-004	
<b>EA029-E: Magnesium Values</b>						
Acidity - Acid Reacted Magnesium (a-23U)	10	mole H+ / t	<10	<10	<10	
sulfidic - Acid Reacted Magnesium (s-23U)	0.02	% S	<0.02	<0.02	<0.02	
<b>EA029-F: Excess Acid Neutralising Capacity</b>						
Excess Acid Neutralising Capacity (23Q)	0.02	% CaCO3	0.15	0.28	—	
Acidity - Excess Acid Neutralising Capacity (a-23Q)	10	mole H+ / t	30	56	—	
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	0.02	% S	0.05	0.09	—	
<b>EA029-H: Acid Base Accounting</b>						
ANC Fineness Factor	0.5		1.5	1.5	1.5	
Net Acidity (sulfur units)	0.02	% S	<0.02	<0.02	<0.02	
Net Acidity (acidity units)	10	mole H+ / t	<10	<10	<10	
Liming Rate	1	kg CaCO3/t	<1	<1	<1	
					CSA2 - 10A	
					SOIL / SOIL	
					11 Apr 2005	
					12:00	
					EP0500192-005	



Client : RPS BOWMAN BISHAW GORHAM  
 Project : CO5054

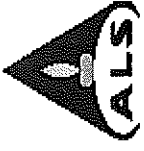
Work Order : EP0500192  
 ALS Quote Reference : —

Page Number : 4 of 16  
 Issue Date : 17 May 2005

ALS Environmental

## Analytical Results

Analyte	CAS number	Client Sample ID	Sample Matrix Type / Description / Sample Date / Time	Cifent Sample ID			
				CSA3 - 2	CSA3 - 12A	CSA3 - 14	CSA4 - 1A
Laboratory Sample ID	Units	EP0500192-006	EP0500192-007	EP0500192-008	EP0500192-009	EP0500192-010	
<b>EA026 : Chromium Reducible Sulphur</b>							
Chromium Reducible Sulphur		0.02	%	<0.02	<0.02	<0.02	<0.02
<b>EA029-A: pH Measurements</b>							
pH KCl (23A)		0.1	pH Unit	6.2	6.2	6.2	6.1
pH OX (23B)		0.1	pH Unit	7.2	6.4	6.3	6.9
<b>EA029-B: Acidity Trail</b>							
Titratable Actual Acidity (23F)	2	mole H+ / t	4	2	2	2	9
Titratable Peroxide Acidity (23G)	2	mole H+ / t	15	<2	<2	<2	2
Titratable Sulfidic Acidity (23H)	2	mole H+ / t	11	<2	<2	<2	<2
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	0.02	<0.02	<0.02	<0.02	0.13
sulfidic - Titratable Sulfidic Acidity (s-23H)	0.02	% pyrite S	<0.02	<0.02	<0.02	<0.02	0.12
<b>EA029-C: Sulfur Trail</b>							
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	<0.02	<0.02
Peroxide Oxidisable Sulfur (23E)	0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02
Acidity - Peroxide Oxidisable Sulfur (a-23E)	10	mole H+ / t	<10	<10	<10	<10	<10
<b>EA029-D: Calcium Values</b>							
KCl Extractable Calcium (23Vh)	0.02	% Ca	0.43	0.24	0.20	0.18	0.29
Peroxide Calcium (23Vh)	0.02	% Ca	0.21	0.15	0.14	0.10	0.15
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
<b>EA029-E: Magnesium Values</b>							
KCl Extractable Magnesium (23Sm)	0.02	% Mg	0.27	0.09	0.07	0.16	0.24
Peroxide Magnesium (23Tm)	0.02	% Mg	0.14	0.06	0.04	0.09	0.13
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



Client : RPS BOWMAN BISHAW GORHAM  
 Project : CO5054

Work Order : EP0500192  
 ALS Quote Reference : —

Page Number : 5 of 16  
 Issue Date : 17 May 2005

ALS Environmental

Analyte	CAS number	LOR	Units	Client Sample ID :	CSA3 - 2	CSA3 - 12A	CSA3 - 14	CSA4 - 1A	CSA4 - 2
<b>Analytical Results</b> Sample Matrix Type / Description : SOIL / SOIL Sample Date / Time : 11 Apr 2005 12:00 Laboratory Sample ID : EP0500192-006									
<b>EA029-F: Excess Acid Neutralising Capacity</b>									
Excess Acid Neutralising Capacity (23Q)		0.02	% CaCO3		0.11	---	---	0.29	<0.02
Acidity - Excess Acid Neutralising Capacity (a-23Q)		10	mole H+ / t		21	---	---	59	<10
sulfidic - Excess Acid Neutralising Capacity (s-23Q)		0.02	% S		0.03	---	---	0.09	<0.02
<b>EA029-H: Acid Base Accounting</b>									
ANC Fineness Factor		0.5			1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)		0.02	% S		<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)		10	mole H+ / t		<10	<10	<10	<10	<10
Limiting Rate		1	Kg CaCO3/t		<1	<1	<1	<1	<1



Client : RPS BOWMAN BISHAW GORHAM  
 Project : CO5054

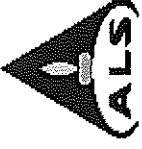
Work Order : EPO500192  
 ALS Quote Reference : ---

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## Analytical Results

Analyte	CAS number	Client Sample ID :				Units	Sample Matrix Type / Description / Sample Date / Time	Laboratory Sample ID :
		CSA5 - 2	CSA5 - 4	CSA5 - 5A	CSA5 - 7A			
<b>EA026 : Chromium Reducible Sulphur</b>								
Chromium Reducible Sulphur		0.02	<0.02	<0.02	<0.02	%	EP0500192-011	
<b>EA029-A: pH Measurements</b>								
pH KCl (23A)		0.1	5.7	6.3	6.6	pH Unit	EP0500192-014	
pH OX (23B)		0.1	6.7	7.6	6.1	pH Unit	EP0500192-015	
<b>EA029-B: Acidity Trail</b>								
Titratable Actual Acidity (23F)		2	4	<2	<2	mole H+ / t	4	
Titratable Peroxide Acidity (23G)		2	<2	27	<2	mole H+ / t	<2	
Titratable Sulfidic Acidity (23H)		2	<2	25	<2	mole H+ / t	<2	
sulfidic - Titratable Actual Acidity (s-23F)		0.02	<0.02	<0.02	<0.02	% pyrite S	<0.02	
sulfidic - Titratable Peroxide Acidity (s-23G)		0.02	<0.02	0.04	<0.02	% pyrite S	<0.02	
sulfidic - Titratable Sulfidic Acidity (s-23H)		0.02	<0.02	0.04	<0.02	% pyrite S	<0.02	
<b>EA029-C: Sulfur Trail</b>								
KCl Extractable Sulfur (23Ce)		0.02	<0.02	<0.02	<0.02	% S	<0.02	
Peroxide Sulfur (23De)		0.02	<0.02	<0.02	<0.02	% S	<0.02	
Peroxide Oxidisable Sulfur (23E)		0.02	<0.02	<0.02	<0.02	% S	<0.02	
Acidity - Peroxide Oxidisable Sulfur (a-23E)		10	<10	<10	<10	mole H+ / t	<10	
<b>EA029-D: Calcium Values</b>								
KCl Extractable Calcium (23Vh)		0.02	0.27	0.19	0.07	% Ca	0.04	
Peroxide Calcium (23Vh)		0.02	0.12	0.10	0.04	% Ca	0.02	
Acid Reacted Calcium (23X)		0.02	<0.02	<0.02	<0.02	% Ca	<0.02	
Acidity - Acid Reacted Calcium (a-23X)		10	<10	<10	<10	mole H+ / t	<10	
sulfidic - Acid Reacted Calcium (s-23X)		0.02	<0.02	<0.02	<0.02	% S	<0.02	
<b>EA029-E: Magnesium Values</b>								
KCl Extractable Magnesium (23Sm)		0.02	0.22	0.09	<0.02	% Mg	0.07	
Peroxide Magnesium (23Tm)		0.02	0.10	0.05	<0.02	% Mg	0.04	
Acid Reacted Magnesium (23U)		0.02	<0.02	<0.02	<0.02	% Mg	<0.02	
Acidity - Acid Reacted Magnesium (a-23U)		10	<10	<10	<10	mole H+ / t	<10	
sulfidic - Acid Reacted Magnesium (s-23U)		0.02	<0.02	<0.02	<0.02	% S	<0.02	



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### Analytical Results

Analyte	CAS number	LOR	Client Sample ID :						
			SOIL / SOIL 11 Apr 2005 12:00	CSA5 - 4 SOIL / SOIL 11 Apr 2005 12:00	CSA5 - 5A SOIL / SOIL 11 Apr 2005 12:00	CSA5 - 7A SOIL / SOIL 11 Apr 2005 12:00	CSA6 - 4 SOIL / SOIL 11 Apr 2005 12:00		
Sample Matrix Type / Description :	EP0500192-011					EP0500192-012	EP0500192-013	EP0500192-014	EP0500192-015
Sample Date / Time :	11 Apr 2005 12:00					11 Apr 2005 12:00	11 Apr 2005 12:00	11 Apr 2005 12:00	11 Apr 2005 12:00
Laboratory Sample ID :	EP0500192-011					EP0500192-012	EP0500192-013	EP0500192-014	EP0500192-015
Units	Units					Units	Units	Units	Units
<b>EA029-F: Excess Acid Neutralising Capacity</b>									
Excess Acid Neutralising Capacity (23Q)		0.02	% CaCO3	0.09	—	0.17	—	—	—
Acidity - Excess Acid Neutralising Capacity (a-23Q)		10	mole H+ / t	19	—	34	—	—	—
sulfidic - Excess Acid Neutralising Capacity (s-23Q)		0.02	% S	0.03	—	0.06	—	—	—
<b>EA029-H: Acid Base Accounting</b>									
ANC Fineness Factor		0.5		1.5	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Net Acidity (acidity units)		10	mole H+ / t	<10	<10	<10	<10	<10	<10
Limiting Rate		1	kg CaCO3/t	<1	<1	<1	<1	<1	<1



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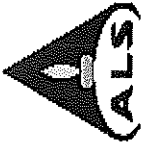
Work Order : EP0500192  
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## Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID :	CSA6 - 6A	CSA8 - 1	CSA8 - 5	CSA8 - 8A	CSA9 - 1A
				Sample Matrix Type / Description :	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
				Sample Date / Time :	11 Apr 2005	11 Apr 2005	11 Apr 2005	11 Apr 2005	11 Apr 2005
				Laboratory Sample ID :	EP0500192-016	EP0500192-017	EP0500192-018	EP0500192-019	EP0500192-020
				Units					
<b>EA026 : Chromium Reducible Sulphur</b>									
Chromium Reducible Sulphur		0.02	%		<0.02	<0.02	<0.02	<0.02	<0.02
<b>EA029-A: pH Measurements</b>									
pH KCl (23A)		0.1	pH Unit		6.9	5.8	6.3	6.6	5.5
pH OX (23B)		0.1	pH Unit		6.2	7.2	6.8	6.8	6.9
<b>EA029-B: Acidity Trail</b>									
Titratable Actual Acidity (23F)		2	mole H+ / t		<2	6	<2	<2	8
Titratable Peroxide Acidity (23G)		2	mole H+ / t		<2	5	18	6	5
Titratable Sulfidic Acidity (23H)		2	mole H+ / t		<2	<2	16	6	<2
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		<0.02	<0.02	0.03	<0.02	<0.02
sulfidic - Titratable Sulfidic Acidity (s-23H)		0.02	% pyrite S		<0.02	<0.02	0.03	<0.02	<0.02
<b>EA029-C: Sulfur Trail</b>									
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	<0.02	<0.02
Peroxide Oxidisable Sulfur (23E)		0.02	% S		<0.02	<0.02	<0.02	<0.02	<0.02
Acidity - Peroxide Oxidisable Sulfur (a-23E)		10	mole H+ / t		<10	<10	<10	<10	<10
<b>EA029-D: Calcium Values</b>									
KCl Extractable Calcium (23Vh)		0.02	% Ca		<0.02	0.28	0.44	0.29	0.21
Peroxide Calcium (23Wh)		0.02	% Ca		<0.02	0.14	0.25	0.16	0.12
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
<b>EA029-E: Magnesium Values</b>									
KCl Extractable Magnesium (23Sm)		0.02	% Mg		0.02	0.23	0.14	0.11	0.16
Peroxide Magnesium (23Tm)		0.02	% Mg		<0.02	0.11	0.09	0.06	0.09
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



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### Analytical Results

Analyte	CAS number	LOR	Client Sample ID :						
			CSA6 - 6A	CSA8 - 1	CSA8 - 5	CSA8 - 8A	CSA9 - 1A		
Sample Matrix Type / Description :		Sample Date / Time :		Sample Date / Time :		Sample Date / Time :		Sample Date / Time :	
Laboratory Sample ID :		Laboratory Sample ID :		Laboratory Sample ID :		Laboratory Sample ID :		Laboratory Sample ID :	
Units		Units		Units		Units		Units	
<b>EA029-F: Excess Acid Neutralising Capacity</b>									
Excess Acid Neutralising Capacity (23Q)		0.02	% CaCO3	---	0.53	0.16	0.09	0.10	
Acidity - Excess Acid Neutralising Capacity (a-23Q)		10	mole H+ / t	---	105	31	18	19	
sulfidic - Excess Acid Neutralising Capacity (s-23Q)		0.02	% S	---	0.17	0.05	0.03	0.03	
<b>EA029-H: Acid Base Accounting</b>									
ANC Fineness Factor		0.5		1.5	1.5	1.5	1.5	1.5	
Net Acidity (sulfur units)		0.02	% S	<0.02	<0.02	<0.02	<0.02	<0.02	
Net Acidity (acidity units)		10	mole H+ / t	<10	<10	<10	<10	<10	
Limiting Rate		1	kg CaCO3/t	<1	<1	<1	<1	<1	



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## Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID :	CSA9 - 7	CSA9 - 13A	CSMB1 - 1	CSMB1 - 1A	CSMB1 - 6A
				Sample Matrix Type / Description :	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL	SOIL / SOIL
				Sample Date / Time :	11 Apr 2005	11 Apr 2005	11 Apr 2005	11 Apr 2005	11 Apr 2005
				Laboratory Sample ID :	EP0500192-021	EP0500192-022	EP0500192-023	EP0500192-024	EP0500192-025
<b>EA026 : Chromium Reducible Sulphur</b>									
Chromium Reducible Sulphur		0.02	%		<0.02	<0.02	<0.02	<0.02	<0.02
<b>EA029-A: pH Measurements</b>									
pH KCl (23A)		0.1	pH Unit		6.4	6.3	5.2	5.4	6.6
pH OX (23B)		0.1	pH Unit		6.8	6.1	4.8	6.0	7.0
<b>EA029-B: Acidity Trail</b>									
Titratable Actual Acidity (23F)		2	mole H+ / t		<2	<2	16	10	<2
Titratable Peroxide Acidity (23G)		2	mole H+ / t		4	<2	<2	<2	18
Titratable Sulfidic Acidity (23H)		2	mole H+ / t		4	<2	<2	<2	18
sulfidic - Titratable Actual Acidity (s-23F)		0.02	% pyrite S		<0.02	<0.02	0.03	<0.02	<0.02
sulfidic - Titratable Peroxide Acidity (s-23G)		0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	0.03
sulfidic - Titratable Sulfidic Acidity (s-23H)		0.02	% pyrite S		<0.02	<0.02	<0.02	<0.02	0.03
<b>EA029-C: Sulfur Trail</b>									
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	<0.02	<0.02
Peroxide Oxidisable Sulfur (23E)		0.02	% S		<0.02	<0.02	<0.02	<0.02	<0.02
Acidity - Peroxide Oxidisable Sulfur (a-23E)		10	mole H+ / t		<10	<10	11	<10	<10
<b>EA029-D: Calcium Values</b>									
KCl Extractable Calcium (23Vh)		0.02	% Ca		0.48	0.51	0.18	0.23	0.15
Peroxide Calcium (23Wh)		0.02	% Ca		0.23	0.04	0.12	0.13	0.09
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
<b>EA029-E: Magnesium Values</b>									
KCl Extractable Magnesium (23Sm)		0.02	% Mg		0.14	0.02	0.12	0.18	0.06
Peroxide Magnesium (23Tm)		0.02	% Mg		0.07	<0.02	0.07	0.09	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



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## Analytical Results

Analyte	CAS number	LOR	Client Sample ID :			
			CSA9 - 7	CSA9 - 13A	CSMB1 - 1	CSMB1 - 1A
Sample Matrix Type / Description :	SOIL / SOIL					
Sample Date / Time :	11 Apr 2005 12:00					
Laboratory Sample ID :	EP0500192-021					
Units						
EA029-F: Excess Acid Neutralising Capacity		0.02	0.16	—	—	0.09
Excess Acid Neutralising Capacity (23Q)						
Acidity - Excess Acid Neutralising Capacity (a-23Q)	10	mole H+ / t	33	—	—	19
sulfidic - Excess Acid Neutralising Capacity (s-23Q)	0.02	% S	0.05	—	—	0.03
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	<0.02	<0.02	0.04	<0.02
Net Acidity (acidity units)	10	mole H+ / t	<10	<10	27	11
Limiting Rate	1	kg CaCO3/t	<1	<1	2	<1



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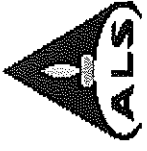
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### Analytical Results

Analyte	CAS number	Client Sample ID :				Units	CSMB3 - 2
		CSMB1 - 11	CSMB2 - 1	CSMB2 - 11A	CSMB3 - 1		
Sample Matrix Type / Description :		SOIL / SOIL		SOIL / SOIL		SOIL / SOIL	
Laboratory Sample ID :		EP0500192-026		EP0500192-027		EP0500192-029	
Sample Date / Time :		11 Apr 2005 12:00		11 Apr 2005 12:00		11 Apr 2005 12:00	
<b>EA026 : Chromium Reducible Sulphur</b>							
Chromium Reducible Sulphur	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
<b>EA029-A: pH Measurements</b>							
pH KCl (23A)	0.1	6.4	5.0	5.9	5.7	5.9	5.9
pH OX (23B)	0.1	6.3	5.0	6.6	4.4	6.8	6.8
<b>EA029-B: Acidity Trail</b>							
Titratable Actual Acidity (23F)	2	<2	20	4	4	11	11
Titratable Peroxide Acidity (23G)	2	<2	<2	<2	<2	20	20
Titratable Sulfidic Acidity (23H)	2	<2	<2	<2	<2	9	9
sulfidic - Titratable Actual Acidity (s-23F)	0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02
sulfidic - Titratable Peroxide Acidity (s-23G)	0.02	<0.02	<0.02	<0.02	<0.02	0.03	0.03
sulfidic - Titratable Sulfidic Acidity (s-23H)	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
<b>EA029-C: Sulfur Trail</b>							
KCl Extractable Sulfur (23Ce)	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Sulfur (23De)	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Peroxide Oxidisable Sulfur (23E)	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acidity - Peroxide Oxidisable Sulfur (a-23E)	10	<10	<10	<10	<10	<10	<10
<b>EA029-D: Calcium Values</b>							
KCl Extractable Calcium (23Vh)	0.02	0.06	0.20	0.23	0.06	0.24	0.24
Peroxide Calcium (23Wh)	0.02	0.04	0.14	0.14	0.05	0.13	0.13
Acid Reacted Calcium (23X)	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acidity - Acid Reacted Calcium (a-23X)	10	<10	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Calcium (s-23X)	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
<b>EA029-E: Magnesium Values</b>							
KCl Extractable Magnesium (23Sm)	0.02	0.03	0.14	0.14	0.03	0.23	0.23
Peroxide Magnesium (23Tm)	0.02	<0.02	0.09	0.09	0.02	0.11	0.11
Acid Reacted Magnesium (23U)	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acidity - Acid Reacted Magnesium (a-23U)	10	<10	<10	<10	<10	<10	<10
sulfidic - Acid Reacted Magnesium (s-23U)	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02



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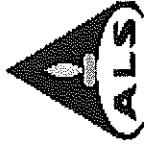
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Analyte	CAS number	LOR	Units	Client Sample ID :			
				CSMB1 - 11	CSMB2 - 1	CSMB2 - 11A	CSMB3 - 1
Sample Matrix Type / Description :							CSMB3 - 2
Sample Date / Time :							SOIL / SOIL 11 Apr 2005 12:00
Laboratory Sample ID :							EP0500192-029
EA029-F: Excess Acid Neutralising Capacity							EP0500192-028
Excess Acid Neutralising Capacity (23Q)		0.02	% CaCO3	---	<0.02	<0.02	0.14
Acidity - Excess Acid Neutralising Capacity (a-23Q)		10	mole H+ / t	---	<10	<10	28
sulfidic - Excess Acid Neutralising Capacity (s-23Q)		0.02	% S	---	<0.02	<0.02	0.04
EA029-H: Acid Base Accounting							EP0500192-027
ANC Fineness Factor		0.5		1.5	1.5	1.5	1.5
Net Acidity (sulfur units)		0.02	% S	<0.02	0.04	<0.02	<0.02
Net Acidity (acidity units)		10	mole H+ / t	<10	25	<10	14
Limiting Rate		1	kg CaCO3/t	<1	2	<1	<1



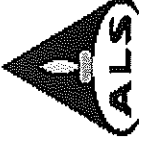
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Analyte	CAS number	Client Sample ID :				Units
		CSMB3 - 7A	CSMB3 - 11A	CSA3 - 12A PEAT SAMPLE	CSMB3-1A	
Sample Matrix Type / Description :						
SOIL / SOIL						
Sample Date / Time :						
11 Apr 2005						
Laboratory Sample ID :						
EP0500192-031						
LOR						
EA026 : Chromium Reducible Sulphur		<0.02	<0.02	<0.02	<0.02	%
Chromium Reducible Sulphur						
EA029-A: pH Measurements						
pH KCl (23A)	0.1	6.3	6.2	5.8	5.6	pH Unit
pH OX (23B)	0.1	7.0	6.2	6.0	6.2	pH Unit
EA029-B: Acidity Trail						
Titratable Actual Acidity (23F)	2	<2	<2	5	8	mole H+ / t
Titratable Peroxide Acidity (23G)	2	20	<2	<2	<2	mole H+ / t
Titratable Sulfidic Acidity (23H)	2	19	<2	<2	<2	mole H+ / t
sulfidic - Titratable Actual Acidity (s-23F)	0.02	<0.02	<0.02	<0.02	<0.02	% pyrite S
sulfidic - Titratable Peroxide Acidity (s-23G)	0.02	0.03	<0.02	<0.02	<0.02	% pyrite S
sulfidic - Titratable Sulfidic Acidity (s-23H)	0.02	0.03	<0.02	<0.02	<0.02	% pyrite S
EA029-C: Sulfur Trail						
KCl Extractable Sulfur (23Ce)	0.02	<0.02	<0.02	<0.02	<0.02	% S
Peroxide Sulfur (23De)	0.02	<0.02	<0.02	<0.02	<0.02	% S
Peroxide Oxidisable Sulfur (23E)	0.02	<0.02	<0.02	<0.02	<0.02	% S
Acidity - Peroxide Oxidisable Sulfur (a-23E)	10	<10	<10	<10	<10	mole H+ / t
EA029-D: Calcium Values						
KCl Extractable Calcium (23Vh)	0.02	0.24	0.24	0.23	0.22	% Ca
Peroxide Calcium (23Wh)	0.02	0.11	0.06	0.17	0.10	% Ca
Acid Reacted Calcium (23X)	0.02	<0.02	<0.02	<0.02	<0.02	% Ca
Acidity - Acid Reacted Calcium (a-23X)	10	<10	<10	<10	<10	mole H+ / t
sulfidic - Acid Reacted Calcium (s-23X)	0.02	<0.02	<0.02	<0.02	<0.02	% S
EA029-E: Magnesium Values						
KCl Extractable Magnesium (23Sm)	0.02	0.05	0.05	0.17	0.10	% Mg
Peroxide Magnesium (23Tm)	0.02	0.03	<0.02	0.07	0.07	% Mg
Acid Reacted Magnesium (23U)	0.02	<0.02	<0.02	<0.02	<0.02	% Mg
Acidity - Acid Reacted Magnesium (a-23U)	10	<10	<10	<10	<10	mole H+ / t
sulfidic - Acid Reacted Magnesium (s-23U)	0.02	<0.02	<0.02	<0.02	<0.02	% S



Client : RPS BOWMAN BISHAW GORHAM  
 Project : CO5054

Work Order : EP0500192  
 ALS Quote Reference : ---

Page Number : 15 of 16  
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ALS Environmental

Analyte	CAS number	Client Sample ID :	
		LOR	Units
<b>EA029-F: Excess Acid Neutralising Capacity</b>			
Excess Acid Neutralising Capacity (23Q)		0.02	% CaCO3
Acidity - Excess Acid Neutralising Capacity (a-23Q)		10	mole H+ / t
sulfidic - Excess Acid Neutralising Capacity (s-23Q)		0.02	% S
<b>EA029-H: Acid Base Accounting</b>			
ANC Fineness Factor		0.5	1.5
Net Acidity (sulfur units)		0.02	<0.02
Net Acidity (acidity units)		10	mole H+ / t
Limiting Rate		1	kg CaCO3/t

Sample Matrix Type / Description / Sample Date / Time	CSMB3 - 7A	CSMB3 - 11A	CSA3 - 12A PEAT SAMPLE	CSMB3-1A
SOIL / SOIL 11 Apr 2005 12:00	SOIL / SOIL 11 Apr 2005 12:00	SOIL / SOIL 11 Apr 2005 12:00	SOIL / SOIL 11 Apr 2005 12:00	SOIL / SOIL ( 18 Apr 2005 ) ( 15:00 )
Laboratory Sample ID :	EP0500192-031	EP0500192-032	EP0500192-033	EP0500192-034

**Analytical Results**



Client : RPS BOWMAN BISHAW GORHAM  
Project : C05054

Work Order : EP0500192  
ALS Quote Reference : —

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ALS Environmental

### Surrogate Control Limits

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure 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.

- No surrogates present on this report.

**APPENDIX F**

**GROUNDWATER BORE CONSTRUCTION LOGS**

**BOREHOLE NUMBER:** CSMB1

290 Churchill Avenue  
 Subiaco W.A. 6008  
 Ph: 9382 4744 Fax: 9382 1177  
 Email: info@bbg.net.au

**PROJECT NUMBER:** C05054

**LOCATION:** Midland Bricks

**DRILLING COMPANY:** Pro-line

**TOTAL DEPTH:** 13.00mbgl

**DRILLING METHOD:** Hollow Stem Auger

**GROUND SURFACE ELEVATION:**

**WEATHER:** Fine / Hot

**SHEET:** 1 OF: 1

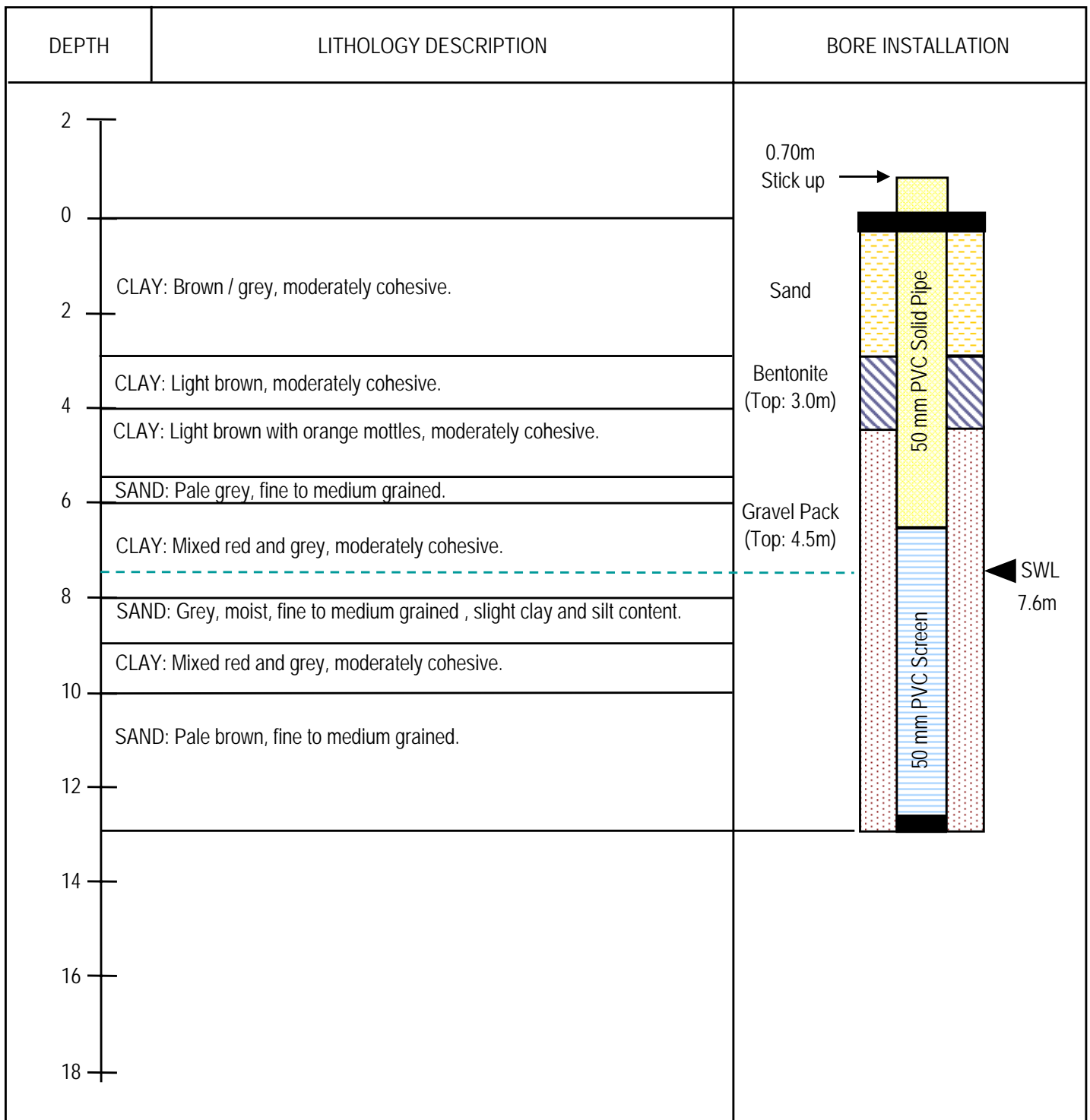
**DRILLER:** Stuart Birnie

**SCIENTIST:** James Holthouse & Troy Webster

**DATE BEGUN:** 22/3/05

**DATE COMPLETED:** 22/3/05

STATIC WATER LEVEL	
DEPTH:	7.6mbgl
DATE:	22/3/05



**BOREHOLE NUMBER:** CSMB2

290 Churchill Avenue  
 Subiaco W.A. 6008  
 Ph: 9382 4744 Fax: 9382 1177  
 Email: info@bbg.net.au

**PROJECT NUMBER:** C05054

**LOCATION:** Midland Bricks

**DRILLING COMPANY:** Pro-line

**TOTAL DEPTH:** 13.00mbgl

**DRILLING METHOD:** Hollow Stem Auger

**GROUND SURFACE ELEVATION:**

**WEATHER:** Fine / Hot

**SHEET:** 1 OF: 1

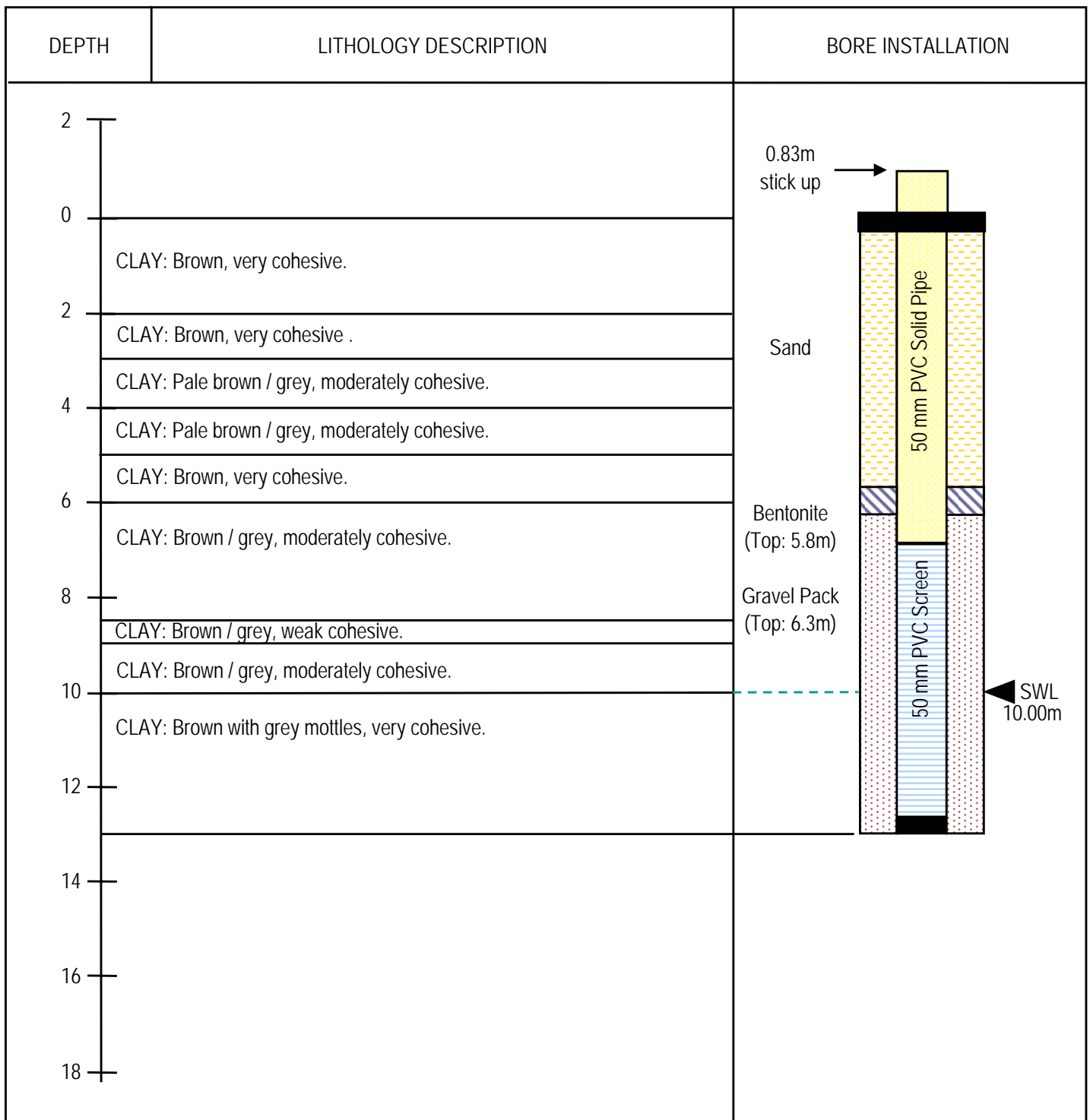
**DRILLER:** Stuart Birnie

**SCIENTIST:** James Holthouse & Troy Webster

**DATE BEGUN:** 23/3/05

**DATE COMPLETED:** 23/3/05

STATIC WATER LEVEL	
DEPTH:	10.00mbgl
DATE:	22/3/05



**BOREHOLE NUMBER:** CSMB3

290 Churchill Avenue  
 Subiaco W.A. 6008  
 Ph: 9382 4744 Fax: 9382 1177  
 Email: info@bbg.net.au

**PROJECT NUMBER:** C05054

**LOCATION:** Midland Bricks

**DRILLING COMPANY:** Pro-line

**TOTAL DEPTH:** 13.00mbgl

**DRILLING METHOD:** Hollow Stem Auger

**GROUND SURFACE ELEVATION:**

**WEATHER:** Fine / Hot

**SHEET:** 1 OF: 1

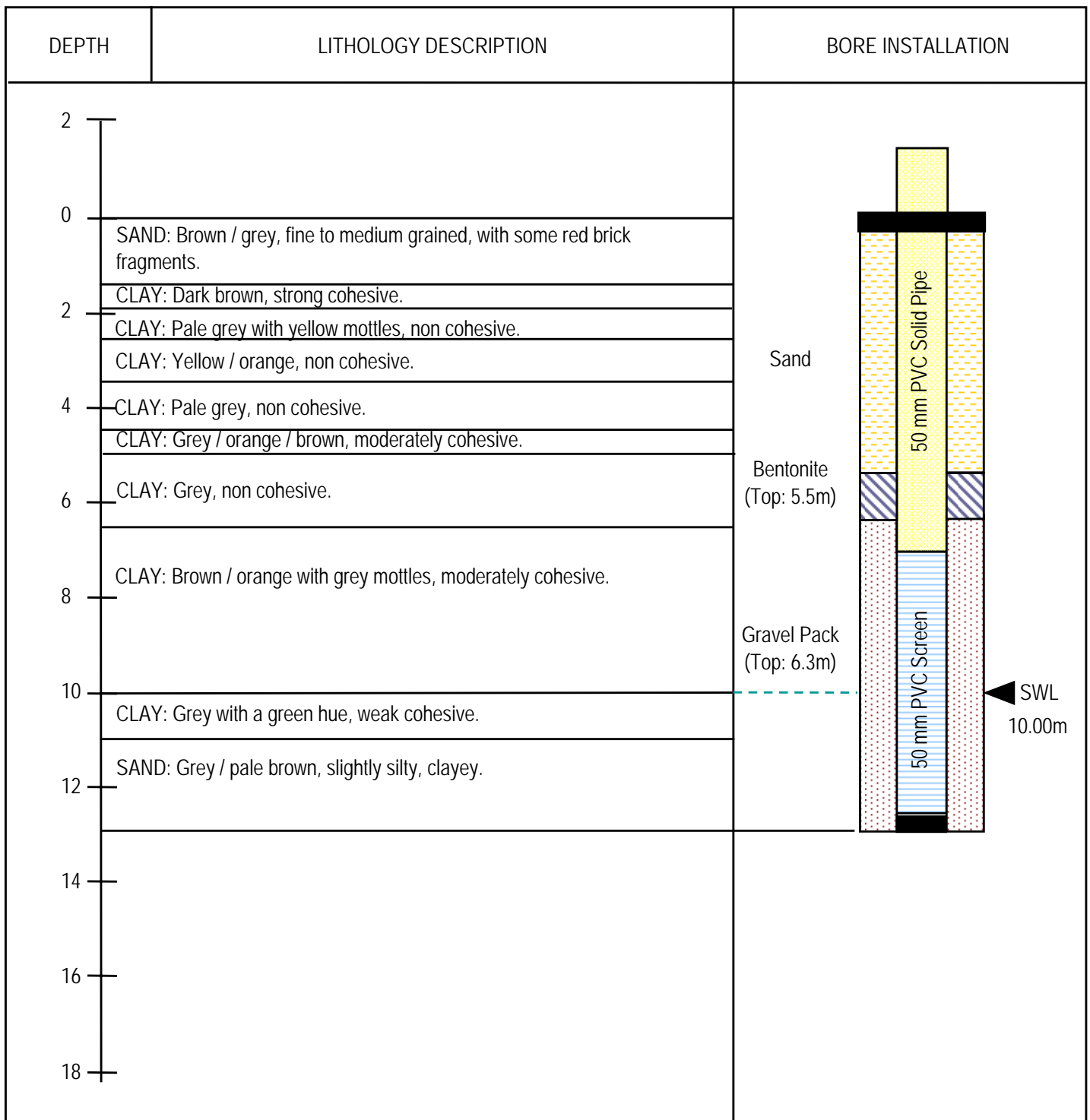
**DRILLER:** Stuart Birnie

**SCIENTIST:** James Holthouse & Troy Webster

**DATE BEGUN:** 22/3/05

**DATE COMPLETED:** 23/3/05

STATIC WATER LEVEL	
DEPTH:	10.00mbgl
DATE:	23/3/05



**APPENDIX G**

**GROUNDWATER SAMPLING LOGS**

# GROUNDWATER SAMPLING LOG

PROJECT NUMBER:	C05054	SAMPLE RECOVERY METHOD:	Bladder Pump
SITE NAME:	Midland Brick	COLLAR ELEVATION (m AHD):	
SAMPLING AREA:	East	DEPTH TO GROUNDWATER (mbtoc / mbgl):	9.800 mbtoc
SAMPLING LOCATION ID:	<b>CSMB1</b>	STANDING WATER LEVEL (m AHD)	
SCIENTIST(S):	James Holthouse	RECOVERY DEPTH (mbtoc / mbgl):	12.500 mbtoc
DATE:	6/04/2005	DEPTH TO BASE: (mbtoc / mbgl):	12.700 mbtoc
TIME:	3.03pm	SAMPLE STORAGE / PRESERVATION:	Ice / Esky - Plastic Bottle
QA/QC SAMPLE IDs:			

## GROUNDWATER STABILISATION DATA

TIME (Mins)	APPEARANCE	COLOUR	TEMP (°C)	pH	E.C. (µs/cm)	REDOX (mV)	D.O. (ppm)
1	Turbid	Brown	32.8	7.87	1173		
2	Turbid	Brown	30.8	7.79	1234		
3	Turbid	Brown	27.8	7.69	1231		
4	Turbid	Brown	27.1	7.64	1240		
5	Turbid	Brown	26.6	7.58	1251		
6	Turbid	Brown	26.3	7.63	1272		
7	Turbid	Brown	26.2	7.65	1276		
8	Turbid	Brown	26.0	7.67	1294		
9	Turbid	Brown	25.8	7.69	1307		
10	Turbid	Brown	25.5	7.67	1320		
12	Turbid	Brown	24.8	7.64	1373		
14	Turbid	Brown	24.7	7.59	1387		
16	Turbid	Brown	24.6	7.56	1415		
18	Turbid	Brown	24.4	7.54	1442		
20	Turbid	Brown	24.3	7.49	1459		
22	Turbid	Brown	24.3	7.43	1487		
24	Turbid	Brown	24.3	7.46	1505		
26	Turbid	Brown	24.3	7.39	1531		
28	Turbid	Brown	24.3	7.39	1545		
30	Turbid	Brown	24.3	7.36	1561		
32	Turbid	Brown	24.3	7.36	1571	129	5.22

PURGE RATE (Litres/Min):	0.5L/M
SAMPLING RATE (Litres/Min):	0.25L/M
0.45 MICRON FILTRATION USED (Y/N):	No

ADDITIONAL COMMENTS:

EASTING:	409010	NORTHING:	6484808
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# GROUNDWATER SAMPLING LOG

PROJECT NUMBER:	C05054	SAMPLE RECOVERY METHOD:	Bladder Pump
SITE NAME:	Midland Brick	COLLAR ELEVATION (m AHD):	
SAMPLING AREA:	Southern area	DEPTH TO GROUNDWATER (mbtoc / mbgl):	10.480 mbtoc
SAMPLING LOCATION ID:	<b>CSMB2</b>	STANDING WATER LEVEL (m AHD)	
SCIENTIST(S):	James Holthouse	RECOVERY DEPTH (mbtoc / mbgl):	13.500 mbtoc
DATE:	6/04/2005	DEPTH TO BASE: (mbtoc / mbgl):	13.680 mbtoc
TIME:	4.15pm	SAMPLE STORAGE / PRESERVATION:	Ice / Esky - Plastic Bottle
QA/QC SAMPLE IDs:			

## GROUNDWATER STABILISATION DATA

TIME (Mins)	APPEARANCE	COLOUR	TEMP (°C)	pH	E.C. (µs/cm)	REDOX (mV)	D.O. (ppm)
1	Turbid	Brown	24.2	7.46	702		
2	Turbid	Brown	23.3	7.43	692		
3	Turbid	Brown	22.6	7.42	675		
4	Turbid	Brown	22.6	7.47	672		
5	Turbid	Brown	22.5	7.46	666		
6	Turbid	Brown	22.7	7.41	664		
7	Turbid	Brown	22.8	7.40	663		
8	Turbid	Brown	22.8	7.37	661		
9	Turbid	Brown	22.8	7.37	664		
10	Turbid	Brown	22.6	7.35	-		
12	Turbid	Brown	22.5	7.38	662		
14	Turbid	Brown	22.4	7.38	656		
16	Turbid	Brown	22.4	7.39	652		
18	Turbid	Brown	22.4	7.35	643		
20	Turbid	Brown	22.4	7.34	637		
22	Turbid	Brown	22.2	7.36	627		
24	Turbid	Brown	22.2	7.36	626		
26	Turbid	Brown	22.2	7.34	602		
30	Turbid	Brown	22.1	7.3	615		
34	Turbid	Brown	22.1	7.37	625		
38	Turbid	Brown	22.1	7.31	625	96	1.87

PURGE RATE (Litres/Min):	0.5L/M
SAMPLING RATE (Litres/Min):	0.25L/M
0.45 MICRON FILTRATION USED (Y/N):	No

ADDITIONAL COMMENTS:

EASTING:	408405	NORTHING:	6484264
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# GROUNDWATER SAMPLING LOG

PROJECT NUMBER:	C05054	SAMPLE RECOVERY METHOD:	Bladder Pump
SITE NAME:	Midland Brick	COLLAR ELEVATION (m AHD):	
SAMPLING AREA:	Driveway bend	DEPTH TO GROUNDWATER (mbtoc / mbgl):	10.595 mbtoc
SAMPLING LOCATION ID:	<b>CSMB3</b>	STANDING WATER LEVEL (m AHD)	
SCIENTIST(S):	James Holthouse	RECOVERY DEPTH (mbtoc / mbgl):	13.000 mbtoc
DATE:	6/04/2005	DEPTH TO BASE: (mbtoc / mbgl):	13.170 mbtoc
TIME:	1.00pm	SAMPLE STORAGE / PRESERVATION:	Ice / Esky - Plastic Bottle
QA/QC SAMPLE IDs:	Duplicate CSMBZ taken at CSMB3		

## GROUNDWATER STABILISATION DATA

TIME (Mins)	APPEARANCE	COLOUR	TEMP (°C)	pH	E.C. (µs/cm)	REDOX (mV)	D.O. (ppm)
1	Turbid	Brown	33.7	6.72	769		
2	Turbid	Brown	32.6	7.09	936		
3	Turbid	Brown	31.8	7.24	947		
4	Turbid	Brown	30.6	7.16	957		
5	Turbid	Brown	29.7	7.40	959		
6	Turbid	Brown	28.9	7.44	960		
7	Turbid	Brown	27.8	7.46	961		
8	Turbid	Brown	26.8	7.50	962		
9	Turbid	Brown	26.2	7.4	972		
10	Turbid	Brown	25.4	7.43	970		
12	Turbid	Brown	25.1	7.53	969		
14	Turbid	Brown	25.1	7.54	990		
16	Turbid	Brown	25.1	7.54	991		
18	Turbid	Brown	25.1	7.54	991		
20	Turbid	Brown	25	7.52	991		
22	Turbid	Brown	24.9	7.52	997		
24	Turbid	Brown	25	7.51	1011		
26	Turbid	Brown	25	7.51	1018		
28	Turbid	Brown	25.1	7.51	994		
30	Turbid	Brown	25.1	7.50	989		
32	Turbid	Brown	25.1	7.50	990	117	5.96

PURGE RATE (Litres/Min):	0.5L/M
SAMPLING RATE (Litres/Min):	0.25L/M
0.45 MICRON FILTRATION USED (Y/N):	No

ADDITIONAL COMMENTS:

EASTING:	408280	NORTHING:	6484536
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**APPENDIX H**

**GROUNDWATER LABORATORY ANALYSIS  
CERTIFICATES**



Environmental and Analytical Chemists

## LABORATORY REPORT

**ARL LAB No:** 8158-63

**DATE:** 12 May 2005

**CLIENT:** RPS Bowman Bishaw Gorham  
PO Box 465  
SUBIACO WA 6904

**ATTENTION:** Mr David Sim

**SAMPLE DESCRIPTION:** Six water samples as received for analysis of alkalinity, chloride, conductivity, metals, ammonia-N, sulphate, pH and total suspended solids (TSS).

**DATE RECEIVED:** 07 April 2005

**LOCATION:** Midland Brick

**JOB NUMBER:** C05054

**METHODS:**

Metals	ARL No 029
Alkalinity	ARL No 037
Chloride	ARL No 018
Conductivity	ARL No 019
pH	ARL No 014
Sulphate	ARL No 028
Total Suspended Solids	ARL No 016
Ammonia-N	ARL No 035


Mr David Sim  
 RPS Bowman Bishaw Gorham  
 Lab No: 8158-63  
 12 May 2005

**RESULTS:**

Lab No	8158	8159	8160
Sample Marks	CSMB1	CSMB2	CSMB3
pH #	7.4	7.4	7.7
Hardness (mgCaCO <sub>3</sub> /l)	250	62	110
Conductivity (mS/cm)	1.4	0.51	0.85
Alkalinity (mgCaCO <sub>3</sub> /l)	170	100	240
		mg/l	
Chloride	370	120	150
Aluminium	<0.01	0.47	0.17
Arsenic	0.001	0.002	0.002
Calcium	48	15	32
Cadmium	<0.0002	<0.0002	<0.0002
Chromium	0.001	0.003	0.002
Copper	0.001	0.005	0.002
Mercury	<0.0002	<0.0002	<0.0002
Magnesium	31	6.0	8.0
Manganese	0.024	0.003	0.008
Nickel	0.001	0.004	0.003
Lead	<0.001	0.002	0.002
Selenium	<0.001	<0.001	<0.001
Zinc	0.008	0.12	<0.005
Ammonia-N	<0.2	<0.2	<0.2
Sulphate	40	35	48
Total Suspended Solids	700	1200	9700

Mr David Sim  
RPS Bowman Bishaw Gorham  
Lab No: 8158-63  
12 May 2005

Lab No	8161	8162	8163
Sample Marks	CSMBZ	CSMBR	CSMBB
pH #	7.7	6.4	6.1
Hardness (mgCaCO <sub>3</sub> /l)	120	<5	<5
Conductivity (mS/cm)	0.88	<0.01	<0.01
Alkalinity (mgCaCO <sub>3</sub> /l)	250	<5	<5
		mg/l	
Chloride	160	<5	<5
Aluminium	0.19	<0.01	<0.01
Arsenic	0.002	0.001	<0.001
Calcium	33	<0.1	<0.1
Cadmium	<0.0002	<0.0002	<0.0002
Chromium	0.002	0.001	0.001
Copper	0.001	0.008	0.008
Mercury	<0.0002	<0.0002	<0.0002
Magnesium	8.3	<0.1	<0.1
Manganese	0.009	<0.001	<0.001
Nickel	0.001	0.001	0.001
Lead	<0.001	<0.001	<0.001
Selenium	<0.001	<0.001	<0.001
Zinc	<0.005	0.006	<0.005
Ammonia-N	<0.2	<0.2	<0.2
Sulphate	50	<3	<3
Total Suspended Solids	8100	13	<5

  
Kim Rodgers  
Laboratory Manager

**APPENDIX I**

**QUALITY ASSURANCE / CONTROL RESULTS**

**Groundwater QA / QC Analysis Results**

Sample ID	Aluminium mg/L	Arsenic mg/L	Calcium mg/L	Cadmium mg/L	Chromium mg/L	Copper mg/L	Mercury mg/L	Magnesium mg/L	Manganese mg/L	Nickel mg/L	Lead mg/L	Selenium mg/L	Zinc mg/L	Alkalinity mg/L	Hardness mg/L	Chloride mg/L	Sulfate mg/L	Ammonia-N mg/L
CSMB3	0.17	0.002	32	0.0002	0.002	0.002	0.0002	8	0.008	0.003	0.002	0.001	0.005	240	110	150	48	0.2
CSMBZ	0.19	0.002	33	0.0002	0.002	0.001	0.0002	8.3	0.009	0.001	0.001	0.001	0.005	250	120	160	50	0.2
RPD	11.1%	0.0%	3.1%	0.0%	0.0%	<b>66.7%</b>	0.0%	3.7%	11.8%	<b>100.0%</b>	<b>66.7%</b>	0.0%	0.0%	4.1%	8.7%	6.5%	4.1%	0.0%
CSMBR	0.01	0.001	0.1	0.0002	0.001	0.008	0.0002	0.1	0.001	0.001	0.001	0.001	0.006	5	5	5	3	0.2
CSMBB	0.01	0.001	0.1	0.0002	0.001	0.008	0.0002	0.1	0.001	0.001	0.001	0.001	0.005	5	5	5	3	0.2

Notes:  
 CSMBZ is a duplicate of CSMB3  
 Values in **bold** denote a Relative Percent Difference greater than 50% - all RPDs > 50% correspond to results at or close to detection level.  
 CSMBR is a field rinsate sample  
 CSMBB is a field blank sample  
 0.001