Geochemical Impact Assessment of Overburden and Coal Reject

DRAYTON SOUTH COAL PROJECT

Prepared for: ***Hansen Bailey***

Date: ***16 February 2015***

Geochemical Impact Assessment of Overburden and Coal Reject

DRAYTON SOUTH COAL PROJECT

prepared for: **Hansen Bailey**

DOCUMENT CONTROL

Report Title Geochemical Impact Assessment of Overburden and Coal Reject

Project Name	Drayton South Coal Project		
Job Number	201443	**Client**	Hansen Bailey
Report Number	R001_A		
Report Date	16 February 2015		

PO Box 3091, Sunnybank South QLD 4109

Tel: 617 3344 1222

Mob 61 431 620 623

Webpage: http://.www.rgsenv.com

EXECUTIVE SUMMARY

ES1 Background

RGS Environmental Pty Ltd (RGS) was commissioned by Hansen Bailey Environmental Consultants (Hansen Bailey), on behalf of Anglo American Coal (Anglo American) to complete a geochemical impact assessment of the overburden and coal reject material as part of the Environmental Impact Statement (EIS) for the Drayton South Coal Project (the Project).

The Project will allow for the continuation of the existing Drayton Mine for up to 15 years, by developing an open cut mining area within EL 5460. The Project will extract up to 6.4 Million tonnes per annum (Mtpa) of export quality thermal coal by utilising existing Drayton Mine assets and infrastructure.

ES2 Scope of Work

The scope of work for this Project was to complete a geochemical impact assessment to address the geochemical characteristics of overburden and coal reject material within the study area. The scope of work included:

- A review of any existing geological/geochemical assessments/data in the area and delineation of additional overburden sampling and testing requirements;
- Design of a suitable geochemical sampling and testing program for overburden and coal reject materials. The program utilised exploration drill core samples derived from ongoing drilling programs;
- Coordination of static laboratory analysis of samples delivered to ALS Brisbane;
- Completion of kinetic leach column tests at the RGS in-house laboratory; and
- Preparation of a geochemical impact assessment report specific to the Project.

ES3 Sampling and Testing Program

Thirty overburden samples and six potential coal reject (coal seam roof and floor) samples were obtained from five drill holes selected to provide lateral and vertical coverage of the overburden and potential coal reject materials likely to be generated by the Project. In addition, a further two composite samples of roof and floor materials and coal reject materials were obtained from the coal quality laboratory and represented composite drill core material from four boreholes (three locations) spanning the five target seams planned to be mined. The sampling strategy was based on existing knowledge of the geology/stratigraphy of the site and from the results of previous geochemical assessment work. All overburden samples were transferred to ALS Brisbane laboratory by Anglo American personnel for sample preparation and geochemical characterisation tests as described below.

A series of static geochemical tests were completed on individual and composite overburden and coal reject samples at ALS Brisbane as coordinated by RGS. Five composite overburden samples were then subjected to kinetic leach column tests over a period of 12 weeks at the RGS in-house laboratory in Brisbane. All leachate collected from the kinetic leach column tests was analysed at ALS Brisbane.

ES4 Conclusions

RGS has completed a geochemical impact assessment of representative overburden and coal reject materials for the Project. The findings of the assessment align well with those of the previous desktop geochemical assessment (RGS, 2010). It is concluded that:

- Overburden and most coal reject materials are expected to have very low oxidisable sulfur content, significant excess Acid Neutralising Capacity (ANC), and be classified as Non-Acid Forming (NAF);

- Overburden and most coal reject materials are likely to have a high factor of safety with respect to potential acid generation and Acid and Metalliferous Drainage (AMD);
- The concentration of total metals/metalloids in overburden and coal reject materials is well below applied guideline criteria for soils and is unlikely to present any environmental issues associated with revegetation and rehabilitation;
- Overburden and coal reject materials reporting to emplacement areas will generate pH neutral to slightly alkaline run-off/seepage with low and moderate salinity values, respectively, following surface exposure. The salinity of run-off/seepage from these materials is expected to decrease with time;
- The concentration of trace metals/metalloids in run-off and seepage from most overburden and coal reject material is likely to be low;
- Overall, the risk of potentially significant water quality impacts from overburden and coal reject materials is low;
- Some overburden and most coal reject materials may be sodic and have structural stability problems related to potential dispersion and erosion; and
- There is a low probability of spontaneous combustion either in situ or for coal, overburden and coal reject materials at the Project. This is because the Project materials are derived from the Wittingham Coal Measures, which are very low sulfide sulfur compared to higher sulfide sulfur materials derived from the Greta seam at Drayton Mine.

ES5 Potential Management Measures

The ongoing management of overburden and coal reject materials for the Project should consider the geochemistry of these materials with respect to their potential risk to cause harm to the environment and their suitability for use in construction and revegetation. As such the following recommendations are put forward:

- Pre-stripping topsoil from areas to be disturbed for use in final rehabilitation activities (surface cover or vegetation growth medium); and
- Implementing practical site rehabilitation practices for potentially sodic overburden and coal reject materials to limit the risk of dispersion and erosion of surface materials at emplacement areas (*e.g.* utilise a topsoil cover as part of final rehabilitation).

Surface water and seepage from overburden and coal reject emplacement areas should be monitored to ensure that key water quality parameters remain within appropriate criteria. It is therefore suggested that:

- Monitoring of surface run-off and seepage from the proposed overburden and coal reject emplacement areas for pH, electrical conductivity (EC), total suspended solids (TSS) on a quarterly basis and dissolved trace metals and sulfate on an annual basis.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ATTACHMENTS

GLOSSARY OF TERMS AND ACRONYMS

Acid	A measure of hydrogen ion (H^+) concentration; generally expressed as pH.
ABA	Acid Base Account. Evaluation of the balance between acid generation and acid neutralisation processes. Generally determines the maximum potential acidity (MPA) and the inherent acid neutralising capacity (ANC), as defined below.
ANC	Acid Neutralising Capacity, expressed as kg H_2SO_4 per tonne of sample.
ANC/MPA Ratio	Ratio of the acid neutralising capacity and maximum potential acidity of a sample. Used to assess the risk of a sample generating acid conditions.
AMD	Acid and Metalliferous Drainage from mine waste materials characterised by low pH, elevated metal concentrations, high sulfate concentrations and high salinity.
CHPP	Coal Handling and Preparation Plant.
eCEC	Effective Cation Exchange Capacity. The amount of exchangeable major cations in a sample expressed as meq/100g.
EC	Electrical Conductivity, expressed as µS/cm.
ESP	Exchangeable Sodium Percentage. The proportion of exchangeable sodium in a sample compared to the cation exchange capacity, expressed as a percentage. Used to assess the risk of a material being dispersive/erosive.
Kinetic test	Procedure used to measure the geochemical/weathering behaviour of a sample of mine material over time.
MPA	Maximum Potential Acidity calculated by multiplying the total sulfur content of a sample by 30.6 (stoichiometric factor) and expressed as kg H_2SO_4 per tonne.
NAF	NonAcid Forming. Geochemical classification criterion for a sample that will not generate acid conditions.
NAPP	Net Acid Producing Potential expressed as kg H_2SO_4 per tonne. Calculated by subtracting the ANC from the MPA.
Overburden	Material that overlies a coal resource and must be removed to mine the coal.
PAF	Potentially Acid Forming. Geochemical classification criterion for a sample that has the potential to generate acid conditions.
(Coal) Reject	Mixture of coarse and finely ground materials from which the desired mineral (coal) values have been largely extracted.
Static test	Procedure for characterising the geochemical nature of a sample at one point in time. Static tests may include measurements of mineral and chemical composition of a sample and the Acid Base Account.
(Coal) Tailing	Finely ground materials from which the desired mineral (coal) values have been largely extracted.
Total Sulfur	Total sulfur content of a sample generally measured using a 'Leco' analyser expressed as % S.

1.0 INTRODUCTION

1.1 Project Description

Drayton Mine is located approximately 13 km south of the township of Muswellbrook in the Upper Hunter Valley of NSW (see **Figure 1**, **Attachment A**). Drayton Mine has been operating in the Muswellbrook community for over 30 years and runs out of coal in 2015. RGS Environmental Pty Ltd (RGS) was commissioned by Hansen Bailey on behalf of Anglo American Coal (Anglo American) to complete a geochemical impact assessment of the overburden and coal reject material as part of the Environmental Impact Statement (EIS) for the Drayton South Coal Project (the Project).

The Project will allow for the continuation of the existing Drayton Mine for up to 15 years, by developing an open cut mining area within EL 5460. The Project will extract up to 6.4 Million tonnes per annum (Mtpa) of export quality thermal coal by utilising existing Drayton Mine assets and infrastructure.

The Project application addresses the reasons provided by the NSW Planning Assessment Commission (PAC) for the refusal of the Drayton South Project. The mine plan and Project boundary is defined by ridgelines nominated in the 'Drayton South Coal Project PAC Review Report' issued in December 2013. The Project will remain behind the ridgelines nominated by the PAC. Significantly, this at least doubles the buffer setback distance from the Coolmore and Woodlands thoroughbred horse studs and is at least 2 kilometres (km) from the horse stud operational areas.

The Project generally includes:

- Continuation of operations at Drayton Mine as currently approved with minor additional mining within the existing East, North and South Mining Areas for a period of 15 years;
- Development of a new open cut mining area with EL 5460 mining up to 6.4 Mtpa Run-Of-Mine (ROM) coal;
- Ongoing employment of a workforce of up to 500 full time equivalent employees;
- Utilisation of the existing Drayton Mine equipment fleet;
- Storage of water, and emplacement of tailings and rejects generated by the Project in existing Drayton Mine voids;
- Utilisation of the existing Drayton Mine infrastructure including the CHPP, rail loop and associated infrastructure, workshops, bath houses and administration offices;
- Construction of a transport corridor to the new mining area;
- Continued utilisation of the Antiene Rail Spur off the Main Northern Railway Line to transport product coal to the Port of Newcastle for export;
- Realigning and upgrading a section of Edderton Road;
- Continuation of mutually beneficial arrangements with neighbours Macquarie Generation and Mt Arthur Coal Mine;
- Installation of further water management and power reticulation infrastructure to support the new mining areas; and
- Progressive rehabilitation of disturbed areas as mining operations are completed.

Figure 2 (Attachment A) illustrates the conceptual layout of the Project.

1.2 Scope of Work

The scope of work completed by RGS for this assessment included:

- A review of any existing geological/geochemical assessments/data in the area and delineation of additional overburden sampling and testing requirements;
- Design of a suitable geochemical sampling and testing program for overburden and coal reject materials. The program utilised exploration drill core samples derived from ongoing drilling programs;
- Coordination of static laboratory analysis of samples delivered to ALS Brisbane;
- Completion of kinetic leach column (KLC) tests at the RGS in-house laboratory; and
- Preparation of a geochemical impact assessment report specific to the Project.

1.3 Report Structure

The report structure is as follows:

- **Section 2.0** describes the existing geology within the study area;
- **Section 3.0** outlines the methodology adopted for the desktop review and the sampling and testing program;
- **Section 4.0** provides a summary of the main findings of the desktop assessment;
- **Section 5.0** outlines the geochemical results obtained for overburden and coal reject testing;
- **Section 6.0** describes the potential implications for overburden and coal reject management;
- **Section 7.0** provides the main conclusions and potential management measures for overburden and coal reject materials generated from the Project;
- **Section 8.0** lists the references used in the assessment; and
- **Section 9.0** outlines the limitations of the assessment.

1.4 Related Studies

The studies which are to be read in conjunction with this assessment include the following:

- The EIS soil and land capability impact assessment;
- The EIS surface water impact assessment; and
- The EIS groundwater impact assessment.

2.0 GEOLOGY

The Project will target five main coal seams as part of a proposed open cut and highwall mining program. The typical stratigraphic profile of the key mining areas associated with the Project, as indicated from the geological model is provided in **Figure 3** (**Attachment A)**. The five coal seams are listed in order of increasing depth as the Whybrow, Redbank Creek, Wambo, Whynot and Blakefield seams, respectively. These seams are located in the upper part of the Jerrys Plains Subgroup of the Wittingham Coal Measures. The Whybrow seam is part of the Mt. Leonard Formation and the remaining four seams form part of the Malabar Formation. The Mt. Leonard Formation is a mainly coarse classic unit with lithologies ranging from massive sandstone to conglomerate with intercalated thin coal seams. The Malabar Formation is about 160 m thick and typically consists of sandstone, siltstone, conglomerate, coal and minor claystone (Pratt, 1995; SCJV, 2005). A brief description of the five coal seams targeted by the Project is provided below.

2.1.1 Whybrow Seam

The Whybrow seam typically occurs as a single horizon immediately below the Denman Formation and is characterised by an approximate 0.25 m thick tuffaceous claystone band in the centre of the seam. The seam can vary in thickness from 2.5 to 4 m and is intruded throughout the eastern limb of the Calool Syncline. The overburden/interburden lithology associated with the seam is mainly sandstone.

2.1.2 Redbank Creek Seam

The Redbank Creek seam is located immediately below the Althorpe Claystone and contains two major tuff bands, which can divide the seam into three recognisable plies, the lowest of which ('C' ply) is the most prospective. The overall thickness of the seam is generally between 4 and 6 m, but in some cases up to 20 m. The interburden lithology below this seam is typically sandstone.

2.1.3 Wambo Seam

The Wambo Creek seam typically occurs midway between the overlying Redbank Creek seam and underlying Whynot seam. It is generally less than 0.5 m thick, but where split, the lower split can be up to 0.8 m thick. Some intrusion occurs in the western part of the study area. The interburden lithology associated with this seam is typically characterised by sandstone, siltstone and shale.

2.1.4 Whynot Seam

The Whynot seam is a low ash thermal coal seam averaging about 2 m in thickness and lying approximately 15 to 25 m below the Redbank Creek seam. The Whynot seam contains no characteristic stone bands. The resource area is divided by an extensive north west to south east trending intrusion and thins eastwards. The interburden lithology associated with this seam is typically characterised by sandstone, siltstone, mudstone and shale.

2.1.5 Blakefield Seam

The Blakefield seam typically occurs 20 m below the Whynot seam and has an average thickness of 2.2 m. The north eastern part of the study area is characterised by seam intrusion. The interburden lithology associated with this seam is typically characterised by sandstone, mudstone and tuff.

As stated above, the Project target seams are located within the upper part of the Jerrys Plains Subgroup of the Wittingham Coal Measures. Other mining operations in the vicinity of the Project area generally mine seams either from the stratigraphically deeper Greta Coal Measures such as Drayton Mine and Bayswater No. 2 Pit (AGE, 2009) or from deeper seams in the Wittingham Coal Measures such as Mt Arthur Coal, Bayswater No. 3 and Bengalla Mine (Hansen Bailey, 2009).

The geology and coal seams at the Project are uniform, well understood and highly predictable.

Table 1

Typical Overburden and Coal Seam Thickness within the Study Area

Coal Seam (splits)	Typical Coal Seam Thickness (m)	Overburden / Interburden Thickness (m)
Whybrow	2.5-4	50
Redbank Creek	4-6	15–20
Wambo	0.5	20
Whynot	2	15
Blakefield	2.2	20–30

3.0 METHODOLOGY

3.1 Desktop Review

RGS has worked closely with Hansen Bailey/Anglo American personnel to develop an appropriate sampling and testing program for representative samples of overburden and coal reject materials as part of the geochemical impact assessment. A sampling and geochemical testing protocol report was provided to Hansen Bailey in January 2011 (RGS, 2011) prior to the site visit and sampling taking place. The detailed methodology used for the sampling and testing program is described in **Section 3.3**. RGS personnel coordinated the sampling program with Anglo American and representative (drill core) samples of overburden and coal reject materials were collected and transferred to ALS Brisbane laboratory for static geochemical testing. Selected samples of overburden and coal reject materials were also subjected to kinetic leach column testing at RGS' in-house laboratory and collected leachates were tested at ALS Brisbane laboratory. All geochemical test work programs completed on the overburden and coal reject samples were co-ordinated by RGS.

RGS has previously completed a review of available geochemical, geological and water quality data associated with the Project. Relevant information was supplied to RGS by Hansen Bailey and Anglo American personnel. Supplied information was used in the current assessment for the development of an overburden and coal reject sampling and geochemical testing program. This process enabled RGS to make efficient use of existing data as well as current exploration drilling programs to develop an effective sampling and geochemical testing program for the Project.

3.2 Site Visit

RGS personnel (Alan Robertson) completed a site visit to the study area on 14 January 2011. This included meetings with key Project geological (exploration) personnel, and providing supervision of the initial drill core sampling program. The site visit enabled RGS to gain an understanding of the Project layout and proposed overburden and coal reject emplacement strategy. The site visit also provided additional rigour to the geochemical assessment process and ensured that results interpretation and final conclusions were robust and based on a sound sampling and testing methodology.

3.3 Sampling and Testing Program

3.3.1 Sampling Program

There are no specific regulatory requirements regarding the number of samples required to be obtained and tested for overburden materials at coal mines in NSW. As such, existing technical guidelines for geochemical assessment of mine waste in Australia (AMIRA, 2002; DITR, 2007 and ACARP, 2008) and worldwide (INAP, 2009) have been used by RGS as a framework for developing the sampling (and testing) program for the Project.

Thirty overburden samples and six potential coal reject (coal seam roof and floor) samples were obtained from five drill holes selected to provide lateral and vertical coverage of the overburden and potential coal reject materials likely to be generated by the Project. In addition, a further two composite samples of roof and floor materials and coal reject materials were obtained from the coal quality laboratory (ALS Maitland) and represented composite drill core material from four boreholes (three locations) spanning the five target seams planned to be mined. The two composite samples were prepared in order to obtain sufficient sample mass for the required geochemical analysis. The location of the drill holes used for geochemical sampling is shown in **Figure 4 (Attachment A)**.

The sampling strategy was based on existing knowledge of the geology/stratigraphy of the site and from the results of previous geochemical assessment work as described in **Section 4.0**. Additional sampling considerations included the potential for significant environmental or health impacts; size of operation; sample representation requirements; material volumes; level of confidence in predictive ability; and cost. Anglo American provided a suitably qualified person (Senior Geologist) to supervise the collection of representative samples of the required range of overburden and coal reject materials. RGS provided the relevant laboratory chain of custody documentation and instructions to allow Anglo American personnel to collect and dispatch the drill core samples to ALS Brisbane laboratory for geochemical characterisation tests as described in **Section 3.3.2**.

3.3.2 Geochemical Testing Program

Static Tests

The drill core samples received by ALS Brisbane were prepared (crushed, split, sub-sampled and pulverised), prior to being subjected to a series of geochemical tests. This standard laboratory procedure provides a homogenous sample but also generates a large sample surface area in contact with the resultant assay solution, thereby providing greater potential for dissolution and reaction, and represents an assumed initial 'worst case' scenario for these materials.

The geochemical test program was designed to assess the degree of risk from oxidation of pyrite, acid generation, and leaching of soluble metals and salts. The assessment also included characterisation of standard soil parameters including salinity, cation exchange capacity, and major metal compositions. A summarised overview of a typical geochemical assessment program for mine waste materials is provided in **Attachment B.**

All of the 38 samples collected were subjected to initial Acid Base Account (ABA) geochemical testing as part of an initial screening process. Specifically, each sample was tested for:

- pH (1:5 w:v, sample:deionised water);
- Electrical conductivity (EC) (1:5 w:v, sample:deionised water);
- Total sulfur [Leco method]; and
- Acid neutralising capacity (ANC) [AMIRA, 2002 method].

The results of the ABA screening assessment are discussed in **Section 5.1**. Where initial ABA screening results indicated that total sulfur content was greater than average crustal abundance (0.1%) (INAP, 2009), samples were selected for further sulfur speciation testing. A total of eight samples were tested for chromium reducible sulfur (Scr) [AS 4969.7-2008 method].

From the total sulfur (or Scr where available) and ANC results, the maximum potential acidity (MPA) and net acid producing potential (NAPP) values of the sample materials were calculated. Where available, the MPA and NAPP values were calculated using Scr data instead of total sulfur data. Scr data (for fresh samples) generally provides a more accurate representation of the MPA that could theoretically be generated, as acid generation primarily occurs from oxidation of reactive sulfides (eg. pyrite), whereas total sulfur includes other forms of sulfur such as sulfate and organic sulfur, which produce negligible acidity.

After the results of the ABA tests were received and reviewed, 15 samples were chosen for multi-element testing that was completed on solid and soluble fractions of pulverised samples. The samples were selected based on material type, location, lithology and geochemical characteristics. All selected samples underwent multi-element testing on both the solid and soluble fractions. The 15 samples were tested for:

- pH (1:5 w:v, sample:deionised water);
- EC (1:5 w:v, sample:deionised water);
- Alkalinity (1:5 w:v, sample:deionised water) [automatic titrator measured as $CaCO_3$];
- Total metals (Al, As, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Mo, N, Ni, P, Sb, Se, Zn) in solids [HCl and HNO_3 acid digest followed ICP-AES/MS];
- Total cations (Ca, Mg, Na, K) [HCl and HNO_3 acid digest followed by ICP-AES/MS];
- Exchangeable cations (Ca, Mg, Na, K) [Ion Exchange Chromatography];
- Soluble metals (Al, As, B, Cd, Cr, Co, Cu, Fe, Pb, Mn, Mo, Ni, P, Sb, Se, Zn) in 1:5 w:v water extracts [ICP-AES/MS];
- Major cations (Ca, Mg, Na, K) in 1:5 w:v sample: deionised water extracts [ICP-AES/MS]; and
- Major anions (Cl, SO_4) in 1:5 w:v sample: deionised water extracts [ICP-AES/MS].

KLC Tests

A total of five KLC tests were completed on various overburden and coal reject materials obtained from the study area at the RGS in-house laboratory. For drill core samples, the KLC test material comprised crushed material passing nominal 10 mm sieve size. For other samples, the sample material was used in the KLC tests as received.

The KLC tests commenced in April 2011 and were completed July 2011. Approximately 1-2 kg dry weight of each selected sample was accurately weighed and used in the KLC tests, with the weight varying according to sample bulk density. The KLC tests were operated with fortnightly deionised water addition and leachate collection for 12 weeks. Heat lamps were used on a daily basis to simulate sunshine and ensure that the KLC test materials were unsaturated and subject to oxidising conditions between leaching events. This method essentially represents the worst case or maximum potential for sulfide oxidation and potential acid/salt generation.

All leachate collected was sent to ALS Brisbane for analysis of parameters including:

- pH and EC;
- Acidity and alkalinity [automatic titrator measured as $CaCO_3$];
- Dissolved metals/metalloids (Al, B, As, Cd, Cr, Co, Cu, Fe, Pb, Mn, Mo, Ni, Sb, Se and Zn) [ICP-AES];
- Dissolved major cations (Ca, Mg, Na and K) [ICP-AES]; and
- Dissolved major anions (Cl, SO_4) [ICP-AES].

KLC test results and trends are presented at **Attachment C** and a copy of all the geochemical results received from ALS Brisbane for the KLC tests is provided at **Attachment D**.

4.0 REVIEW OF EXISTING GEOCHEMICAL DATA

A desktop geochemical assessment of overburden and potential coal reject materials was completed for the Project (RGS, 2010). The assessment relied upon a number of existing sources of information including Hansen Bailey (2009), Envirosciences (1992), and AGE (2009); and found that:

- Overburden material in the study area is likely to be geochemically benign, with very low total sulfur content, excess neutralising capacity and therefore, negligible acid generating potential. This material should contain low concentrations of total metals and is likely to generate alkaline surface runoff/seepage with relatively low concentrations of soluble salts and trace metals;
- Whilst it is possible that material associated with uneconomic coal seams could be less benign than bulk overburden of the Project, this material is likely to make up a very small fraction of the total overburden volume reporting to storage facilities;
- Some overburden is likely to be sodic, prone to dispersion and erosion, and unlikely to be suitable for surface rehabilitation purposes without amelioration measures;
- Coal rejects derived from the target seams are likely to contain relatively low concentrations of total sulfur, a significant proportion of which is likely to be present as (non-acid forming) organic sulfur. It is expected that the risk of acid generation from coal rejects will be low; and
- The concentration and solubility of environmentally significant metals/metalloids in coal rejects is likely to be low and within applicable soil and water quality guideline concentrations.

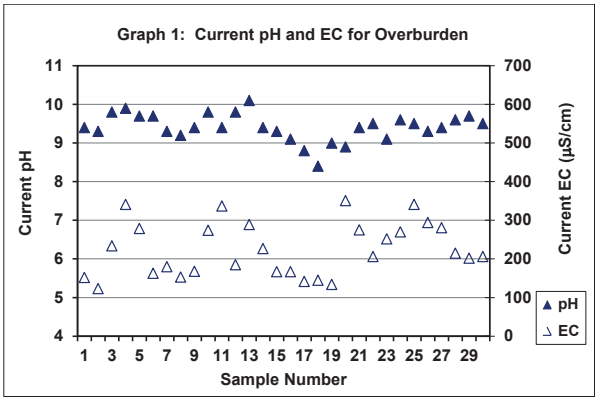
5.0 GEOCHEMICAL TEST RESULTS

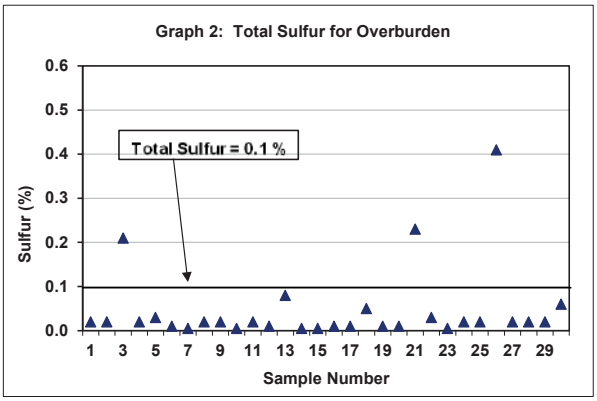
5.1 Acid Base Account Results

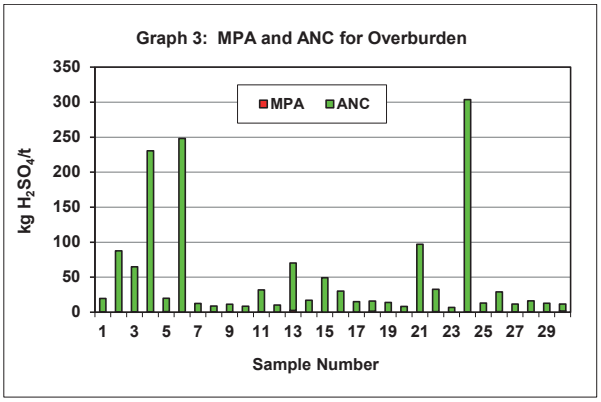
5.1.1 Overburden

Acid Base Account (ABA) test results for the 30 drill core samples collected from five drill hole locations representing overburden materials from the Project are summarised below and presented in **Table 2** and **Graphs 1, 2, 3** and **4**.

- **pH:** The current $pH_{1:5}$ of the overburden samples ranges from 8.4 to 10.1 and is moderately alkaline (median pH 9.4) (**Graph 1**).
- **EC:** The current $EC_{1:5}$ of the overburden samples ranges from 123 to 351 µS/cm and is typically low (median 211 µS/cm) (**Graph 1**).
- **Total sulfur:** The total sulfur content of the overburden samples is typically very low and ranges from <0.01 to 0.41 % (median 0.02 %). All but three overburden samples have total sulfur values less than 0.1 % (**Graph 2**).
- **Sulfide Sulfur**: The sulfidic sulfur content of a selection (3) of the overburden samples was determined using the Scr test. The results shown in **Table 2** indicate that most of the total sulfur is non-sulfidic.
- **Maximum potential acidity (MPA):** Based on the total sulfur content and sulfidic sulfur content of the samples (where available), the MPA that could be generated by the overburden samples is negligible, ranging from 0.2 to 2.5 kg H_2SO_4/t (median 0.6 kg H_2SO_4/t) (**Graph 3**).
- **ANC:** The ANC value for the samples ranges from 6.6 to 303 kg H_2SO_4/t and is typically moderate (median 16.3 kg H_2SO_4/t) (**Graph 3**). The median ANC value is more than an order of magnitude greater than the median MPA.
- **NAPP:** The calculated NAPP value for the samples ranges from -302.4 to -6.4 kg H_2SO_4/t and is typically negative (median -15.9 kg H_2SO_4/t).







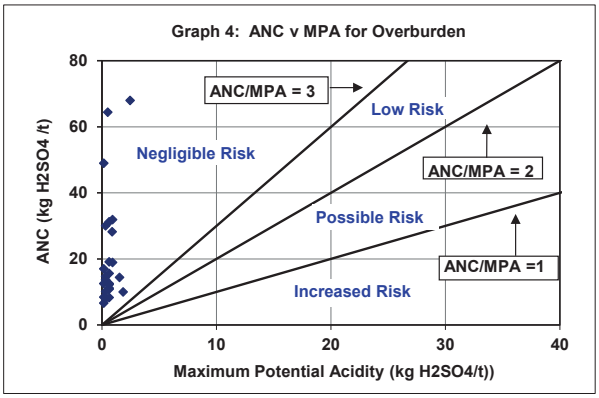


Table 2: Acid-Base Account Results for Overburden Materials

RGS Sample Number	ALS Laboratory Sample ID	Date	Drill Hole Number	Sample Name	Sample Interval (m)			Lithology	Sample Type	pH[1]	EC[1]	Total Sulfur	Scr	MPA[2]	ANC[2]	NAPP[2]	ANC/MPA ratio	Sample Classification[3]
					From	To	Depth				(µS/cm)	(%)		(kg H_2SO_4/t)				
Overburden																		
1	EB1104975-001	2/03/11	DD1158	EO 001	28.25	28.81	0.56	Sandstone	Interburden	9.4	152	0.020	-	0.6	19.1	-18.5	31.2	Non-Acid Forming (Barren)
2	EB1104975-002	2/03/11	DD1158	EO 002	37.09	37.44	0.35	Sandstone	Interburden	9.3	123	0.020	-	0.6	87	-86.4	142.0	Non-Acid Forming (Barren)
3	EB1104975-003	2/03/11	DD1158	EO 003	60.23	60.62	0.39	Sandstone/Silt	Interburden	9.8	234	0.210	0.016	0.5	64.4	-63.9	131.4	Non-Acid Forming (Barren)
4	EB1104975-004	2/03/11	DD1158	EO 004	66.59	67.10	0.51	Tuff	Interburden	9.9	341	0.020	-	0.6	230	-229.4	375.5	Non-Acid Forming (Barren)
5	EB1104975-005	2/03/11	DD1158	EO 005	78.26	78.70	0.44	Sandstone	Interburden	9.7	279	0.030	-	0.9	18.9	-18.0	20.6	Non-Acid Forming (Barren)
6	EB1104975-006	2/03/11	DD1158	EO 006	94.06	94.53	0.47	Sandstone	Interburden	9.7	163	0.010	-	0.3	248	-247.7	809.8	Non-Acid Forming (Barren)
7	EB1104977-001	2/03/11	DD1156	EO 001	53.69	54.09	0.40	Sandstone	Interburden	9.3	180	0.005	-	0.2	12.5	-12.3	81.6	Non-Acid Forming (Barren)
8	EB1104977-002	2/03/11	DD1156	EO 002	62.83	63.15	0.32	Sandstone	Interburden	9.2	153	0.020	-	0.6	8.3	-7.7	13.6	Non-Acid Forming (Barren)
9	EB1104977-003	2/03/11	DD1156	EO 003	68.69	69.10	0.41	Claystone	Interburden	9.4	168	0.020	-	0.6	10.8	-10.2	17.6	Non-Acid Forming (Barren)
10	EB1104977-004	2/03/11	DD1156	EO 004	83.46	83.79	0.33	Tuff	Interburden	9.8	274	0.005	-	0.2	8.4	-8.2	54.9	Non-Acid Forming (Barren)
11	EB1104977-005	2/03/11	DD1156	EO 005	104.72	105.21	0.49	Claystone	Interburden	9.4	337	0.020	-	0.6	31.2	-30.6	50.9	Non-Acid Forming (Barren)
12	EB1104977-006	2/03/11	DD1156	EO 006	123.91	124.28	0.37	Sandstone/Siltstone	Interburden	9.8	185	0.010	-	0.3	10.1	-9.8	33.0	Non-Acid Forming (Barren)
13	EB1104977-007	2/03/11	DD1156	EO 007	138.65	139.02	0.37	Dolorite	Interburden	10.1	289	0.080	-	2.5	68	-65.6	27.8	Non-Acid Forming (Barren)
14	EB1104981-001	2/03/11	DD1163	EO 001	17.46	17.88	0.42	Sandstone	Interburden	9.4	227	0.005	-	0.2	17	-16.8	111.0	Non-Acid Forming (Barren)
15	EB1104981-002	2/03/11	DD1163	EO 002	25.02	25.37	0.35	Sandstone	Interburden	9.3	167	0.005	-	0.2	49	-48.8	320.0	Non-Acid Forming (Barren)
16	EB1104981-003	2/03/11	DD1163	EO 003	28.71	29.11	0.40	Sandstone	Interburden	9.1	167	0.010	-	0.3	30	-29.7	98.0	Non-Acid Forming (Barren)
17	EB1104981-004	2/03/11	DD1163	EO 004	39.76	40.07	0.31	Siltstone	Interburden	8.8	142	0.010	-	0.3	14.7	-14.4	48.0	Non-Acid Forming (Barren)
18	EB1104981-005	2/03/11	DD1163	EO 005	54.08	54.44	0.36	Sandstone	Interburden	8.4	145	0.050	-	1.5	14.4	-12.9	9.4	Non-Acid Forming (Barren)
19	EB1104981-006	2/03/11	DD1163	EO 006	60.81	61.24	0.43	Sandstone	Interburden	9.0	134	0.010	-	0.3	13.7	-13.4	44.7	Non-Acid Forming (Barren)
20	EB1104978-001	15/03/11	DD1151	EO 001	15.42	15.83	0.41	Claystone	WA1 Overburden	8.9	351	0.010	-	0.3	7.9	-7.6	25.8	Non-Acid Forming (Barren)
21	EB1104978-002	15/03/11	DD1151	EO 002	20.27	20.96	0.69	Sandstone	WA1 Overburden	9.4	275	0.230	0.006	0.2	96.8	-96.6	526.8	Non-Acid Forming (Barren)
22	EB1104978-003	15/03/11	DD1151	EO 003	23.76	24.30	0.54	Siltstone/Sandstone	WA1 Overburden	9.5	206	0.030	-	0.9	31.9	-31.0	34.7	Non-Acid Forming (Barren)
23	EB1104980-001	15/03/11	DD1150	EO 001	18.10	18.61	0.51	Sandstone/Siltstone	WA1 Overburden	9.1	252	0.005	-	0.2	6.6	-6.4	43.1	Non-Acid Forming (Barren)
24	EB1104980-004	15/03/11	DD1150	EO 004	25.53	25.82	0.29	Sandstone	WA2 Interburden	9.6	270	0.020	-	0.6	303	-302.4	494.7	Non-Acid Forming (Barren)
25	EB1104980-005	15/03/11	DD1150	EO 005	27.75	28.05	0.30	Claystone	WA2 Interburden	9.5	341	0.020	-	0.6	12.5	-11.9	20.4	Non-Acid Forming (Barren)
26	EB1104978-005	15/03/11	DD1151	EO 005	26.87	27.46	0.59	Sandstone	WA2 Overburden	9.3	294	0.410	0.029	0.9	28.2	-27.3	31.8	Non-Acid Forming (Barren)
27	EB1104978-006	15/03/11	DD1151	EO 006	31.58	31.95	0.37	Siltstone	WA2 Overburden	9.4	281	0.020	-	0.6	11.1	-10.5	18.1	Non-Acid Forming (Barren)
28	EB1104980-007	15/03/11	DD1150	EO 007	32.00	32.37	0.37	Siltstone	WN1 Interburden	9.6	215	0.020	-	0.6	15.6	-15.0	25.5	Non-Acid Forming (Barren)
29	EB1104980-008	15/03/11	DD1150	EO 008	38.50	39.00	0.50	Siltstone	WN1 Interburden	9.7	202	0.020	-	0.6	12.2	-11.6	19.9	Non-Acid Forming (Barren)
30	EB1104978-007	15/03/11	DD1151	EO 007	38.19	38.54	0.35	Claystone/Siltstone	WN3 Overburden	9.5	206	0.060	-	1.8	10	-8.2	5.4	Non-Acid Forming (Barren)

Notes
1. Current pH, EC, Alkalinity and Acidity provided for 1:5 sample:water extracts
2. Scr = Chromium Reducible Sulfur; MPA = Maximum potential acidity; ANC = Acid neutralising capacity; and NAPP = Net acid producing potential.
3. Sample classification detail provided in report text.

Graph 3 illustrates that the ANC value significantly exceeds the MPA value in all overburden samples tested and consequently, all of the overburden samples have negative NAPP values.

Graph 4 shows a plot of ANC versus MPA for the overburden samples. The ANC/MPA ratio of the samples ranges from 5.4 to 810 and is typically very high (median 122.2). ANC/MPA ratio lines have been plotted on the graph to illustrate the factor of safety associated with the samples. Generally those samples with an ANC/MPA ratio of greater than 2 are considered to have a low to negligible risk of acid generation and a high factor of safety in terms of potential for acid generation (DITR, 2007; INAP, 2009). The results indicate that all of the overburden samples tested have negligible risk of acid generation and a very high factor of safety.

The ABA results presented in this section have been used to classify the acid forming nature of the 30 overburden samples as shown in **Table 2**. The geochemical criteria used by RGS to classify the acid forming nature of the overburden samples are provided in **Table 3**.

Table 3

Geochemical Classification Criteria for Overburden Materials

Geochemical Classification	Total or Sulfide Sulfur[#] (%)	NAPP (kg H_2SO_4/t)	ANC/ MPA Ratio	Number of Samples	% of Total Samples
Non-Acid Forming – Barren (NAF – Barren)	≤ 0.1	-	-	30	100
Non-Acid Forming (NAF)	≥ 0.1	< - 5	≥ 2	0	0
Uncertain	≥ 0.1	> - 5 and < +5	<2	0	0
Potentially Acid Forming (PAF)	≥ 0.1	> +5	<2	0	0

Notes:
[#]If total sulfur or sulfidic sulfur is less than or equal to 0.1 %, the NAPP and ANC/MPA ratio are not required for material classification as the sample is essentially barren of sulfur and has negligible acid generating capacity.

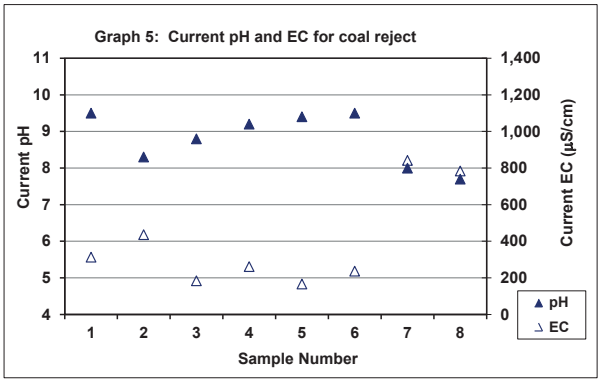
The results in **Table 3** indicate that all of the overburden samples tested fall in the NAF-Barren geochemical classification category. Overall, from an acid-base perspective, the overburden material tested can generally be regarded as a NAF-barren unit. Most overburden material also has significant excess buffering capacity that should be available to more than adequately buffer the negligible amount of any acidity that could theoretically be produced.

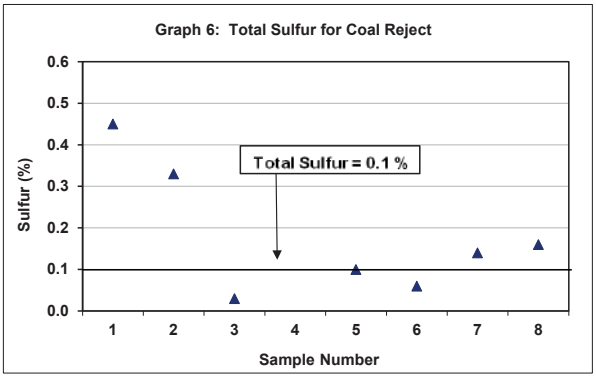
5.1.2 Coal Reject Material

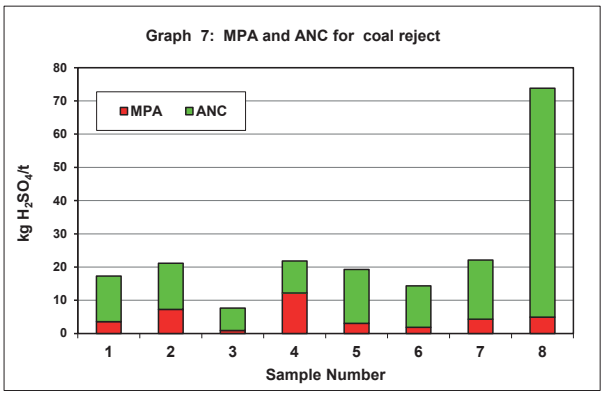
ABA test results for eight samples collected from six drill holes at five drill hole locations representing coal reject material from the Project are summarised below and presented in **Table 4** and **Graphs 5, 6, 7** and **8**.

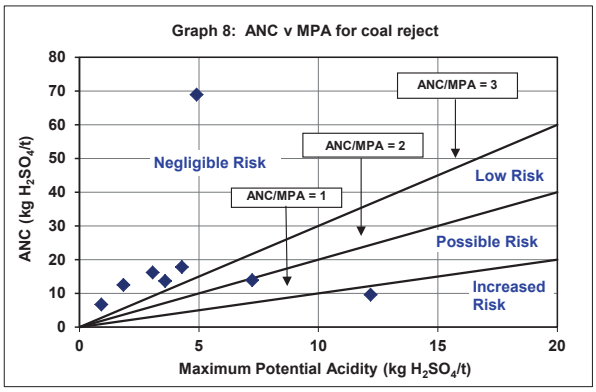
- **pH:** The current $pH_{1:5}$ of the potential reject samples range from was 7.7 to 9.5 and is moderately alkaline (median pH 9.0) (**Graph 5**).
- **EC:** The current $EC_{1:5}$ of the potential reject samples range from 167 to 842 µS/cm and is typically low (median 287.5 µS/cm) (**Graph 5**).
- **Sulfur:** The total sulfur content of the reject samples range from 0.03 to 0.86 %. The sulfidic sulfur content of a selection (3) of the coal reject samples was determined using the Scr test. The results shown in **Table 4** indicate that approximately half of the total sulfur is non-sulfidic.
- **MPA:** Based on the total sulfur content, the MPA that could be generated by the coal reject samples range from 0.9 to 12.2 kg H_2SO_4/t and is low (median 2.8 kg H_2SO_4/t) (**Graph 7**).

- **ANC:** The ANC value for the potential reject samples range from 6.7 to 68.9 kg H_2SO_4/t and is moderate (median 13.8 kg H_2SO_4/t) (**Graph 7**). The median ANC value is almost five times greater than the median MPA.
- **NAPP:** The calculated NAPP value for the potential reject samples range from -66.3 to +2.6 kg H_2SO_4/t and are typically negative (median -10.4 kg H_2SO_4/t).









Graph 7 illustrates that the MPA value in most of the coal reject samples is low and six of the eight samples have an MPA value < 5 kg H_2SO_4/t. The ANC value exceeds the MPA value in all but one of the coal reject sample tested (sample DD1150 EO, 006 WA2 Floor) and consequently, seven out of eight coal reject samples have negative NAPP values. **Graph 8** shows a plot of ANC versus MPA for the coal reject samples. The ANC/MPA ratio of the samples ranges from 0.8 to 26.8 and is typically elevated (median 6.0). ANC/MPA ratio lines have been plotted on the graph to illustrate the factor of safety associated with the samples. Generally those samples with an ANC/MPA ratio of greater than 2 are considered to have a negligible risk of acid generation and a high factor of safety in terms of potential for acid generation (DITR, 2007; INAP, 2009). The results indicate that seven of the eight coal reject samples tested have a low to negligible risk of acid generation and a high factor of safety.

The eight individual coal reject samples tested have been classified according to the geochemical classification criteria previously presented in **Table 3,** as shown in the geochemical results presented at **Table 4**. The results show that seven of the eight samples are classified as NAF-Barren or NAF. One of the eight samples has been classified as Uncertain due to the slightly positive NAPP value and low ANC/MPA ratio.

Overall, from an acid-base perspective, the coal reject materials tested can generally be regarded as a NAF unit. Most coal reject material also has significant excess buffering capacity that should be available to more than adequately buffer the low to negligible amount of any acidity that could theoretically be produced.

Table 4: Acid-Base Account Results for Coal Reject Materials

RGS Sample Number	ALS Laboratory Sample ID	Date	Drill Hole Number	Sample Name	Sample Interval (m)			Lithology	Sample Type	pH[1]	EC[1]	Total Sulfur	Scr	MPA[2]	ANC[2]	NAPP[2]	ANC/MPA ratio	Sample Classification[3]
					From	To	Depth				(µS/cm)	(%)		(kg H_2SO_4/t)				
Coal Rejects																		
1	EB1104978-004	15/03/11	DD1151	EO 004	25.00	25.39	0.39	Siltstone	WA1 Floor	9.5	313	0.45	0.117	3.6	13.7	-10.1	3.8	Non-Acid Forming
2	EB1104980-003	15/03/11	DD1150	EO 003	20.93	21.28	0.35	Claystone	WA1 Floor	8.3	436	0.33	0.236	7.2	13.9	-6.7	1.9	Non-Acid Forming
3	EB1104980-002	15/03/11	DD1150	EO 002	19.73	20.02	0.29	Claystone	WA1 Roof	8.8	184	0.03	-	0.9	6.7	-5.8	7.3	Non-Acid Forming (Barren)
4	EB1104980-006	15/03/11	DD1150	EO 006	29.47	29.81	0.34	Claystone	WA2 Floor	9.2	262	0.86	0.398	12.2	9.6	2.6	0.8	Uncertain
5	EB1104978-008	15/03/11	DD1151	EO 008	39.75	40.22	0.47	Siltstone/Sandstone	WN3 Floor	9.4	167	0.10	-	3.1	16.2	-13.1	5.3	Non-Acid Forming (Barren)
6	EB1104980-009	15/03/11	DD1150	EO 009	42.86	43.13	0.27	Carb. Claystone	WN3 Floor	9.5	237	0.06	-	1.8	12.5	-10.7	6.8	Non-Acid Forming (Barren)
7	EB1105959-001	23/03/11	Composite of DD1123, DD1126, DD1126A and DD1146						SCK Coal Reject	8.0	842	0.14	0.062	1.9	17.8	-15.9	9.4	Non-Acid Forming (Barren)
8	EB1105959-002	23/03/11	Composite of DD1123, DD1126, DD1126A and DD1146						SCK Roof/Floor	7.7	784	0.16	0.084	2.6	68.9	-66.3	26.8	Non-Acid Forming (Barren)

Notes

1. Current pH, EC, Alkalinity and Acidity provided for 1:5 sample:water extracts
2. Scr = Chromium Reducible Sulfur; MPA = Maximum potential acidity; ANC = Acid neutralising capacity; and NAPP = Net acid producing potential.
3. Sample classification detail provided in report text.

5.2 Multi-Element Concentration in Solids

Multi-element scans were completed on 15 selected samples of overburden and coal reject materials to identify any elements (particularly metals/metalloids) present at concentrations that may be of environmental concern with respect to revegetation and surface water/seepage quality. The results were compared to potentially relevant guideline criteria to determine any concerns related to mine operation and final rehabilitation to allow management measures to be developed, if required. For total metal/metalloid concentrations in overburden or coal reject materials in NSW, there are no specific guidelines and/or regulatory criteria. In the absence of these and to provide relevant context, RGS has compared the total metal/metalloid concentration in overburden and coal reject materials (solids) to health-based investigation levels (HIL(C)) that apply to recreational open spaces (NEPC, 2013). The applicability of this guideline stems from the potential final land use of the mine following closure (eg. ecological values and agricultural activities).

Seven individual overburden samples and eight coal reject samples were selected and subjected to multi-element test work. A list of the selected samples is provided at **Table 5**.

Table 5

Overburden and Coal Reject Samples Selected for Multi-Element Tests

ALS Laboratory Sample ID	Date	Drill Hole Number	Sample Name	Sample Interval (m)			Lithology	Sample Type
				From	To	Depth		
EB1104975-001	2/03/11	DD1158	EO 001	28.25	28.81	0.56	Sandstone	Interburden
EB1104975-003	2/03/11	DD1158	EO 003	60.23	60.62	0.39	Sandstone/Silt	Interburden
EB1104977-003	2/03/11	DD1156	EO 003	68.69	69.10	0.41	Claystone	Interburden
EB1104977-004	2/03/11	DD1156	EO 004	83.46	83.79	0.33	Tuff	Interburden
EB1104978-002	15/03/11	DD1151	EO 002	20.27	20.96	0.69	Sandstone	WA1 Overburden
EB1104978-004	15/03/11	DD1151	EO 004	25.00	25.39	0.39	Siltstone	WA1 Floor
EB1104978-005	15/03/11	DD1151	EO 005	26.87	27.46	0.59	Sandstone	WA2 Overburden
EB1104978-008	15/03/11	DD1151	EO 008	39.75	40.22	0.47	Siltstone/Sandstone	WN3 Floor
EB1104980-002	15/03/11	DD1150	EO 002	19.73	20.02	0.29	Claystone	WA1 Roof
EB1104980-003	15/03/11	DD1150	EO 003	20.93	21.28	0.35	Claystone	WA1 Floor
EB1104980-006	15/03/11	DD1150	EO 006	29.47	29.81	0.34	Claystone	WA2 Floor
EB1104980-009	15/03/11	DD1150	EO 009	42.86	43.13	0.27	Carb. Claystone	WN3 Floor
EB1022785-033	2/03/11	DD1163	EO 003	28.71	29.11	0.40	Sandstone	Interburden
EB1105959-001	23/03/11	Composite of DD1123, DD1126, DD1126A and DD1146						SCK Coal Reject
EB1105959-002	23/03/11	Composite of DD1123, DD1126, DD1126A and DD1146						SCK Roof/Floor

The results from multi-element testing (total metals/metalloids) of the overburden and coal reject samples are presented in **Table 6**. The acquired data indicates that the overburden and coal reject materials have total metal/metalloid concentrations in solids well within the applied NEPC (HIL(C)) guideline criteria for soils.

Table 6: Multi-Element Results for Overburden and Coal Reject Materials

	Sample Type -->		Overburden							Coal Reject							
	Material description -->		Sandstone Interburden (DD1158 EO 001)	Sandstone/Silt Interburden (DD1158 EO 003)	Claystone Interburden (DD1156 EO 003)	Tuff Interburden (DD1156 EO 004)	Sandstone Interburden (DD1163 EO 003)	Sandstone WA2 Overburden (DD1151 EO 005)	Sandstone WA1 Overburden (DD1151 EO 002)	Siltstone WA1 Floor (DD1151 EO 004)	Claystone WA1 Floor (DD1150 EO 003)	Claystone WA1 Roof (DD1150 EO 002)	Claystone WA2 Floor (DD1150 EO 006)	Siltstone/Sandstone WN3 Floor (DD1151 EO 008)	Carb. Claystone WN3 Floor (DD1150 EO 009)	SCK Coal Reject	SCK Roof/Floor
Parameters	Detection Limit	NEPC[1] Health-Based (HIL(C)) Investigation Level															
Elements	All units mg/kg																
Aluminium (Al)	50	-	2,920	3,740	3,530	4,230	4,030	3,620	6,480	4,190	9,940	12,400	6,280	6,220	12,200	3,940	3,950
Antimony (Sb)	5	-	<5	<5	<5	<5	<5	7	<5	<5	<5	<5	<5	<5	<5	<5	<5
Arsenic (As)	5	300	12	<5	<5	<5	14	6	17	8	7	<5	<5	<5	5	<5	17
Boron (B)	50	20,000	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	1	90	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3	<1	<1	<1
Calcium (Ca)	10	-	6,260	32,800	3,820	2,790	1,170	9,720	38,600	9,370	3,790	2,330	1,570	6,380	1,250	5,460	16,800
Chromium (Cr) total	2	300 *	14	8	9	<2	15	40	31	12	21	17	12	9	11	5	12
Cobalt (Co)	2	300	36	20	21	<2	18	74	13	15	24	17	9	19	4	2	9
Copper (Cu)	5	17,000	16	21	30	5	26	84	12	15	30	29	25	20	29	11	25
Iron (Fe)	50	-	51,000	22,500	110,000	1,110	20,500	6,060	17,400	5,860	12,800	17,400	13,000	163,000	18,200	25,500	46,400
Lead (Pb)	5	600	10	8	12	52	23	22	10	6	13	8	11	13	16	21	10
Magnesium (Mg)	10	-	3,800	9,870	4,540	1,540	2,290	2,180	3,750	2,340	5,470	4,990	3,160	8,250	5,060	3,620	9,430
Manganese (Mn)	5	19,000	837	367	2,200	<5	392	141	558	78	192	93	125	2,000	139	321	404
Molybdenum (Mo)	2	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Nickel (Ni)	2	1,200	36	28	24	<2	76	283	28	64	204	40	36	20	14	7	36
Potassium (K)	10	-	950	1,120	1,550	1,260	1,160	730	900	690	1,440	1,920	1,220	1,550	2,460	1,150	1,090
Selenium (Se)	5	700	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Sodium (Na)	10	-	340	880	470	1,300	40	720	900	1,000	1,410	960	690	820	1,150	990	1,330
Zinc (Zn)	5	30,000	64	67	132	104	105	150	41	41	109	42	60	144	105	64	62
Exchangeable Cations	All units meq/100g (except Exchangeable Sodium Percentage (%))																
Exch. Calcium	0.1	-	9.7	20.1	1.8	10.4	3.5	19.7	21.5	18.4	11.5	5.8	4.8	2.9	4.7	8.1	4.9
Exch. Magnesium	0.1	-	6	6.3	4.3	8.9	2.8	5.4	3.5	9.2	24.5	14.4	6.9	6	9.9	11.5	5.9
Exch. Potassium	0.1	-	0.6	0.5	0.8	1	1.1	0.4	0.5	0.4	1.0	1.2	0.7	0.7	1.6	0.7	0.6
Exch. Sodium	0.1	-	0.8	2.4	1.4	4.7	<0.1	2	1.6	3.4	5.6	3.6	2	2.6	4.2	3.6	3.7
Cation Exchange Capacity	0.1	-	17	29.3	8.4	25.1	7.5	27.4	27.2	31.4	42.6	25	14.3	12.2	20.4	23.9	15.1
Exchangeable Sodium Percentage	0.1 %	-	4.6	8.1	17.3	18.9	0.7	7.3	6.0	10.8	13.2	14.4	13.7	21.6	20.7	15.2	24.3
Calcium/Magnesium Ratio	0.1 %	-	1.6	3.2	0.4	1.2	1.3	3.6	6.1	2.0	0.5	0.4	0.7	0.5	0.5	0.7	0.8

Notes < indicates less than the analytical detection limit. Shaded cells exceed applied guideline limit.

1. NEPC (2013). National Environmental Protection Council (NEPC). National Environmental Protection (Assessment of Site Contamination) Measure (NEPM). Guideline on investigation levels for soil and groundwater. HIL(C); recreational open spaces.

* Guideline level for Cr(VI) = 200 mg/kg. Guideline level for Cr(III) = 24% of total Cr.

5.3 Assessment of Element Enrichment

To provide additional context and in line with mining industry guidelines (DITR, 2007; INAP, 2009), the multi-element results described in **Section 5.2** were also compared to the average background concentration (average crustal abundance) of those elements (metal/metalloids) in soil and rock (Bowen, 1979; and INAP, 2009)**.** From this comparison, a geochemical abundance index (GAI) was calculated. The GAI quantifies an assay result for a particular element in terms of the average crustal abundance for that element. The index, based on a log (2) scale, is expressed in seven integer increments (0 to 6), which correspond to enrichment factors from 0 to over 96 times average crustal abundance, as shown in **Table 7**.

Table 7

Geochemical Abundance Index (GAI) Values and Enrichment Factor

GAI	Enrichment factor	GAI	Enrichment factor
-	Less than 3-fold enrichment	4	24 – 48 fold enrichment
1	3 – 6 fold enrichment	5	48 – 96 fold enrichment
2	6 – 12 fold enrichment	6	Greater than 96 fold enrichment
3	12 – 24 fold enrichment		

As a general rule, a GAI greater than or equal to three indicates enrichment to a level that may warrant further investigation. This is the case with some environmentally important 'trace' elements, such as As, Cd, Cu and Zn, rather than with major rock-forming elements, such as Ca, Mg, K and Na.

Elements identified as enriched may not necessarily be a concern for revegetation, drainage water quality or public health, but their significance should still be evaluated. Similarly, because an element is not enriched does not mean it will never be a concern, because under some conditions (*eg*. low pH) the solubility of common environmentally important elements such as Al, Cu, Cd, Fe and Zn increases significantly.

The GAI results presented in **Table 8** indicate that the overwhelming majority of the 15 overburden and coal reject samples tested have GAI values less than 3 for all elements. The exceptions are a single sandstone overburden sample which is enriched with cobalt (Co) and a single sample of coal reject floor material which is enriched with cadmium compared to average crustal abundance. The overburden and coal reject materials will be well mixed at relevant storage facilities therefore the bulk materials will not be significantly enriched with any elements compared to average crustal abundance.

The initial solubility of metals/metalloids in water extracts from overburden materials is discussed in **Section 5.4** and longer term solubility is discussed with respect to KLC tests in **Section 5.5**.

Table 8: Geochemical Abundance Index (GAI) Results for Overburden and Coal Reject Materials

	Sample Type →		Overburden							Coal Reject							
	Material Description →		Sandstone Interburden (DD1158 EO 001)	Sandstone/Silt Interburden (DD1158 EO 003)	Claystone Interburden (DD1156 EO 003)	Tuff Interburden (DD1156 EO 004)	Sandstone Interburden (DD1163 EO 003)	Sandstone WA2 Overburden (DD1151 EO 005)	Sandstone WA1 Overburden (DD1151 EO 002)	Siltstone WA1 Floor (DD1151 EO 004)	Claystone WA1 Floor (DD1150 EO 003)	Claystone WA1 Roof (DD1150 EO 002)	Claystone WA2 Floor (DD1150 EO 006)	Siltstone/Sandstone WN3 Floor (DD1151 EO 008)	Carb. Claystone WN3 Floor (DD1150 EO 009)	SCK Coal Reject	SCK Roof/Floor
Parameters	Detection Limit	Average Crustal Abundance[1]															
Major Elements	All units in mg/kg		Geochemical Abundance Index														
Aluminium (Al)	50	71,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Antimony (Sb)	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arsenic (As)	5	6	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1
Boron (B)	50	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cadmium (Cd)	1	0.35	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
Calcium (Ca)	50	15,000	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Chromium (Cr)	2	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cobalt (Co)	2	8	2	1	1	0	1	3	0	0	1	1	0	1	0	0	0
Copper (Cu)	5	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron (Fe)	50	40,000	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
Lead (Pb)	5	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Magnesium (Mg)	50	5,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manganese (Mn)	5	1,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molybdenum (Mo)	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nickel (Ni)	2	50	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0
Potassium (K)	50	14,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Selenium (Se)	5	0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium (Na)	50	5,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zinc (Zn)	5	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes:
GAI's greater than or equal to 3 are highlighted.

1. Average Crustal Abundance values sourced from the "GARD Guide", Chapter 5 (INAP, 2009). When no GARD Guide value is available for particular element, Average Crustal Abundance values are taken from Bowen H.J.M.(1979) Environmental Chemistry of the Elements, Academic Press, New York, p42-43.

5.4 Effective Cation Exchange Capacity and Sodicity

In order to evaluate the potential 'soil quality' of overburden and coal reject materials at the Project, the eCEC and ESP was investigated. The results for the 15 samples described in **Sections 5.2** and **5.3** are shown in **Table 6**. The ALS laboratory certificates for the samples subjected to exchangeable cation analysis are provided in **Attachment D**.

The exchangeable cation results indicate that the eCEC of the 15 overburden and coal reject samples ranges from 7.5 to 42.6 meq/100g, and is typically in the 'moderate' range (median = 23.9 meq/100g) as shown in **Table 9** (Hazelton and Murphy, 2007). The eCEC results suggest that from a revegetation viewpoint, most overburden and coal reject materials will provide a reasonable growth medium for vegetation roots, without the need for fertiliser addition.

Table 9

Ratings for Effective Cation Exchange Capacity

eCEC Rating	CEC meq/100g
Very Low	<6
Low	6-12
Moderate	12-25
High	25-40
Very High	>40

The ESP results for the 15 overburden and coal reject samples range from 0.7 to 24.3 % (median 13.7 %). Generally samples with ESP values less than 6 are considered non-sodic and unlikely to be susceptible to dispersion and erosion. Samples with ESP values greater than 6 are considered moderately sodic and greater than 14 are considered strongly sodic and may be susceptible to dispersion and erosion (Isbell, 2002; and Northcote and Skene, 1972).

The ESP results presented in **Table 6** indicate that the sodicity of overburden samples is low in the sandstone material, but can be elevated in the claystone and tuff. The ESP in the coal reject samples is relatively high and has a median value of 14.8 which is more than double the median ESP value of the overburden materials (7.3). Hence, most coal reject materials represented by these samples would be considered sodic.

The results of the eCEC and ESP tests on overburden and coal reject samples and any potential implications for management of these materials at the Project are discussed further in **Section 6.0**.

5.5 Water Quality Static Leach Tests

There are no specific regulatory criteria for metal/metalloid concentrations in leachate derived from overburden and coal reject materials on mine sites in NSW. As such, RGS has compared the multi-element results in water extracts from the 15 overburden and coal reject samples described in Sections 5.2 to 5.5 with Australian water quality guidelines and receiving water criteria to provide some context for discussion of test results (ANZECC & ARCANZ, 2000).

It should be recognised that direct comparison of geochemical data with water quality guideline values and receiving water criteria can be misleading. For the purpose of this study, guideline and receiving water values are only provided for broad context and should not be interpreted as arbitrary 'maximum' values or 'trigger' values. Using sample pulps (ground to passing 75 µm) provides a very high surface area to solution ratio, which encourages mineral reaction and dissolution of the solid phase. As such, the results of screening tests on water extract solutions represent an assumed 'worst case' scenario for undiluted leachate from overburden and coal reject materials. The quality of actual runoff and/or seepage water from overburden and coal reject material storage areas would be better than the multi-

element results due to the less optimum conditions for leaching and the significant dilution from fresh rainfall runoff. The results are therefore not representative of site drainage water quality.

The results from multi-element testing of water extracts (1:5 solid:water) from the 15 overburden and coal reject samples are presented at **Table 10**. The extracts are typically neutral to alkaline and range from pH 7.7 to 9.8. The samples have relatively low EC values (152 to 842 µS/cm) with a median EC of 262 µS/cm; generally indicating low salinity and low concentrations of dissolved solids.

The dominant major soluble cation is sodium and the dominant major soluble anions are typically bicarbonate, chloride and sulfate. The concentration of soluble sulfate is relatively low (4 to 122 mg/L) and remains well below the applied ANZECC & ARCANZ (2000) livestock drinking water quality guideline criterion (1,000 mg/L).

The concentration of most trace metals/metalloids tested in the 15 water extracts is predominantly below the laboratory limit of reporting (LoR) and below the applied water quality guideline criteria where these exist (ANZECC & ARCNAZ, 2000). The only trace metals/metalloids which have a slightly elevated concentration in a small amount of samples are molybdenum (one sample) and selenium (5 samples). However, the median values of less than the laboratory LoR (ie. <0.02 mg/L and 0.02 mg/L) are below and equal to the livestock drinking water guideline values of 0.15 mg/L and 0.02 mg/L for molybdenum and selenium, respectively. Overall, these results indicate that most metals are sparingly soluble at the neutral to alkaline pH of the water extracts.

A review of available groundwater and surface water data at Saddlers Creek indicates that the water extract results described above are reasonably consistent with background water quality data.

It should be noted that the slightly elevated concentrations of molybdenum and selenium represent a “worst case” scenario in that all samples are crushed and pulverised to less than 75 µm before testing at ALS laboratory and as such, have a significantly larger surface area for potential reaction and leaching than for materials in the field situation. It is also noted that selenium is commonly detected in slightly elevated concentrations in leachate from mine waste materials as part of geochemical impact assessments for coal mines in Australia, but typically has a concentration below the laboratory LoR (and relevant guideline concentrations) in the field situation.

Overall, these results indicate that dissolved metal/metalloid concentrations in initial surface runoff and seepage from overburden and coal reject materials at the Project is unlikely to significantly impact upon the quality of surface and groundwater resources.

Any implications of these results for the management of overburden and coal reject materials at emplacement areas are discussed in **Section 6.0.**

Table 10: Multi-Element Results for Water Extracts from Overburden and Coal Reject Materials

	Sample Type -->		Overburden							Coal Reject							
	Material description -->		Sandstone Interburden (DD1158 EO 001)	Sandstone/Silt Interburden (DD1158 EO 003)	Claystone Interburden (DD1156 EO 003)	Tuff Interburden (DD1156 EO 004)	Sandstone Interburden (DD1163 EO 003)	Sandstone WA2 Overburden (DD1151 EO 005)	Sandstone WA1 Overburden (DD1151 EO 002)	Siltstone WA1 Floor (DD1151 EO 004)	Claystone WA1 Floor (DD1150 EO 003)	Claystone WA1 Roof (DD1150 EO 002)	Claystone WA2 Floor (DD1150 EO 006)	Siltstone/Sandstone WN3 Floor (DD1151 EO 008)	Carb. Claystone WN3 Floor (DD1150 EO 009)	SCK Coal Reject	SCK Roof/Floor
Parameters	Detection Limit	Guideline Levels[1]															
pH	0.1 pH unit	-	9.4	9.8	9.4	9.8	9.1	9.3	9.4	9.5	8.3	8.8	9.2	9.4	9.5	8.0	7.7
Electrical Conductivity	1 µS/cm	-	152	234	168	274	167	294	275	313	436	184	262	167	237	842	784
Total Alkalinity ($mgCaCO_3/L$)	0.2 mg/L	-	648	2,040	270	490	<1	938	7,860	1,202	552	510	476	366	510	404	1,380
Bicarbonate Alkalinity ($mgCaCO_3$	0.2 mg/L	-	592	1,890	260	346	139	938	7,720	1,144	534	496	476	346	490	404	1,380
Carbonate Alkalinity ($mgCaCO_3/L$	0.2 mg/L	-	58	144	10	144	<0.2	<0.2	135	58	19	14	<0.2	19	19	<1	<1
Major Ions	All element concentrations in mg/L																
Calcium (Ca)	2	1,000	4	<2	<2	<2	4	14	<2	<2	<2	<2	2	<2	<2	16	10
Magnesium (Mg)	2	-	4	<2	<2	<2	<2	14	<2	2	<2	<2	4	<2	<2	16	10
Sodium (Na)	2	-	22	52	32	<2	<2	64	50	84	70	48	54	54	34	120	138
Potassium (K)	2	-	<2	4	<2	2	12	<2	6	<2	<2	2	6	2	2	14	10
Chloride (Cl)	2	-	10	8	<2	<2	<2	26	<2	<2	<2	<2	12	16	22	246	138
Sulfate (SO_4)	2	1,000	22	20	16	<2	38	100	30	54	100	46	54	42	34	22	122
Metals/Metalloids	All element concentrations in mg/L																
Aluminium (Al)	0.2	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.8	3.6	<0.2	<0.2
Antimony (Sb)	0.02	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.020	<0.02
Arsenic (As)	0.02	0.5	0.240	0.040	0.020	0.040	<0.02	<0.02	<0.02	<0.02	0.060	<0.02	<0.02	0.040	0.200	<0.02	<0.02
Boron (B)	0.2	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium (Cd)	0.02	0.01	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chromium (Cr)	0.02	1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Cobalt (Co)	0.02	1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Copper (Cu)	0.02	1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Iron (Fe)	0.2	-	<0.2	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.4	<0.2	<0.2
Lead (Pb)	0.02	0.1	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Manganese (Mn)	0.02	-	<0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	<0.02	0.0	0.0
Molybdenum (Mo)	0.02	0.15	0.1	0.1	0.1	<0.02	<0.02	0.2	<0.02	0.02	0.04	<0.02	0.06	<0.02	<0.02	<0.02	<0.02
Nickel (Ni)	0.02	1	<0.02	<0.02	<0.02	<0.02	<0.02	0.06	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Selenium (Se)	0.02	0.02	0.02	<0.02	0.04	<0.02	0.02	0.04	<0.02	0.02	0.04	0.26	<0.02	0.02	0.02	<0.02	0.04
Zinc (Zn)	0.02	20	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Notes: < Indicates concentration less than the detection limit. Shaded cells indicate values which exceed applied ANZECC/NEPC guideline values.

1. ANZECC and ARMCANZ, Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT (2000). Livestock drinking water (cattle).

5.5 Water Quality Kinetic Tests

Kinetic Leach Column (KLC) tests were completed for three composite overburden samples and two coal reject samples using the methodology described in **Section 3.3.2**. The makeup of the three composite overburden samples and two coal reject samples is provided at **Table 11**. The composite reject samples for KLC tests (KLC4 and KLC5) were collected by Anglo American personnel from four boreholes DD1123, DD1126, DD1126A, DD1146 spanning the five target seams (Whybrow, Redbank Creek, Wambo, Whynot and Blakefield) planned to be mined at Drayton South. The samples were prepared at the ALS coal quality laboratory in Maitland, NSW. KLC4 is a composite of samples from within the seam and KLC5 is a composite of roof and floor samples from each seam.

Table 11

Overburden and Coal Reject Samples Selected for KLC Tests

ALS Laboratory Sample ID	Date	Drill Hole Number	Sample Name	Sample Interval (m)			Lithology	Sample Type	KLC Test Number
				From	To	Depth			
Overburden									
EB1104975-001	2/03/11	DD1158	EO 001	28.25	28.81	0.56	Sandstone	Interburden	1
EB1104975-002	2/03/11	DD1158	EO 002	37.09	37.44	0.35	Sandstone	Interburden	
EB1104975-003	2/03/11	DD1158	EO 003	60.23	60.62	0.39	Sandstone/Silt	Interburden	
EB1104975-004	2/03/11	DD1158	EO 004	66.59	67.10	0.51	Tuff	Interburden	
EB1104975-005	2/03/11	DD1158	EO 005	78.26	78.70	0.44	Sandstone	Interburden	
EB1104975-006	2/03/11	DD1158	EO 006	94.06	94.53	0.47	Sandstone	Interburden	
EB1104977-001	2/03/11	DD1156	EO 001	53.69	54.09	0.40	Sandstone	Interburden	
EB1104977-002	2/03/11	DD1156	EO 002	62.83	63.15	0.32	Sandstone	Interburden	
EB1104978-003	15/03/11	DD1151	EO 003	23.76	24.30	0.54	Siltstone/Sandstone	WA1 Overburden	2
EB1104978-005	15/03/11	DD1151	EO 005	26.87	27.46	0.59	Sandstone	WA2 Overburden	
EB1104978-006	15/03/11	DD1151	EO 006	31.58	31.95	0.37	Siltstone	WA2 Overburden	
EB1104978-007	15/03/11	DD1151	EO 007	38.19	38.54	0.35	Claystone/Siltstone	WN3 Overburden	
EB1104981-001	2/03/11	DD1163	EO 001	17.46	17.88	0.42	Sandstone	Interburden	3
EB1104981-002	2/03/11	DD1163	EO 002	25.02	25.37	0.35	Sandstone	Interburden	
EB1104981-003	2/03/11	DD1163	EO 003	28.71	29.11	0.40	Sandstone	Interburden	
EB1104981-004	2/03/11	DD1163	EO 004	39.76	40.07	0.31	Siltstone	Interburden	
EB1104981-005	2/03/11	DD1163	EO 005	54.08	54.44	0.36	Sandstone	Interburden	
EB1104981-006	2/03/11	DD1163	EO 006	60.81	61.24	0.43	Sandstone	Interburden	
Coal Rejects									
EB1105959001	23/03/11	Composite of DD1123, DD1126, DD1126A, DD1146						SCK Coal Reject	4
EB1105959002	23/03/11	Composite of DD1123, DD1126, DD1126A, DD1146						SCK Roof/Floor	5

5.5.1 KLC Test Results

The geochemical results and trends obtained for the two KLC tests on composite overburden samples are presented in **Attachment C**. **Tables KLC1** to **KLC5** provide KLC test data, selected components of which are shown graphically in **Figures KLC1** to **KLC5**.

The KLC leachate concentrations in Table are presented alongside ANZECC & ARCANZ (2000) guideline values for livestock drinking water quality. These guidelines are provided for context only and are not intended to be interpreted as “maximum permissible levels” for site water storage or discharge. It should be noted that the ratio of sample to water in most of the KLC tests is approximately 2:1 (w/v) (ie. concentrated), whereas the ratio of sample to water generally used in tests where results can (arbitrarily) be compared against guideline concentrations to provide relevant context is an order of magnitude more dilute at 1:5 (w/v). Whilst arbitrary comparisons against guideline concentrations can be useful in some situations and help to provide relevant context, such comparisons cannot be directly extrapolated to the field situation at the project.

The KLC test results obtained over the 12 week test period indicate that:

- Leachate from the KLC tests ranges from pH neutral (6.61) tomoderately alkaline (9.55) and typically has excess alkalinity. Leachate from overburden generally has a more alkaline pH value than leachate from coal reject;
- The EC value of leachate from the KLC tests ranges from 48 to 4,140 µS/cm. Leachate from overburden typically has a low EC value (<500 µS/cm) whilst leachate from coal rejects typically has a higher EC value (> 1,000 µS/cm), although for all samples the EC value in leachate tends to decrease with time;
- The acidity of leachate from the KLC tests is low and ranges from <1 to 5 mg$CaCO_3$/L[1]. The acidity of leachate from overburden is typically less than the analytical detection limit whereas the acidity from coal rejects is measurable.
- The alkalinity of leachate from the KLC tests on both overburden and coal reject ranges from 4 to 84 mg $CaCO_3$/L and is fairly consistent over the 12 week test period;
- The concentrations of soluble calcium and magnesium in leachate from the KLC tests have been used to calculate the residual ANC in these KLC test materials. The results indicate that most of the originally measured ANC (≥ 96%) remains in the composite samples and should continue to provide excess alkalinity for a significant period of time;
- The concentration of soluble sulfate in leachate from the KLC tests has been used to calculate the residual sulfur content of the sample materials. The results show that ≥ 87 % of the total sulfur content of each sample remains in the samples after 12 weeks of leaching;
- The concentration of soluble sulfate in leachate from the KLC tests is low and for overburden remains at an order of magnitude lower than the applied ANZECC (2000) water quality guideline for this anion (1,000 mg/L). For coal reject, the sulfate concentration in leachate is higher but still remains within the applied guideline value; and
- The concentration of soluble trace metals in leachate from the KLC tests is low and remains well within applied (ANZECC (2000[2]) water quality guidelines for all metals/metalloids tested for except for molybdenum and selenium concentration which are slightly elevated in leachate from some samples, although the elevated concentrations tend to decrease over time.

Potential implications of these results with respect to management of overburden and coal reject materials at the Project are discussed in **Section 6.0.**

[1] The units of mg/L $CaCO_3$ have been used for both alkalinity and acidity results in this report to facilitate data comparison.

[2]There are no guidelines and regulatory criteria specifically related to runoff and seepage from overburden spoil and coal reject materials since guidelines (and regulatory criteria) will depend upon the end-use and receiving environment. Therefore, to provide relevant context, RGS has compared the soluble concentration of each element leached from KLC test materials to ANZECC & ARCANZ (2000) livestock drinking water guidelines. These guidelines allow for concentrations of individual parameters appropriate for an industrial facility in a rural area and are more appropriate (in the context of the project) than guidelines designed for water to be used for human consumption or being directly discharged into an aquatic environment (*eg.* stream, river or lake).

5.6 Spontaneous Combustion

Drayton Mine's operations are within the Greta Coal Measures, which occur several hundred metres below the Wittingham Coal Measures, which are present at the Project. There are several differences in the coal and sediments of these two coal measures, one of which is the amount of sulfur present, specifically pyritic sulfur.

For spontaneous combustion to occur a heat source and fuel are required. The spontaneous combustion issues at the current Drayton Mine relate primarily to pyrite (iron sulphide) oxidising (exothermic reaction) in the presence of combustible material (coal and/or other highly carbonaceous material). At the Project the sulfur content is much lower (generally well under 0.5% as demonstrated by coal reject results in **Section 5.1.2**) than Drayton Mine and most of the sulfur is organic with very minor pyritic. Within the overburden and interburden there is very little sulfur with several samples returning results below the laboratory LoR (ie. <0.01 %S). There is therefore very low probability for spontaneous combustion *in situ* or in spoil dumps.

Coal left in stockpiles for an extended period of time especially if uncompacted and exposed to wind is a separate issue. There is a low probability for coals to be stockpiled for extended periods, but excessive time periods and favourable conditions can lead to spontaneous combustion in most coals. Coal stockpiles are currently well managed to prevent spontaneous combustion at Drayton Mine and this practice will continue at the proposed Project.

6.0 DISCUSSION

6.1 Acid Base Account Test Results

The results of the ABA tests presented in **Section 5.1**, indicate that all (100%) of overburden material tested is NAF and has a high factor of safety with respect to potential acid generation. The overburden samples tested have very low (≤0.1%) total oxidisable sulfur content and are therefore classified as NAF-barren. Most overburden materials also have significant acid buffering capacity (moderate to high ANC value), which is more than enough to buffer the negligible amount of acidity that could theoretically be generated from these materials. Overall, from an acid-base perspective, the overburden material tested can be regarded as a NAF unit containing excess neutralising capacity.

The results of the ABA tests indicate that the overwhelming majority of the coal reject material tested is NAF and has a high factor of safety with respect to potential acid generation. In particular, the composite coal reject samples, which provide the most representative samples of coal reject material, have very low total oxidisable sulfur content (<0.1 %). The composite samples also have significant acid buffering capacity (moderate to high ANC value), which is more than enough to buffer the negligible amount of acidity that could theoretically be generated from these materials. Overall, from an acid-base perspective, the coal reject material tested can also be regarded as a NAF unit containing excess neutralising capacity.

Calculation of residual ANC remaining in the composite overburden and coal reject materials used in KLC tests indicates that much of the original measured ANC remains in these materials and is likely to continue to provide excess alkalinity for a significant period of time.

The concentration of soluble sulfate in leachate from the KLC tests is lower in the overburden samples than the coal reject samples and the sulfate generation rate shows some variability but is relatively consistent over the 12 week test period. The sulfate generation rate for each of the composite overburden and coal reject samples used in the KLC tests has been calculated as shown in **Table 12**.

Table 12

Oxidation Rates for Overburden and Coal Reject Materials

KLC Sample Name	Sulfate Generation Rate (mg/kg/week)	Oxidation Rate (kg $O_2/m^3/s$)
Composite Overburden(KLC1)	15.6	2.3×10^{-8}
Composite Overburden(KLC2)	18.2	2.7×10^{-8}
Composite Overburden(KLC3)	8.1	1.2×10^{-8}
Composite Coal reject (KLC4)	15.5	2.3×10^{-8}
Composite Coal reject (KLC5)	63.1	9.3×10^{-8}

The sulfate generation rate from the overburden KLC samples ranges from 8.1 to 63.1mg/kg/week which suggests that the rate of sulfide oxidation is low to moderate in these materials (equivalent to an oxidation rate ranging from 1.2×10^{-8} to 9.3×10^{-8} kg $O_2/m^3/s$). Results of previous KLC test work completed as part of a mining industry sponsored study program (AMIRA, 1995) indicate that mine materials with an oxidation rate of $<5 \times 10^{-8}$kg $O_2/m^3/s$ and low to moderate ANC levels have a high factor of safety and are likely to generate pH neutral to alkaline leachate. Hence, of the five composite overburden and coal reject samples tested, only sample KLC5 has a slightly higher oxidation rate than the value described above. However, the oxidation rate in this material appears to be diminishing with time and this material also has a high ANC value and is therefore extremely unlikely to generate acid leachate.

Overall it is expected that the overburden and coal reject materials generated at the Project will have a very low risk of generating Acid and Metalliferous Drainage (AMD).

6.2 Multi-Element Composition and Water Quality

6.2.1 Multi-Element Composition

The multi-element compositions of overburden and coal reject samples are presented at **Section 5.2**, along with a comparison with applied guideline concentrations. The acquired data indicate that all total metal/metalloid concentrations in overburden and coal reject samples are well below the applied NEPC (2013) HIL(C) guideline values, where such guideline values exist. Similarly, the overwhelming majority of overburden and coal reject materials are not significantly enriched with any elements compared to average crustal abundance. Hence, overburden and coal reject materials represented by the samples should not present a significant risk to the environment with respect to total metal/metalloid concentrations in solids.

6.2.2 Water Quality

Static and KLC test results indicate that initial and ongoing surface run-off/seepage from overburden and coal reject materials is likely to be pH neutral to slightly alkaline. The dominant major soluble cation is sodium and the dominant major soluble anions are typically bicarbonate, chloride and sulfate. The concentration of all of these ions in run-off and seepage is expected to decrease over time. In addition, the salinity of surface run-off and seepage from overburden is expected to be low and from coal reject is expected to be elevated, although the salinity of surface run-off and seepage from both materials is likely to decrease with time. The concentration of soluble sulfate in surface run-off and seepage is expected to be low for overburden and remain well within the applied (ANZECC & ARCANZ, 2000) water quality guideline concentration for this anion. For coal reject, the sulfate concentration in surface runoff and seepage is expected to be higher, but still remain within the guideline value. Hence, the risk of potential impact on the quality of surface and groundwater from the Project should be low for overburden and coal reject materials, although this finding should be confirmed by the ongoing water quality monitoring program for surface water and groundwater at the Project.

Most trace metals in overburden and coal reject are sparingly soluble at the predicted neutral to slightly alkaline pH of surface run-off/seepage and dissolved concentrations are expected to be low compared to the applied water quality guideline criteria (ANZECC & ARCANZ, 2000) livestock drinking water guidelines. Minor exceptions may include molybdenum and selenium and it is recommended that these elements be included in the water quality monitoring program for overburden and coal reject emplacement areas at the Project.

A review of available groundwater and surface water data at Saddlers Creek indicates that the water extract and KLC test results described above are reasonably consistent with background water quality data.

6.3 Revegetation and Rehabilitation

The following discussion provides some context to the soil chemistry of overburden materials, should these report to final overburden and coal reject emplacement surfaces. From a soil chemistry view point, the overburden and potential coal reject materials are likely to be pH neutral to slightly alkaline. The overburden materials will generally have low salinity levels compared to coal reject materials, although salinity levels in coal reject should diminish over time. Both overburden and coal reject materials display moderate to high eCEC values, which should not hinder revegetation.

The sodicity of overburden materials is expected to be low in the sandstone material, but could be elevated in the relatively small volumes of mudstone and tuff. The sodicity of the coal reject materials is relatively high compared to most overburden materials.

Where the EC is relatively low, such as in the overburden samples, soils are considered sodic if the ESP value is greater than 6% and less than 14% and strongly sodic if the ESP is 15 or more (Isbell, 2002; and Northcote and Skene, 1972). Materials classified as sodic may be prone to dispersion and erosion. Hence, some overburden materials (mudstone and tuff) likely to report to overburden emplacement areas at the Project may have structural stability problems related to potential dispersion. ESP values for overburden indicate that sandstone is less sodic and may be more suitable for revegetation and rehabilitation activities (in final landform surfaces or as a growth medium) for the Project. It is therefore recommended that sandstone be preferentially placed at the outer surfaces of overburden emplacement areas. If it is not practical for this to occur, it is recommended that the rehabilitation practices for potentially sodic overburden at the Project include a topsoil cover as part of final rehabilitation to limit the risk of dispersion and erosion of surface materials.

Coal reject materials are likely to be sodic and prone to dispersion and erosion. However, it is understood that these materials will report to the North Void area at the Project and will be covered with overburden (spoil) as part of final rehabilitation to limit the risk of dispersion and erosion of surface materials.

6.4 Spontaneous Combustion

There is a very low probability for spontaneous combustion *in situ* or in spoil dumps at the Project. Coal rejects also have a low propensity to spontaneously combust and will be used to backfill the North Void area at the Project. There is a low probability for coals to be stockpiled for extended periods, however excessive time periods and favourable conditions can lead to spontaneous combustion in most coals. Coal stockpiles are currently well managed to prevent spontaneous combustion at the current Drayton Mine and this practice will continue at the proposed Project.

7.0 CONCLUSIONS AND POTENTIAL MANAGEMENT MEASURES

7.1 Conclusions

RGS has completed a geochemical impact assessment of representative overburden and coal reject materials from the Project. The findings of the assessment align well with those of the previous desktop geochemical assessment completed by RGS in January 2010 (RGS, 2010). It is concluded that:

- Overburden and most coal reject materials are expected to have very low oxidisable sulfur content, significant excess ANC, and be classified as NAF;
- Overburden and most coal reject materials are likely to have a high factor of safety with respect to potential acid generation and AMD;
- The concentration of total metals/metalloids in overburden and coal reject materials is well below applied guideline criteria for soils and is unlikely to present any environmental issues associated with revegetation and rehabilitation;
- Overburden and coal reject materials reporting to emplacement areas will generate pH neutral to slightly alkaline run-off/seepage with low and moderate salinity values, respectively, following surface exposure. The salinity of run-off/seepage from these materials is expected to decrease over time;
- The concentration of trace metals/metalloids in run-off and seepage from most overburden and coal reject material is likely to be low;
- Overall, the risk of potentially significant water quality impacts from overburden and coal reject materials is low;
- Some overburden and most coal reject materials may be sodic and have structural stability problems related to potential dispersion and erosion; and
- There is a low probability of spontaneous combustion either *in situ* or for coal, overburden and coal reject materials at the Project.

7.2 Potential Management Measures

The ongoing management of overburden and coal reject materials at the Project should consider the geochemistry of these materials with respect to their potential risk to cause harm to the environment and their suitability for use in construction and revegetation. As such the following recommendations are put forward:

- Pre-stripping topsoil from areas to be disturbed for use in final rehabilitation activities (surface cover or vegetation growth medium); and
- Implementing practical site rehabilitation practices for potentially sodic overburden and coal reject materials to limit the risk of dispersion and erosion of surface materials at emplacement areas (eg. utilise a topsoil cover as part of final rehabilitation).

Surface water and seepage from overburden and coal reject emplacement areas should be monitored to ensure that key water quality parameters remain within appropriate criteria. It is therefore recommended that:

- Monitoring of surface run-off and seepage from the proposed overburden and coal reject emplacement areas for pH, EC, TSS be undertaken on a quarterly basis and dissolved trace metals and sulfate on an annual basis.

8.0 REFERENCES

ACARP (2008). *Development of ARD Assessment for Coal Process Wastes*. ACARP Project C15034. Report prepared by Environmental Geochemistry International and Levay and Co. Environmental Services, University of South Australia, July 2008.

AGE (2009). *Report on Mt Arthur Coal Consolidation Project. Groundwater Impact Assessment.* Australian Groundwater and Environmental Consultants Pty Ltd Project No. G1446. Prepared for Hansen Bailey Pty Ltd, June 2009.

AMIRA (1995). Mine Waste Management: *Project P387 Prediction and Identification of Acid Forming Mine Waste*. Australian Minerals Industry Research Association, Report prepared by EGi Pty Ltd, August 1995.

AMIRA (2002). *ARD Test Handbook: Project 387A Prediction and Kinetic Control of Acid Mine Drainage*. Australian Minerals Industry Research Association, Ian Wark Research Institute and Environmental Geochemistry International Pty Ltd, May 2002.

ANZECC & ARCANZ (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT (2000). Livestock drinking water.

DITR (2007). Department of Industry, Tourism and Resources. *Leading Practice Sustainable Development Program for the Mining Industry. Managing Acid and Metalliferous Drainage*. February 2007, Canberra ACT.

Hansen Bailey (2009). Mount Arthur Coal Consolidation Project. Environmental Assessment. Report prepared by Hansen Bailey Pty Ltd for Hunter Valley Energy Coal Pty Ltd, November 2009.

Hazelton P.A and Murphy B.W. (2007). *Interpreting Soil Test Results: What Do All The Numbers Mean?* Second Edition. CSIRO Publishing, Victoria.

Envirosciences Pty Limited (1992). *Environmental Impact Statement for Drayton South Coal Mine*, Document F156, Volume 4, Appendix 15 Chemical Characteristics of Overburden).

INAP (2009). *Global Acid Rock Drainage Guide (GARD Guide).* Document prepared by Golder Associates on behalf of the International Network on Acid Prevention (INAP). June 2009 (http://www.inap.com.au/).

Isbell R.F. (2002). The Australian Soil Classification (revised edition). CSIRO Publishing. Victoria.

NEPC (2013). National Environmental Protection Council (NEPC). National Environmental Protection (Assessment of Site Contamination) Measure (NEPM). Guideline on investigation levels for soil and groundwater. HIL(C); recreational open spaces.

Northcote, K.H., and Skene, J.K.M. (1972). *Australian Soils with Saline and Sodic properties.* CSIRO Australia, Soil Publication No. 27, Canberra.

Pratt W. (1995). *Geology and Coal Resources of the Saddlers Creek Area.* Department of Mineral Resources Coal and Petroleum Geology Branch Report. Volume 1 Report, Appendix I – Seam Resource Detail Tables and Appendix III – Mining Potential. CGB Report No. 95/006, June 1995.

RGS (2010). Drayton South Project. Desktop Geochemical Assessment of Overburden and Potential Coal Reject & Proposal to Undertake a Geochemical Assessment as part of a Future Environmental Assessment. RGS Project No. 091018,January 2010.

RGS (2011). Drayton South Project. Geochemical Assessment of Overburden and Potential Coal Reject. Sampling and Testing Protocol. RGS Project No. 091018, January 2011.

SCJV (2005). *Saddlers Creek Coal Development Area EL5460. Underground resources of the Woodlands Hill, Arrowfield, Bowfield & Warkworth Seams. Geological Report.* Saddlers Creek Joint Venture, August 2005.

9.0 LIMITATIONS

RGS has prepared this report for the use of Hansen Bailey and Anglo American. It is based on accepted consulting practices and standards and no other warranty is made as to the professional advice included in this assessment. It is prepared in accordance with the scope of work and for the purpose outlined in RGS Proposal Number 201443, submitted to Hansen Bailey on 27 November 2014.

This assessment was prepared in February 2015 and is based on the information provided by Hansen Bailey and Anglo American at the time of preparation. RGS disclaims responsibility for any changes that may have occurred after this time.

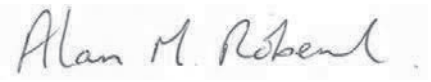
The sources of information and methodology used by RGS are outlined in this report and no independent verification of this information has been made. RGS assumes no responsibility for any inaccuracies or omissions, although no indication was found that any information contained in this assessment as provided to RGS was incorrect.

This assessment should be read in full. No responsibility is accepted for use of any part of this assessment in any other context or for any other purpose or by third parties. This assessment does not provide legal advice, which can only be given by qualified legal practitioners.

If you have any questions regarding the information presented in this report, please contact the under signed on (+617) 3344 1222 or (+61) 431 620 623.

Yours sincerely,

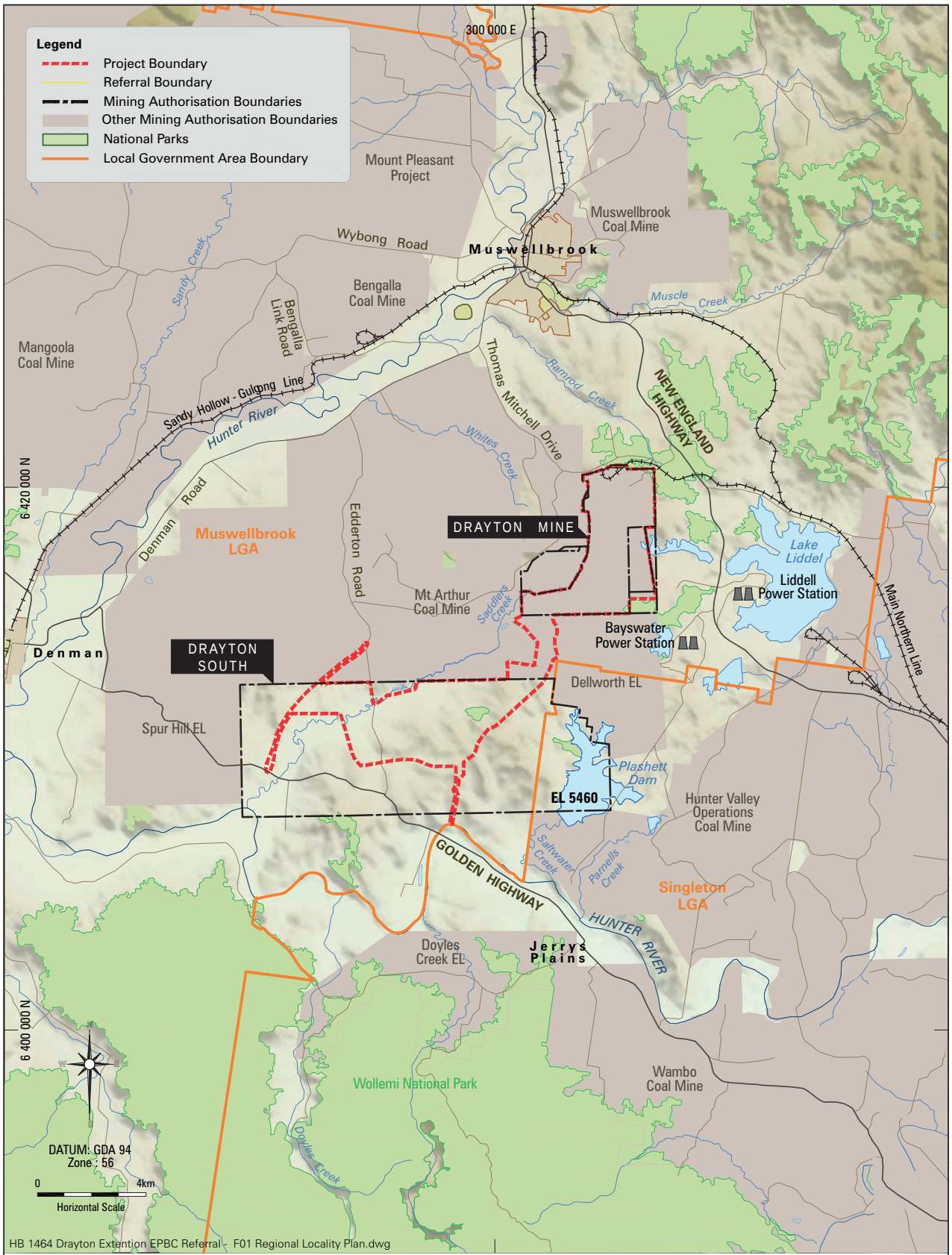
RGS ENVIRONMENTAL PTY LTD



Dr. Alan M. Robertson
Principal Geochemist/Director

ATTACHMENT A

Figures



Data Source: Client Supplied

RGS Environmental Pty Ltd
PO Box 3091, Sunnybank South QLD 4109 Australia
Tel/Fax +61 7 3344 1222
Mobile 0431 620 623
Email alan@rgsenv.com

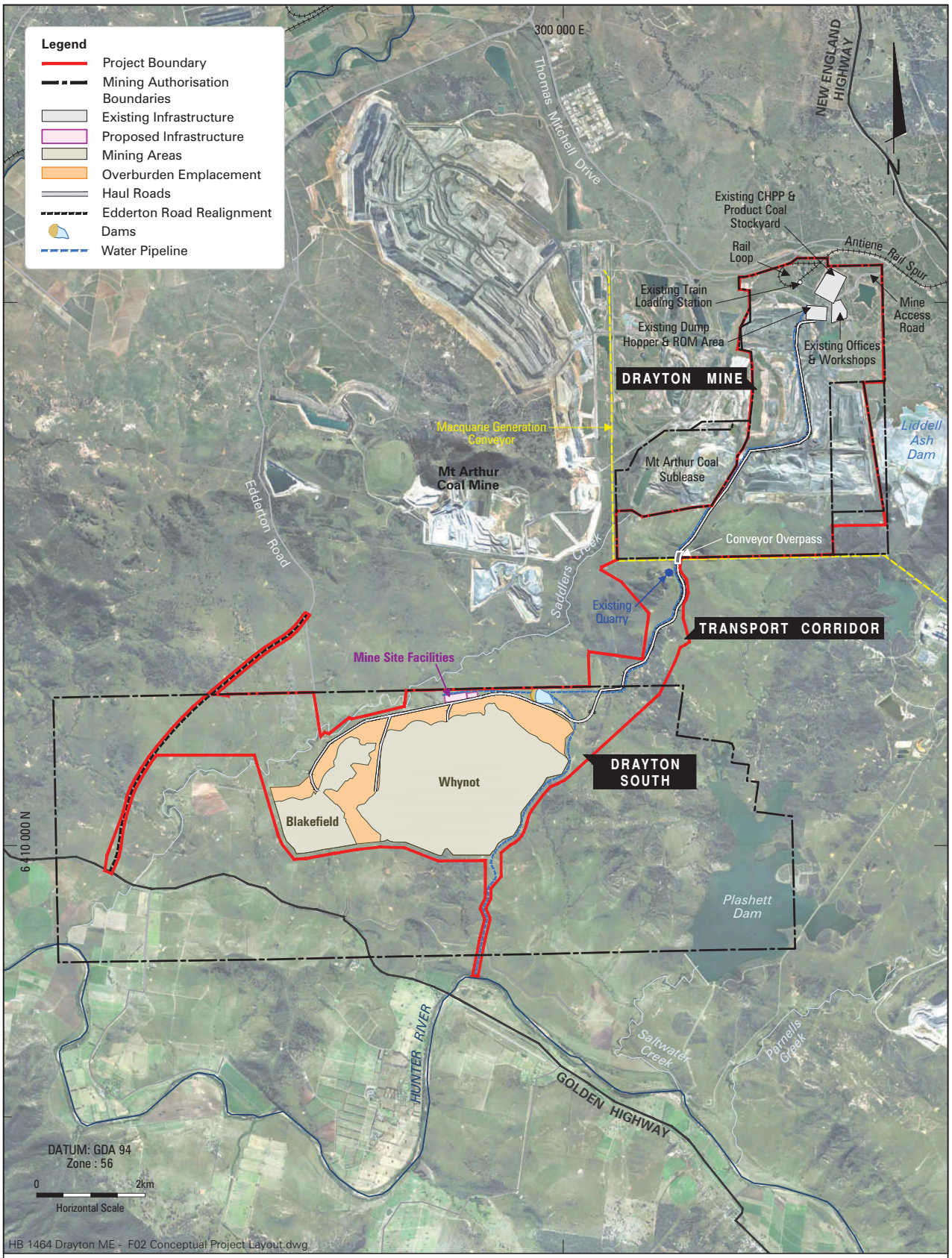
File: 201443-001 A4
Date: 16/02/2015

HANSEN BAILEY ENVIRONMENTAL CONSULTANTS

GEOCHEMICAL ASSESSMENT OF OVERBURDEN AND COAL REJECT MATERIALS
DRAYTON SOUTH COAL PROJECT

Figure: **1**

REGIONAL LOCALITY PLAN



Data Source: Client Supplied

RGS Environmental Pty Ltd
PO Box 3091, Sunnybank South QLD 4109 Australia
Tel/Fax +61 7 3344 1222
Mobile 0431 620 623
Email alan@rgsenv.com

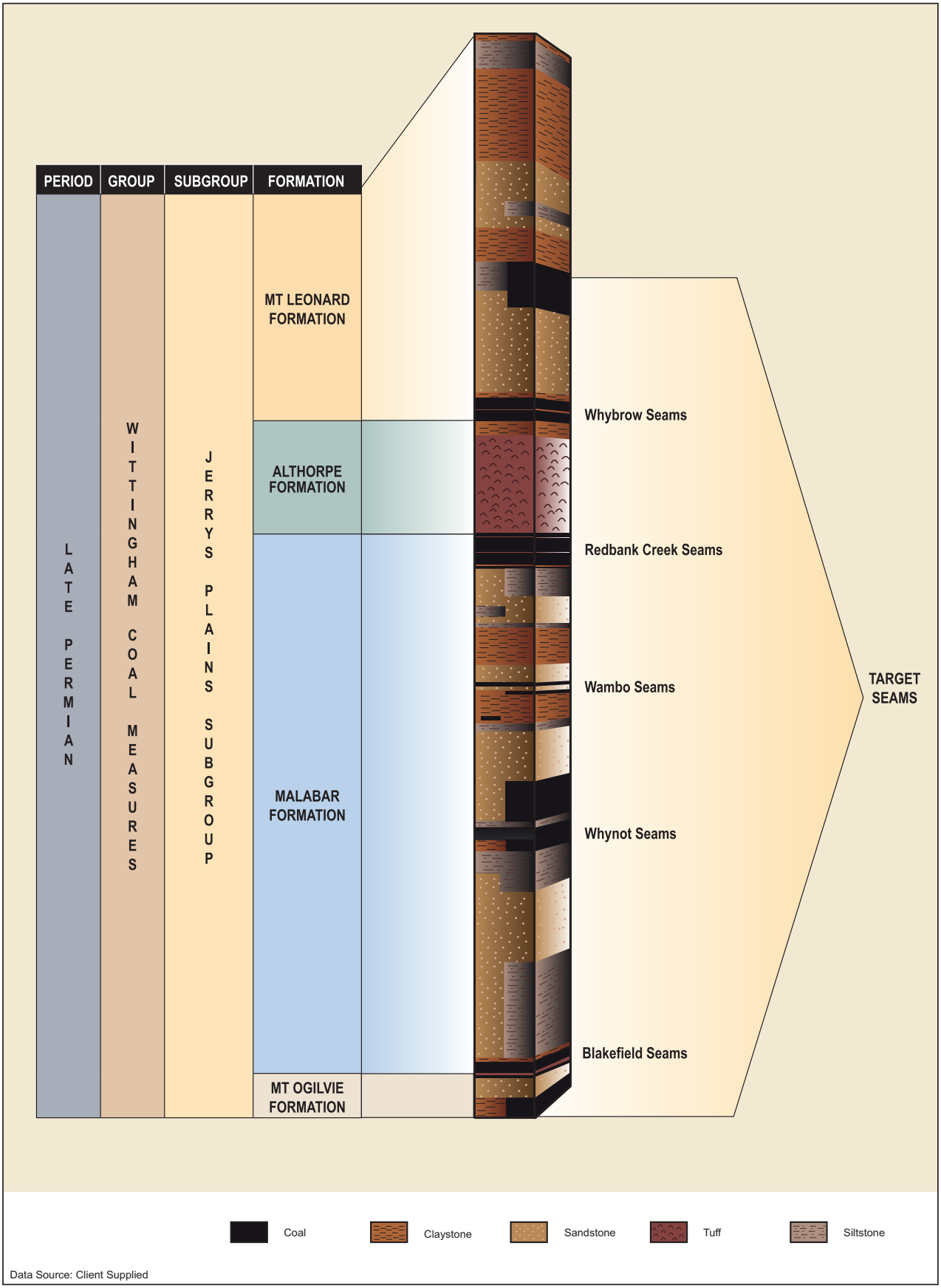
File: 201443-002 A4
Date: 16/02/2015

HANSEN BAILEY ENVIRONMENTAL CONSULTANTS

GEOCHEMICAL ASSESSMENT OF OVERBURDEN AND COAL REJECT MATERIALS
DRAYTON SOUTH COAL PROJECT

Figure: **2**

CONCEPTUAL PROJECT LAYOUT



Data Source: Client Supplied

RGS Environmental Pty Ltd
PO Box 3091, Sunnybank South QLD 4109 Australia
Tel/Fax +61 7 3344 1222
Mobile 0431 620 623
Email alan@rgsenv.com

File: 201443-003 A4
Date: 16/02/2015

HANSEN BAILEY ENVIRONMENTAL CONSULTANTS

GEOCHEMICAL ASSESSMENT OF OVERBURDEN AND COAL REJECT MATERIALS
DRAYTON SOUTH COAL PROJECT

Figure: **3**

INDICATIVE STRATIGRAPHIC COLUMN

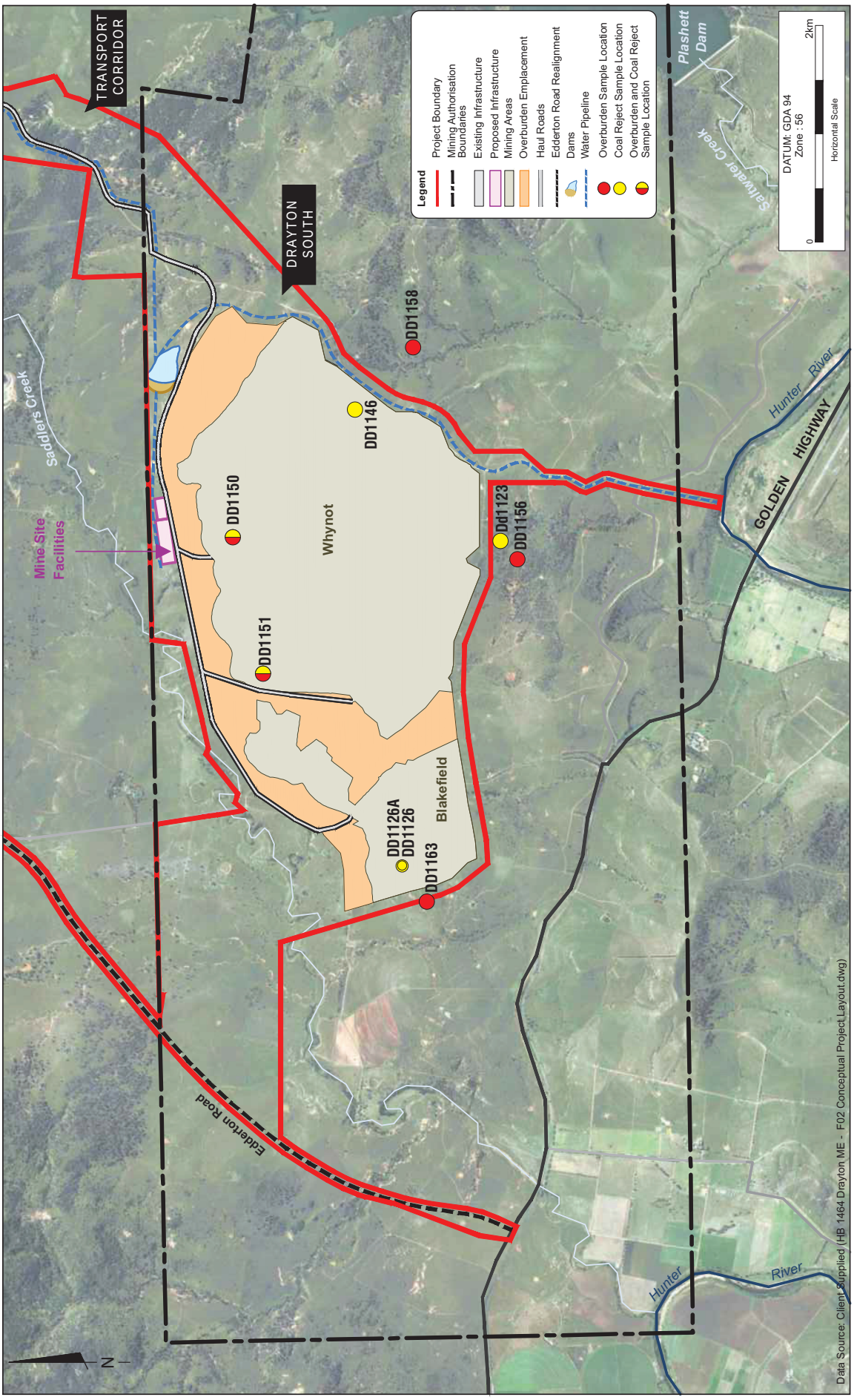


Figure:4

DRILL HOLE LOCATIONS USED FOR GEOCHEMICAL SAMPLING PROGRAM

HANSEN BAILEY ENVIRONMENTAL CONSULTANTS

GEOCHEMICAL ASSESSMENT OF OVERBURDEN AND COAL REJECT MATERIALS
DRAYTON SOUTH COAL PROJECT

RGS Environmental Pty Ltd
PO Box 3091, Sunnybank South QLD 4109 Australia
Tel/Fax +61 7 3344 1222
Mobile 0431 620 623
Email alan@rgsenv.com

File: 201443-004 A4
Date: 16/02/2015

ATTACHMENT B

Geochemical Assessment of Mine Waste Materials

ATTACHMENT B

GEOCHEMICAL ASSESSMENT OF MINE WASTE MATERIALS

ACID GENERATION AND PREDICTION

Acid generation is caused by the exposure of sulfide minerals, most commonly pyrite (FeS_2), to atmospheric oxygen and water. Sulfur assay results are used to calculate the maximum acid that could be generated by the sample by either directly determining the pyritic S content or assuming that all sulfur not present as sulfate occurs as pyrite. Pyrite reacts under oxidising conditions to generate acid according to the following overall reaction:

$$FeS_2 + 15/4\ O_2 + 7/2\ H_2O \rightarrow Fe(OH)_3 + 2\ H_2SO_4$$

According to this reaction, the maximum potential acidity (MPA) of a sample containing 1%S as pyrite would be 30.6 kg H_2SO_4/t. The chemical components of the acid generation process consist of the above sulfide oxidation reaction and acid neutralization, which is mainly provided by inherent carbonates and to a lesser extent silicate materials. The amount and rate of acid generation is determined by the interaction and overall balance of the acid generation and neutralisation components.

Net Acid Producing Potential

The net acid producing potential (NAPP) is used as an indicator of materials that may be of concern with respect to acid generation. The NAPP calculation represents the balance between the maximum potential acidity (MPA) of a sample, which is derived from the sulphide sulfur content, and the acid neutralising capacity (ANC) of the material, which is determined experimentally. By convention, the NAPP result is expressed in units of kg H_2SO_4/t sample. If the capacity of the solids to neutralise acid (ANC) exceeds their capacity to generate acid (MPA), then the NAPP of the material is negative. Conversely, if the MPA exceeds the ANC, the NAPP of the material is positive. A NAPP assessment involves a series of analytical tests that include:

Determination of pH and EC

pH and EC measured on 1:5 w/w water extract. This gives an indication of the inherent acidity and salinity of the waste material when initially exposed in a waste emplacement area.

Total Sulfur Content and Maximum Potential Acidity

Total sulfur content is determined by the Leco high temperature combustion method. The total sulfur content is then used to calculate the MPA, which is based on the assumption that the entire sulfur content is present as reactive pyrite. Direct determination of the pyritic sulfur content can provide a more accurate estimate of the MPA.

Acid Neutralising Capacity

By addition of acid to a known weight of sample, then titration with NaOH to determine the amount of residual acid. The ANC measures the capacity of a sample to react with and neutralise acid. The ANC can be further evaluated by slow acid titration to a set end-point in the Acid Buffering Characteristic Curve (ABCC) test through calculation of the amount of acid consumed and evaluation of the resultant titration curve.

Net Acid Producing Potential

Calculated from the MPA and ANC results. The NAPP represents the balance between a sample's inherent capacities to generate and neutralise acid. If the MPA is greater than the ANC then the NAPP is positive. If the MPA is less than the ANC then the sample then the NAPP is negative.

Net Acid Generation

The net acid generation (NAG) test involves the addition of hydrogen peroxide to a sample of mine rock or process residue to oxidise reactive sulfide, then measurement of pH and titration of any net acidity produced by the acid generation and neutralisation reactions occurring in the sample. A significant NAG result (*i.e.* final NAG_{pH}< 4.5) indicates that the sample is potentially acid forming (PAF) and the test provides a direct measure of the net amount of acid remaining in the sample after all acid generating and acid neutralising reactions have taken place. A NAG_{pH}> 4.5 indicates that the sample is non-acid forming (NAF). The NAG test provides a direct assessment of the potential for a material to produce acid after a period of exposure and weathering and is used to refine the results of the theoretical NAPP predictions. The NAG test can sometimes be used as a stand-alone test at some hard rock mines, but is recommended that this only be considered after site specific calibration work is carried out. The NAG test can generate false positive results for waste materials from coal mines containing elevated organic carbon and is currently not used by RGS for coal mine wastes.

ASSESSMENT OF ELEMENT ENRICHMENT AND SOLUBILITY

In mineralised areas it is common to find a suite of enriched elements that have resulted from natural geological processes. Multi-element scans are carried out to identify any elements that are present in a material (or readily leachable from a material) at concentrations that may be of environmental concern with respect to surface water quality, revegetation and public health. The samples are generally analysed for the following elements:

Major elements	Al, Ca, Fe, K, Mg, Na and S.
Minor elements	As, B, Cd, Co, Cr, Cu, F, Hg, Mn, Mo, Ni, Pb, Sb, Se and Zn.

The concentration of these elements in samples can be directly compared with relevant state or national environmental and health based concentration guideline criteria to determine the level of significance. Water extracts are used to determine the immediate element solubilities under the existing sample pH conditions of the sample. The following tests are normally carried out:

Multi-element Composition of Solids

Multi-element composition of solid samples determined using a combination of ICP-mass spectroscopy (ICP-MS), ICP-optical emission spectroscopy (OES), and atomic absorption spectrometry (AAS).

Multi-element Composition of Water Extracts (1:5 sample:deionised water)

Multi-element composition of water extracts from solid samples determined using a combination of ICP-mass spectroscopy (ICP-MS), ICP-optical emission spectroscopy (OES), and atomic absorption spectrometry (AAS).

Under some conditions (*e.g.* low pH) the solubility and mobility of common environmentally important elements can increase significantly. If element mobility under initial pH conditions is deemed likely and/or subsequent low pH conditions may occur, kinetic leach column test work may be completed on representative samples.

KINETIC LEACH COLUMN TESTS

Kinetic leach column tests can be used to provide information on the reaction kinetics of mine waste materials. The major objectives of kinetics tests are to:

- Provide time-dependent data on the kinetics and rate of acid generation and acid neutralising reactions under laboratory controlled (or onsite conditions);
- Investigate metal release and drainage/seepage quality; and
- Assess treatment options such as addition of alkaline materials.

The kinetic tests simulate the weathering process that leads to acid and base generation and reaction under laboratory controlled or site conditions. The kinetic tests allow an assessment of the acid forming characteristics and indicate the rate of acid generation, over what period it will occur, and what management controls may be required.

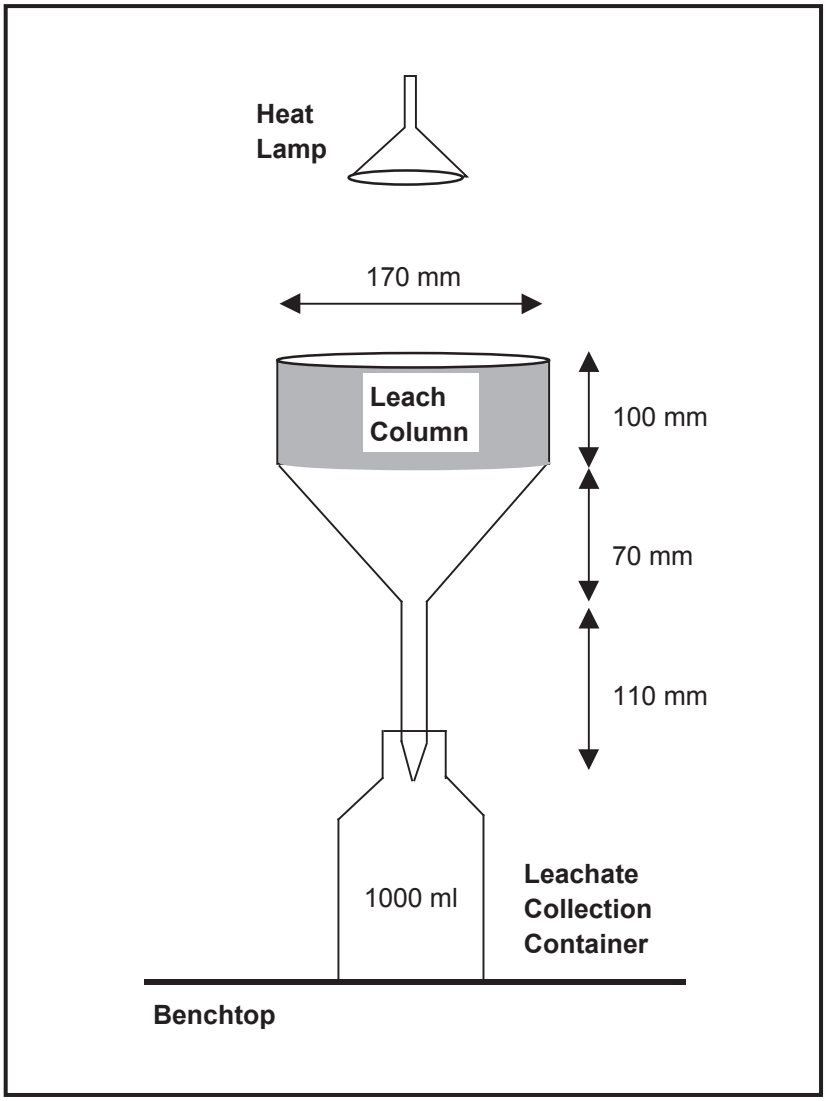
In kinetic column leach tests, water is added to a sample and the mixture allowed to leach products and by-products of acid producing and consuming reactions. Samples of leachate are then collected and analysed. Intermittent water application is applied to simulate rainfall and heat lamps are used to simulate sunshine. These tests provide real-time information and may have to continue for months or years. Monitoring includes trends in pH, sulfate, acidity or alkalinity, and metals, for example. The pH of the collected leachate simulates the acid drainage process, acidity or alkalinity levels indicate the rate of acid production and acid neutralisation, and sulfate production can be related to the rate of sulfide oxidation. Metal concentration data provides an assessment of metal solubility and leaching behaviour.

Figure B1 shows the kinetic leach column set up used by RGS adapted from *AMIRA, 2002*. The columns are placed under heat lamps to allow the sample to dry between water additions to ensure adequate oxygen ingress into the sample material.

Approximately 2 to 3 kg of sample is generally used in the leach columns and depending on the physical nature of the material and particle size can be used on an as-received basis (*i.e.* no crushing as with process residues) or crushed to nominal 5 to 10 mm particle size (as with overburden). The sample in the column is initially leached with deionised water at a rate of about 500 ml/kg of sample and the initial leachate from the columns collected and analysed. Subsequent column leaching is carried out at a rate of about 500 ml/kg per month and again collected and analysed. The leaching rate can be varied to better simulate expected site conditions or satisfy test program data requirements. The column must be exposed to drying conditions in between watering events. The residual water content and air void content in the column can be determined by comparing the wet and dry column weights. A heat lamp is generally used above the sample during daylight hours to maintain the leach column surface temperature at about 30^{o}C.

Figure B1

Kinetic Leach Column Setup



Reference:

AMIRA (2002). AMIRA International. *ARD Test Handbook. Project P387A Prediction & Kinetic Control of Acid Mine Drainage.* Ian Wark Institute and Environmental Geochemistry International Pty Ltd. May 2002, Melbourne, VIC.

ATTACHMENT C

Kinetic Leach Column Test Results and Trends

Table KLC1

KLC1 Test Results: Overburden 1

Sample Weight (kg)	1.1	**Total S (%)**		0.042	**ANC ($kg H_2SO_4/t$)**		86	
pH(1:5)	9.5	**S_{CR} (%)**		0.016	**NAPP ($kg H_2SO_4/t$)**		-85.5	
EC(1:5) (µS/cm)	203	**MPA ($kg H_2SO_4/t$)**		0.5	**ANC:MPA ratio**		175.5	
Date	29-Apr-11	13-May-11	27-May-11	10-Jun-11	29-Jun-11	15-Jul-11	28-Jul-11	
Leach Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Volume Collected (L)	0.78	0.79	0.70	0.55	0.67	0.73	0.73	
Cum. Volume (L)	0.78	1.57	2.27	2.82	3.49	4.22	4.95	
Pore Volumes	0.6	1.2	1.7	2.1	2.6	3.1	3.7	
pH	9.52	9.27	9.29	9.55	9.44	9.24	9.53	
EC (µS/cm)	188	194	421	351	116	78	67	
Acidity (mg/L)*	<1	<1	<1	<1	<1	<1	<1	
Alkalinity (mg/L)*	46	31	67	84	43	24	25	
Net Alkalinity (mg/L)*	46	31	67	84	43	24	25	
Dissolved elements (mg/L)								**Guideline Levels[1]**
Al	0.16	0.28	0.02	0.12	1.11	0.77	0.39	5
As	0.036	0.016	0.107	0.083	0.019	0.009	0.009	0.5
B	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	5
Ca	1	1	2	1	0.5	0.5	<1	1000
Cd	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.01
Cl	12	15	33	14	4	2	<1	-
Co	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1
Cr	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	1 / -
Cu	0.002	0.001	0.002	0.003	<0.001	<0.001	0.001	1 / 0.5
Fe	<0.05	<0.05	<0.05	<0.05	0.14	0.09	<0.05	-
K	2	1	3	3	1	1	1	-
Mg	1	1	2	1	0.5	0.5	<1	-
Mn	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Mo	0.069	0.131	0.204	0.173	0.05	0.027	0.021	0.15
Na	36	37	90	77	28	15	14	-
Ni	0.003	0.002	0.003	0.004	0.002	0.001	<0.001	1
Pb	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.1
SO_4	26	35	96	66	21	9	11	1,000
Sb	<0.001	<0.001	0.004	0.004	0.001	<0.001	<0.001	-
Se	<0.01	0.01	0.03	0.02	<0.01	<0.01	<0.01	0.02
Zn	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	20
RESULTS**								
SO_4 Release Rate	18	25	61	33	13	6	7	
Cumulative SO_4 Release	18	44	104	138	150	156	164	
Ca Release Rate	1	1	1	1	0	0	0	
Cumulative Ca Release	1	1	3	3	4	4	4	
Mg Release Rate	0.7	0.7	1.3	1	0	0	0	
Cumulative Mg Release	0.7	1.4	3	3	4	4	4	
Residual ANC (%)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
Residual Sulfur (%)	98.5	96.5	91.7	89.1	88.0	87.6	87.0	
SO_4/(Ca+Mg) molar ratio	4.1	5.5	7.6	10.4	6.6	2.8	3.5	

< indicates less than the analytical detection limit.

* Acidity and Alkalinity data calculated in mg $CaCO_3$/L ** SO4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur, S_{CR} = Chromium Reducible Sulfur, MPA = Maximum Potential Acidity, ANC = Acid Neutralising Capacity, and NAPP = Net Acid Producing Potential

1. The first guideline level shown refers to ANZECC (2000) and the second to NEPC (1999) . Where the two guidelines limits for a given element are in agreement, only one value is shown. A 'dash' represents no trigger value provided for this element.

Figure KLC1a: pH and EC trends for Overburden 1

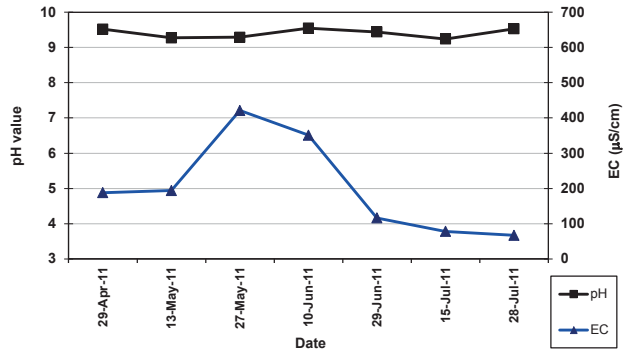


Figure KLC1c: Soluble Metal Trends for Overburden 1

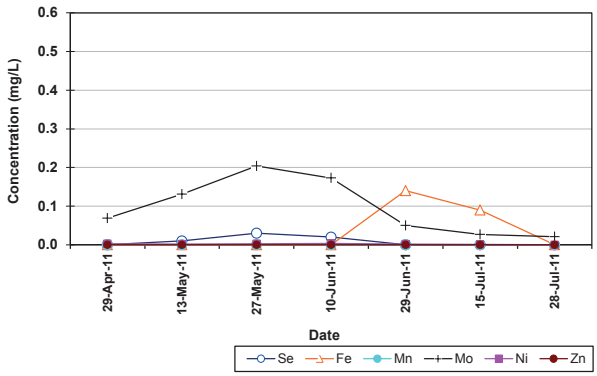


Figure KLC1b: Sulfate Release Rate and Net Alkalinity trends for

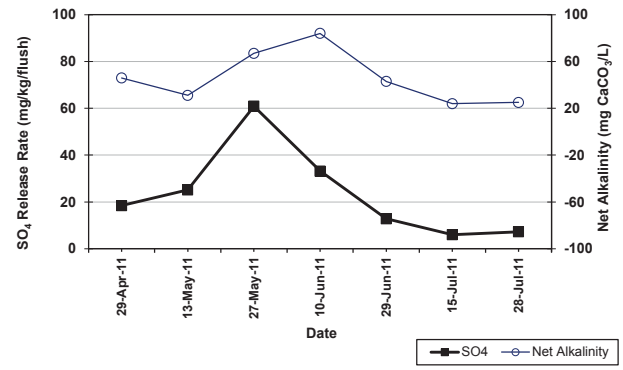


Figure KLC1d: Residual ANC and SO_4:(Ca+Mg) Trends for for Overburden 1

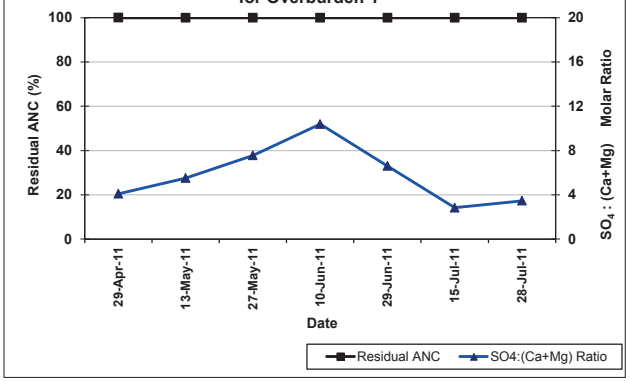


Table KLC2

KLC2 Test Results: Overburden 2

Sample Weight (kg)	1.4	**Total S (%)**		0.19	**ANC (kg H_2SO_4/t)**		18.9	
pH(1:5)	9.4	**S_{CR} (%)**		0.073	**NAPP (kg H_2SO_4/t)**		-16.7	
EC(1:5) (µS/cm)	260	**MPA (kg H_2SO_4/t)**		2.2	**ANC:MPA ratio**		8.5	
Date	29-Apr-11	13-May-11	27-May-11	10-Jun-11	29-Jun-11	15-Jul-11	28-Jul-11	
Leach Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Volume Collected (L)	0.78	0.80	0.71	0.60	0.63	0.65	0.71	
Cum. Volume (L)	0.78	1.58	2.29	2.89	3.52	4.17	4.88	
Pore Volumes	0.6	1.2	1.7	2.1	2.6	3.1	3.6	
pH	7.86	9.12	8.77	9.34	9.09	8.35	8.99	
EC (µS/cm)	239	405	470	354	320	278	179	
Acidity (mg/L)*	<1	<1	<1	<1	<1	1	1	
Alkalinity (mg/L)*	29	26	35	32	28	27	26	
Net Alkalinity (mg/L)*	29	26	35	32	28	26	25	
Dissolved elements (mg/L)								**Guideline Levels[1]**
Al	0.04	0.03	0.04	0.22	0.48	1.81	0.79	5
As	0.005	0.004	0.01	0.008	0.004	0.004	0.005	0.5
B	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	5
Ca	3	3	3	2	1	0.5	<1	1000
Cd	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001	<0.0001	0.01
Cl	26	65	70	44	42	23	12	-
Co	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	1
Cr	<0.001	<0.001	0.002	<0.001	<0.001	0.002	<0.001	1 / -
Cu	0.001	<0.001	<0.001	0.001	<0.001	0.002	0.01	1 / 0.5
Fe	<0.05	<0.05	<0.05	0.06	0.12	0.49	0.2	-
K	1	2	2	2	1	2	<1	-
Mg	2	4	4	2	2	1	<1	-
Mn	0.002	0.001	0.002	0.002	0.003	0.007	0.003	-
Mo	0.008	0.023	0.024	0.014	0.022	0.022	0.023	0.15
Na	40	72	88	71	69	50	33	-
Ni	0.003	<0.001	<0.001	<0.001	0.001	0.004	0.002	1
Pb	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.1
SO_4	32	57	82	71	73	58	40	1,000
Sb	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Se	0.01	0.04	0.05	0.04	0.04	0.03	0.02	0.02
Zn	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	20
RESULTS**								
SO_4 Release Rate	18	33	41	31	33	27	20	
Cumulative SO_4 Release	18	50	92	122	155	182	202	
Ca Release Rate	2	2	2	1	0	0	0	
Cumulative Ca Release	2	3	5	6	6	6	7	
Mg Release Rate	1	2	2	1	1	0	0	
Cumulative Mg Release	1	3	5	6	7	8	8	
Residual ANC (%)	100	100	100	100	100	100	100	
Residual Sulfur (%)	99.7	99.1	98.4	97.9	97.3	96.9	96.5	
SO_4/(Ca+Mg) molar ratio	2.1	2.5	3.6	5.6	7.1	11.3	12.6	

< indicates less than the analytical detection limit.

* Acidity and Alkalinity data calculated in mg $CaCO_3$/L

** SO4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur, S_{CR} = Chromium Reducible Sulfur, MPA = Maximum Potential Acidity, ANC = Acid Neutralising Capacity, and NAPP = Net Acid Producing Potential

1. The first guideline level shown refers to ANZECC (2000) and the second to NEPC (1999) . Where the two guidelines limits for a given element are in agreement, only one value is shown. A 'dash' represents no trigger value provided for this element.

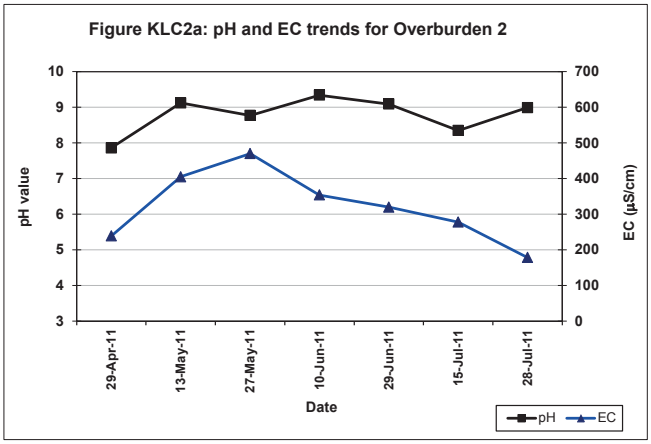


Figure KLC2a: pH and EC trends for Overburden 2
pH value
EC (µS/cm)
Date
29-Apr-11
13-May-11
27-May-11
10-Jun-11
29-Jun-11
15-Jul-11
28-Jul-11
pH
EC

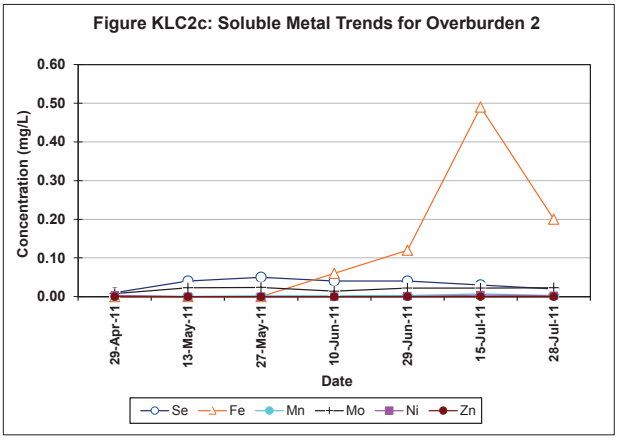


Figure KLC2c: Soluble Metal Trends for Overburden 2
Concentration (mg/L)
Date
Se
Fe
Mn
Mo
Ni
Zn

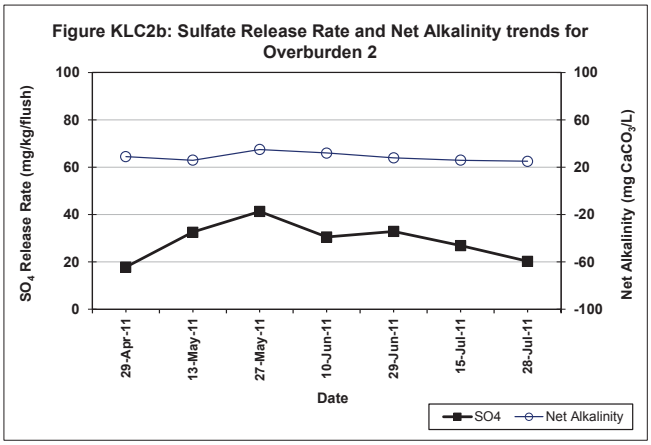


Figure KLC2b: Sulfate Release Rate and Net Alkalinity trends for Overburden 2
SO4 Release Rate (mg/kg/flush)
Net Alkalinity (mg CaCO3/L)
Date
SO4
Net Alkalinity

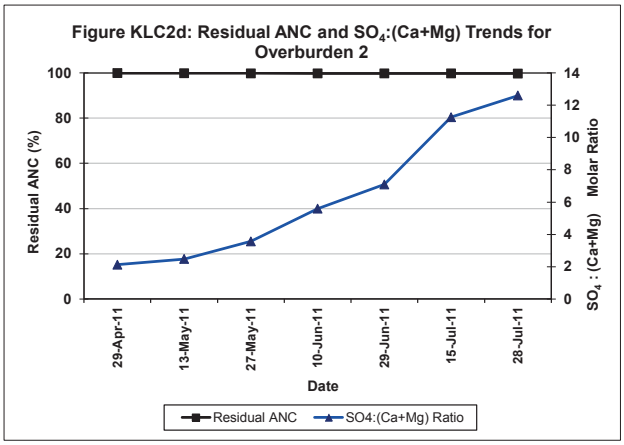


Figure KLC2d: Residual ANC and SO4:(Ca+Mg) Trends for Overburden 2
Residual ANC (%)
SO4 : (Ca+Mg) Molar Ratio
Date
Residual ANC
SO4:(Ca+Mg) Ratio

Table KLC3

KLC3 Test Results: Overburden 3

Sample Weight (kg)	1.5	**Total S (%)**		0.03	**ANC ($kg H_2SO_4/t$)**		22.4	
pH(1:5)	8.3	**S_{CR} (%)**			**NAPP ($kg H_2SO_4/t$)**		-21.4	
EC(1:5) (µS/cm)	561	**MPA ($kg H_2SO_4/t$)**		1.0	**ANC:MPA ratio**		22.2	
Date	29-Apr-11	13-May-11	27-May-11	10-Jun-11	29-Jun-11	15-Jul-11	28-Jul-11	
Leach Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Volume Collected (L)	0.76	0.80	0.71	0.80	0.99	0.84	0.85	
Cum. Volume (L)	0.76	1.56	2.27	3.06	4.06	4.90	5.75	
Pore Volumes	0.7	1.4	2.0	2.7	3.5	4.3	5.0	
pH	7.67	8.00	7.85	8.95	9.00	8.29	8.80	
EC (µS/cm)	196	122	246	112	48	70	57	
Acidity (mg/L)*	<1	1	<1	<1	<1	<1	<1	
Alkalinity (mg/L)*	22	11	15	18	14	11	8	
Net Alkalinity (mg/L)*	22	10	15	18	14	11	8	
Dissolved elements (mg/L)								**Guideline Levels[1]**
Al	0.04	0.02	<0.01	0.04	0.37	0.38	0.16	5
As	0.005	0.002	0.003	0.004	0.003	0.002	0.003	0.5
B	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	5
Ca	3	2	5	2	1	1	1	1000
Cd	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.01
Cl	26	15	33	9	4	4	4	-
Co	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1
Cr	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1 / -
Cu	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	0.007	1 / 0.5
Fe	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-
K	2	2	3	3	2	2	1	-
Mg	3	2	7	3	2	2	2	-
Mn	0.002	0.001	0.002	<0.001	<0.001	0.001	<0.001	-
Mo	0.016	0.02	0.036	0.028	0.012	0.007	0.01	0.15
Na	30	19	33	19	10	8	6	-
Ni	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1
Pb	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.1
SO_4	24	19	49	32	18	12	12	1,000
Sb	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Se	0.01	<0.01	0.03	0.01	<0.01	<0.01	<0.01	0.02
Zn	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	20
RESULTS**								
SO_4 Release Rate	12	10	23	17	12	7	7	
Cumulative SO_4 Release	12	22	45	62	74	81	88	
Ca Release Rate	2	1	2	1	1	1	1	
Cumulative Ca Release	2	3	5	6	7	7	8	
Mg Release Rate	2	1	3.3	2	1	1	1	
Cumulative Mg Release	2	3	6	7	9	10	11	
Residual ANC (%)	100	100	100	100	100	100	100	
Residual Sulfur (%)	99	98	95	94	92	92	91	
SO_4/(Ca+Mg) molar ratio	1.3	1.5	1.2	1.9	1.7	1.2	1.2	

< indicates less than the analytical detection limit.

* Acidity and Alkalinity data calculated in mg $CaCO_3$/L

** SO4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur, S_{CR} = Chromium Reducible Sulfur, MPA = Maximum Potential Acidity, ANC = Acid Neutralising Capacity, and NAPP = Net Acid Producing Potential

1. The first guideline level shown refers to ANZECC (2000) and the second to NEPC (1999) . Where the two guidelines limits for a given element are in agreement, only one value is shown. A 'dash' represents no trigger value provided for this element.

Figure KLC3a: pH and EC trends for Overburden 3

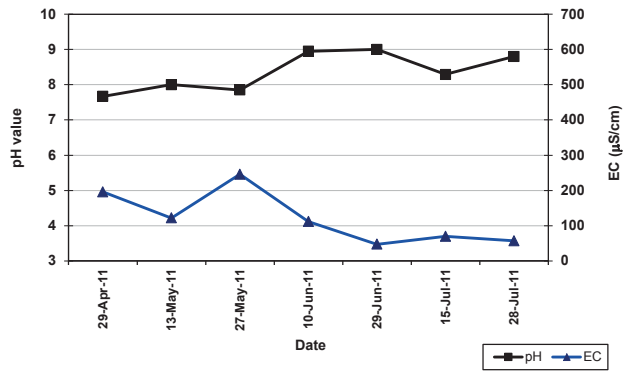


Figure KLC3c: Soluble Metal Trends for Overburden 3

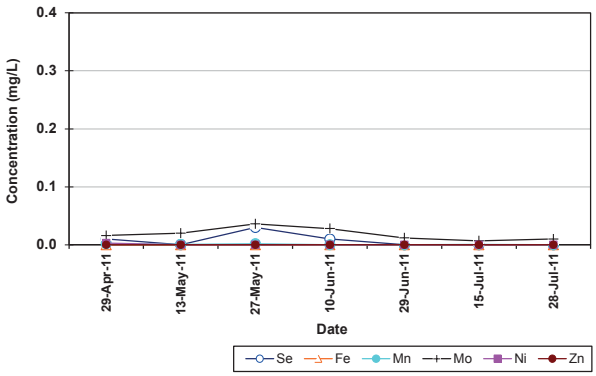


Figure KLC3b: Sulfate Release Rate and Net Alkalinity trends for Overburden 3

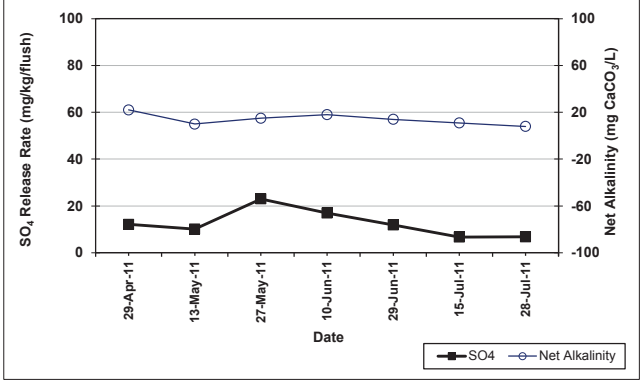


Figure KLC3d: Residual ANC and SO_4:(Ca+Mg) Trends for Overburden 3

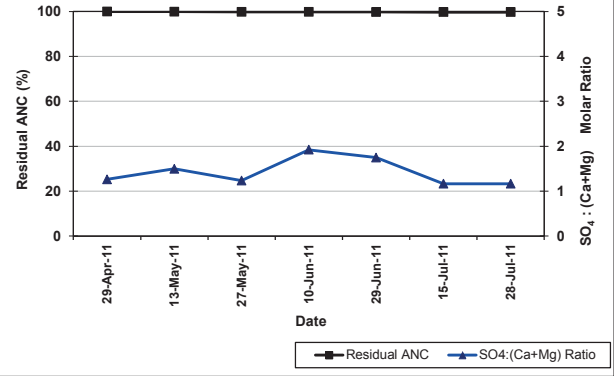


Table KLC4

KLC4 Test Results: Coal Reject

Sample Weight (kg)	1.8	**Total S (%)**		0.14	**ANC (kg H_2SO_4/t)**		17.8	
pH(1:5)	8.0	**S_{CR} (%)**		0.062	**NAPP (kg H_2SO_4/t)**		-13.5	
EC(1:5) (µS/cm)	842	**MPA (kg H_2SO_4/t)**		4.3	**ANC:MPA ratio**		4.2	
Date	29-Apr-11	13-May-11	27-May-11	10-Jun-11	29-Jun-11	15-Jul-11	28-Jul-11	
Leach Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Volume Collected (L)	0.58	0.60	0.77	0.51	0.59	0.58	0.65	
Cum. Volume (L)	0.58	1.18	1.95	2.46	3.05	3.63	4.28	
Pore Volumes	0.4	0.9	1.4	1.8	2.3	2.7	3.2	
pH	7.34	7.63	7.23	7.60	7.75	7.43	7.95	
EC (µS/cm)	1,290	4,140	1,389	1,223	1,331	1,200	806	
Acidity (mg/L)*	<1	2	3	3	2	2	3	
Alkalinity (mg/L)*	15	57	12	11	21	24	25	
Net Alkalinity (mg/L)*	15	55	9	8	19	22	22	
Dissolved elements (mg/L)								**Guideline Levels[1]**
Al	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5
As	0.037	0.049	0.012	0.035	0.004	0.014	0.027	0.5
B	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	5
Ca	24	107	32	25	30	23	19	1000
Cd	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.01
Cl	635	1410	531	457	450	409	319	-
Co	0.002	0.005	0.001	<0.001	<0.001	<0.001	<0.001	1
Cr	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1 / -
Cu	0.001	0.002	0.001	0.002	<0.001	<0.001	0.002	1 / 0.5
Fe	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-
K	10	26	13	11	11	11	9	-
Mg	28	138	42	41	36	27	23	-
Mn	0.044	0.136	0.035	0.031	0.030	0.019	0.012	-
Mo	0.005	0.018	0.008	0.008	0.010	0.009	0.013	0.15
Na	239	523	211	210	205	147	128	-
Ni	0.005	0.009	0.002	0.003	0.002	0.002	0.002	1
Pb	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.1
SO_4	43	130	40	70	95	78	71	1,000
Sb	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-
Se	0.15	0.22	0.06	0.14	0.03	0.06	0.12	0.02
Zn	<0.005	0.009	<0.005	<0.005	<0.005	<0.005	<0.005	20
RESULTS**								
SO_4 Release Rate	14.3	45	18	21	32	26	26	
Cumulative SO_4 Release	14.3	59	76	97	129	155	181	
Ca Release Rate	8.0	36.7	14.0	7.3	10.1	7.6	7.1	
Cumulative Ca Release	8.0	44.6	58.7	66.0	76.1	83.7	90.8	
Mg Release Rate	9.3	47.3	18.4	12.0	12.1	8.9	8.5	
Cumulative Mg Release	9.3	56.6	75.0	87.0	99.1	108.1	116.6	
Residual ANC (%)	100	98	97	97	97	96	96	
Residual Sulfur (%)	100	99	98	98	97	96	96	
SO_4/(Ca+Mg) molar ratio	0.3	0.2	0.2	0.3	0.4	0.5	0.5	

< indicates less than the analytical detection limit.

* Acidity and Alkalinity data calculated in mg $CaCO_3$/L ** SO4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur, S_{CR} = Chromium Reducible Sulfur, MPA = Maximum Potential Acidity, ANC = Acid Neutralising Capacity, and NAPP = Net Acid Producing Potential

1. The first guideline level shown refers to ANZECC (2000) and the second to NEPC (1999) . Where the two guidelines limits for a given element are in agreement, only one value is shown. A 'dash' represents no trigger value provided for this element.

Figure KLC4a: pH and EC trends for Coal Reject

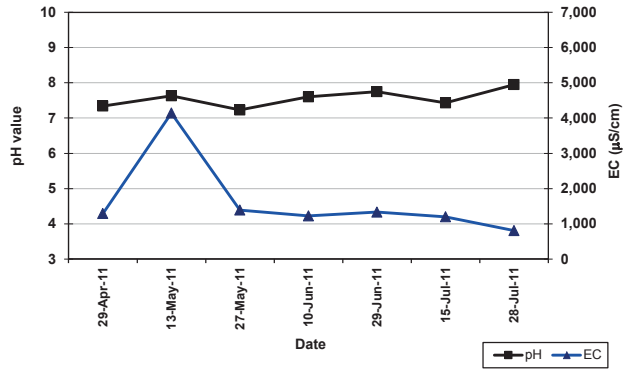


Figure KLC4c: Soluble Metal Trends for Coal Reject

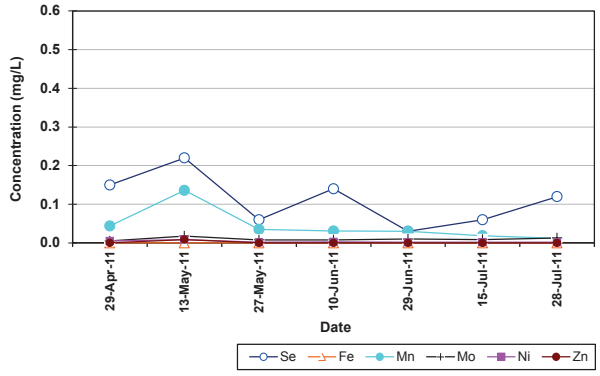


Figure KLC4b: Sulfate Release Rate and Net Alkalinity trends for Coal Reject

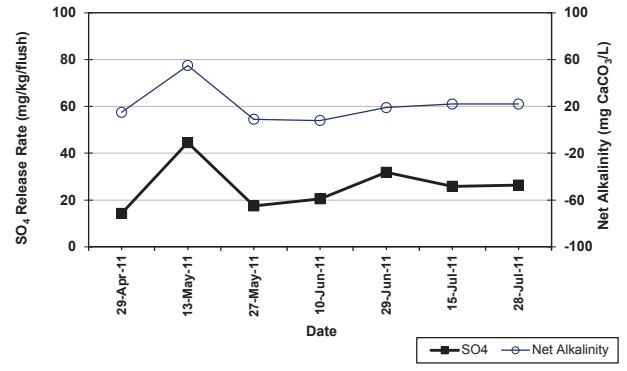


Figure KLC4d: Residual ANC and SO_4:(Ca+Mg) Trends for Coal Reject

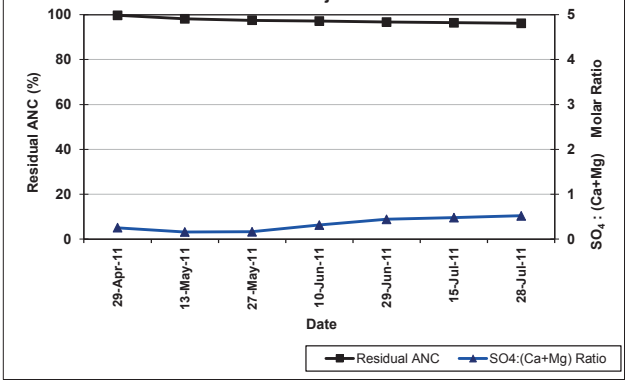


Table KLC5

KLC5 Test Results: Coal Reject

Sample Weight (kg)	1.5	**Total S (%)**		0.16	**ANC (kg H_2SO_4/t)**		68.9	
pH(1:5)	7.7	**S_{CR} (%)**		0.084	**NAPP (kg H_2SO_4/t)**		-64.0	
EC(1:5) (µS/cm)	784	**MPA (kg H_2SO_4/t)**		4.9	**ANC:MPA ratio**		14.1	
Date	29-Apr-11	13-May-11	27-May-11	10-Jun-11	29-Jun-11	15-Jul-11	28-Jul-11	
Leach Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	
Volume Collected (L)	0.65	0.68	0.90	0.52	0.66	0.59	0.69	
Cum. Volume (L)	0.65	1.33	2.23	2.75	3.41	4.00	4.69	
Pore Volumes	0.6	1.2	1.9	2.4	3.0	3.5	4.1	
pH	6.61	7.62	7.54	7.45	7.96	7.86	8.12	
EC (µS/cm)	2,140	2,440	957	821	685	539	416	
Acidity (mg/L)*	4	5	3	2	2	2	2	
Alkalinity (mg/L)*	4	45	51	30	39	48	49	
Net Alkalinity (mg/L)*	0	40	48	28	37	46	47	
Dissolved elements (mg/L)								**Guideline Levels[1]**
Al	<0.01	<0.01	<0.01	0.02	0.02	0.07	0.02	5
As	0.051	0.012	0.016	0.025	0.014	0.016	0.015	0.5
B	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	5
Ca	39	60	15	12	9	7	6	1000
Cd	0.0016	0.0004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.01
Cl	855	877	285	149	74	30	18	-
Co	0.078	0.043	0.01	0.005	0.002	0.002	0.002	1
Cr	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	1 / -
Cu	<0.001	0.003	<0.001	0.002	<0.001	<0.001	0.001	1 / 0.5
Fe	0.16	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-
K	11	23	8	7	6	6	4	-
Mg	38	61	15	10	9	6	5	-
Mn	0.205	0.165	0.044	0.02	0.007	0.005	0.005	-
Mo	0.002	0.018	0.016	0.029	0.023	0.017	0.02	0.15
Na	496	481	219	153	127	86	66	-
Ni	0.108	0.096	0.021	0.008	0.004	0.003	0.003	1
Pb	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.1
SO_4	390	324	157	176	194	136	117	1,000
Sb	<0.001	<0.001	<0.001	0.001	0.001	0.001	0.001	-
Se	0.26	0.11	0.05	0.07	0.01	0.01	0.01	0.02
Zn	0.2	0.036	0.007	<0.005	<0.005	<0.005	<0.005	20
RESULTS**								
SO_4 Release Rate	175	152	97	63	89	55	56	
Cumulative SO_4 Release	175	327	424	487	575	631	686	
Ca Release Rate	17	28.1	9.3	4.3	4.1	2.8	2.9	
Cumulative Ca Release	17	46	55	59	63	66	69	
Mg Release Rate	17.0	28.6	9.3	3.6	4.1	2.4	2.4	
Cumulative Mg Release	17.0	45.6	54.9	58.5	62.6	65.1	67.4	
Residual ANC (%)	100	100	99	99	99	99	99	
Residual Sulfur (%)	96	93	91	90	88	87	86	
SO_4/(Ca+Mg) molar ratio	1.6	0.8	1.6	2.6	3.4	3.4	3.4	

< indicates less than the analytical detection limit.

* Acidity and Alkalinity data calculated in mg $CaCO_3$/L ** SO4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur, S_{CR} = Chromium Reducible Sulfur, MPA = Maximum Potential Acidity, ANC = Acid Neutralising Capacity, and NAPP = Net Acid Producing Potential

1. The first guideline level shown refers to ANZECC (2000) and the second to NEPC (1999) . Where the two guidelines limits for a given element are in agreement, only one value is shown. A 'dash' represents no trigger value provided for this element.

Figure KLC5a: pH and EC trends for Coal Reject

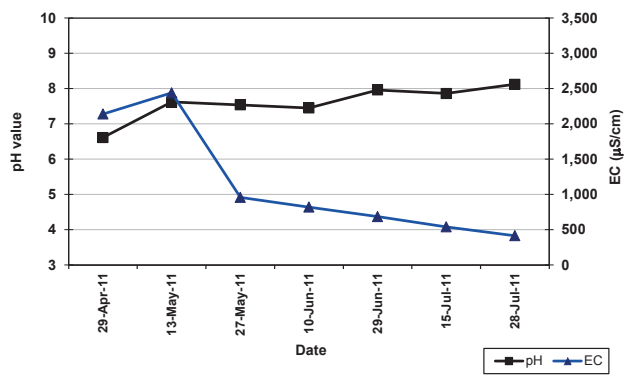


Figure KLC5c: Soluble Metal trends for Coal Reject

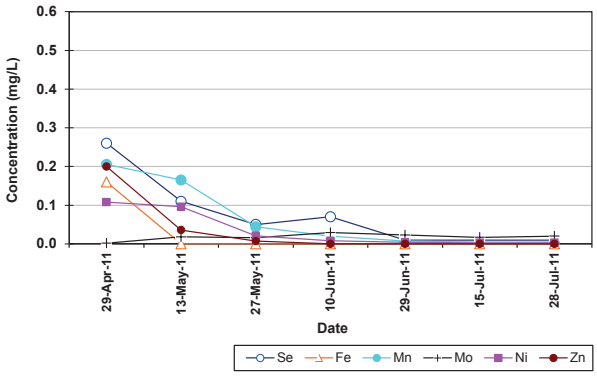


Figure KLC5b: Sulfate Release Rate and Net Alkalinity trends for Coal Reject

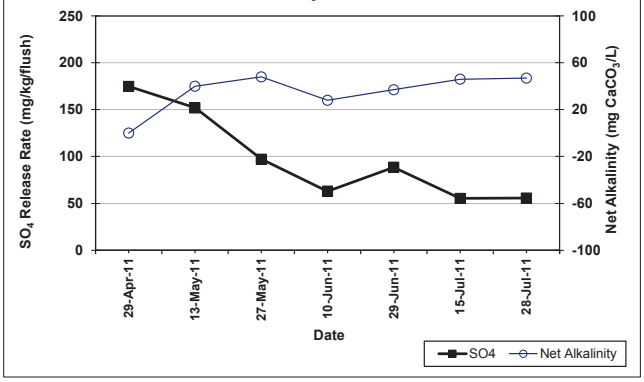
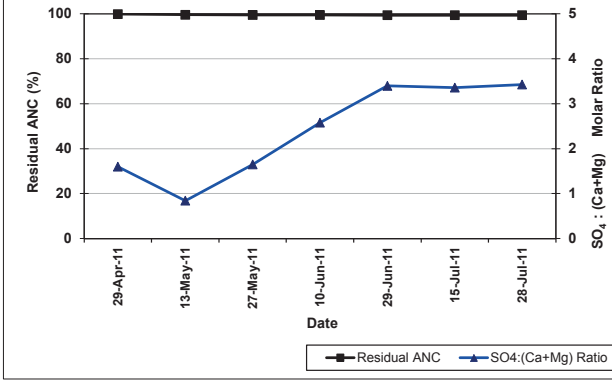


Figure KLC5d: Residual ANC and SO_4:(Ca+Mg) trends for Coal Reject



ATTACHMENT D

ALS Laboratory Results

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1104975**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: Drayton South Project	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 15-MAR-2011
Sampler	: Anglocoal	Issue Date	: 29-MAR-2011
Site	: Drayton South		
		No. of samples received	: 6
Quote number	: BN/567/10	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Stafford Minerals - AY

Page	:	2 of 4
Work Order	:	EB1104975
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	Drayton South Project

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **ANC Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong.**

Page : 3 of 4
Work Order : EB1104975
Client : RGS ENVIRONMENTAL PTY LTD
Project : Drayton South Project

Analytical Results

Sub-Matrix: SOIL			Client sample ID	DD1158 EO 001 28.25 - 28.81	DD1158 EO 002 37.09 - 37.44	DD1158 EO 003 60.23 - 60.62	DD1158 EO 004 66.59 - 67.1	DD1158 EO 005 78.26 - 78.7
			Client sampling date / time	02-MAR-2011 15:00	02-MAR-2011 15:00	02-MAR-2011 15:00	02-MAR-2011 15:00	02-MAR-2011 15:00
Compound	CAS Number	LOR	Unit	EB1104975-001	EB1104975-002	EB1104975-003	EB1104975-004	EB1104975-005
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.4	9.3	9.8	9.9	9.7
EA009: Nett Acid Production Potential								
^ Acid Production Potential (APP)	----	0.5	kg H2SO4/t	0.6	<0.5	6.5	<0.5	0.9
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-18.5	-86.5	-57.8	-229	-18.0
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	152	123	234	341	279
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	19.1	87.0	64.4	230	18.9
^ ANC as CaCO3	----	0.1	% CaCO3	2.0	8.9	6.6	23.4	1.9
Fizz Rating	----	0	Fizz Unit	0	2	2	3	0
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.21	0.02	0.03

Page	:	4 of 4
Work Order	:	EB1104975
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	Drayton South Project

Analytical Results

Sub-Matrix: SOIL			Client sample ID	DD1158 EO 006 94.06 - 94.53	----	----	----	----
			Client sampling date / time	02-MAR-2011 15:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB1104975-006	----	----	----	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.7	----	----	----	----
EA009: Nett Acid Production Potential								
^ Acid Production Potential (APP)	----	0.5	kg H2SO4/t	<0.5	----	----	----	----
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-247	----	----	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	163	----	----	----	----
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	248	----	----	----	----
^ ANC as CaCO3	----	0.1	% CaCO3	25.2	----	----	----	----
Fizz Rating	----	0	Fizz Unit	3	----	----	----	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.01	----	----	----	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1104977**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: Drayton South Project	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 15-MAR-2011
Sampler	: Anglocoal	Issue Date	: 29-MAR-2011
Site	: Drayton South		
		No. of samples received	: 7
Quote number	: BN/567/10	No. of samples analysed	: 7

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Stafford Minerals - AY

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **ANC Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong.**

Page	:	3 of 4
Work Order	:	EB1104977
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	Drayton South Project

Analytical Results

Sub-Matrix: SOIL			Client sample ID	DD1156 EO 001 53.69 - 54.09	DD1156 EO 002 62.83 - 63.15	DD1156 EO 003 68.69 - 69.1	DD1156 EO 004 83.46 - 83.79	DD1156 EO 005 104.72 - 105.21
			Client sampling date / time	02-MAR-2011 15:00	02-MAR-2011 15:00	02-MAR-2011 15:00	02-MAR-2011 15:00	02-MAR-2011 15:00
Compound	CAS Number	LOR	Unit	EB1104977-001	EB1104977-002	EB1104977-003	EB1104977-004	EB1104977-005
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.3	9.2	9.4	9.8	9.4
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-12.5	-7.7	-10.2	-8.4	-30.7
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	180	153	168	274	337
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	12.5	8.3	10.8	8.4	31.2
^ ANC as CaCO3	----	0.1	% CaCO3	1.3	0.8	1.1	0.9	3.2
Fizz Rating	----	0	Fizz Unit	0	0	0	0	2
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	0.02	0.02	<0.01	0.02

Page	:	4 of 4
Work Order	:	EB1104977
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	Drayton South Project

Analytical Results

Sub-Matrix: **SOIL**			Client sample ID	**DD1156 EO 006 123.91 - 124.28**	**DD1156 EO 007 138.65 - 139.02**	----	----	----
			Client sampling date / time	02-MAR-2011 15:00	02-MAR-2011 15:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1104977-006**	**EB1104977-007**	**----**	**----**	**----**
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**9.8**	**10.1**	----	----	----
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	**-9.7**	**-65.7**	----	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**185**	**289**	----	----	----
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**10.1**	**68.0**	----	----	----
^ ANC as CaCO3	----	0.1	% CaCO3	**1.0**	**6.9**	----	----	----
Fizz Rating	----	0	Fizz Unit	**0**	**2**	----	----	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.01**	**0.08**	----	----	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1104978**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: Drayton South Project	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 15-MAR-2011
Sampler	: Anglocoal	Issue Date	: 29-MAR-2011
Site	: Drayton South		
		No. of samples received	: 8
Quote number	: BN/567/10	No. of samples analysed	: 8

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Stafford Minerals - AY

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **ANC Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong.**

Page : 3 of 4
Work Order : EB1104978
Client : RGS ENVIRONMENTAL PTY LTD
Project : Drayton South Project

Analytical Results

Sub-Matrix: SOIL			Client sample ID	DD1151 EO 001 15.42 - 15.83	DD1151 EO 002 20.27 - 20.96	DD1151 EO 003 23.76 - 24.3	DD1151 EO 004 25 - 25.39	DD1151 EO 005 26.87 - 27.46
			Client sampling date / time	[15-MAR-2011]	[15-MAR-2011]	[15-MAR-2011]	[15-MAR-2011]	[15-MAR-2011]
Compound	CAS Number	LOR	Unit	EB1104978-001	EB1104978-002	EB1104978-003	EB1104978-004	EB1104978-005
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.9	9.4	9.5	9.5	9.3
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-7.6	-89.8	-31.0	<0.5	-15.6
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	351	275	206	313	294
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	7.9	96.8	31.9	13.7	28.2
^ ANC as CaCO3	----	0.1	% CaCO3	0.8	9.9	3.2	1.4	2.9
Fizz Rating	----	0	Fizz Unit	0	2	2	0	2
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.01	0.23	0.03	0.45	0.41

Page	:	4 of 4
Work Order	:	EB1104978
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	Drayton South Project

Analytical Results

Sub-Matrix: SOIL			Client sample ID	DD1151 EO 006 31.58 - 31.95	DD1151 EO 007 38.19 - 38.54	DD1151 EO 008 39.75 - 40.22	----	----
			Client sampling date / time	[15-MAR-2011]	[15-MAR-2011]	[15-MAR-2011]	----	----
Compound	CAS Number	LOR	Unit	EB1104978-006	EB1104978-007	EB1104978-008	----	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.4	9.5	9.4	----	----
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-10.3	-7.9	-13.0	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	281	206	167	----	----
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	11.1	10.0	16.2	----	----
^ ANC as CaCO3	----	0.1	% CaCO3	1.1	1.0	1.6	----	----
Fizz Rating	----	0	Fizz Unit	0	0	0	----	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.06	0.10	----	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1104980**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: Drayton South Project	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 15-MAR-2011
Sampler	: Anglocoal	Issue Date	: 29-MAR-2011
Site	: Drayton South		
		No. of samples received	: 9
Quote number	: BN/567/10	No. of samples analysed	: 9

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Stafford Minerals - AY

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **ANC Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong.**

Page : 3 of 4
Work Order : EB1104980
Client : RGS ENVIRONMENTAL PTY LTD
Project : Drayton South Project

Analytical Results

Sub-Matrix: SOIL			Client sample ID	DD1150 EO 001 18.1 - 18.61	DD1150 EO 002 19.73 - 20.02	DD1150 EO 003 20.93 - 21.28	DD1150 EO 004 25.53 - 25.82	DD1150 EO 005 27.57 - 28.05
			Client sampling date / time	[15-MAR-2011]	[15-MAR-2011]	[15-MAR-2011]	[15-MAR-2011]	[15-MAR-2011]
Compound	CAS Number	LOR	Unit	EB1104980-001	EB1104980-002	EB1104980-003	EB1104980-004	EB1104980-005
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.1	8.8	8.3	9.6	9.5
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-6.6	-5.7	-3.7	-303	-11.9
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	252	184	436	270	341
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	6.6	6.7	13.9	303	12.5
^ ANC as CaCO3	----	0.1	% CaCO3	0.7	0.7	1.4	30.9	1.3
Fizz Rating	----	0	Fizz Unit	0	0	0	4	0
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	0.03	0.33	0.02	0.02

Page	:	4 of 4
Work Order	:	EB1104980
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	Drayton South Project

Analytical Results

Sub-Matrix: SOIL			Client sample ID	DD1150 EO 006 29.47 - 29.81	DD1150 EO 007 32 - 32.37	DD1150 EO 008 38.5 - 39	DD1150 EO 009 42.86 - 43.13	----
			Client sampling date / time	[15-MAR-2011]	[15-MAR-2011]	[15-MAR-2011]	[15-MAR-2011]	----
Compound	CAS Number	LOR	Unit	EB1104980-006	EB1104980-007	EB1104980-008	EB1104980-009	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.2	9.6	9.7	9.5	----
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	16.9	-15.0	-11.6	-10.6	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	262	215	202	237	----
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	9.6	15.6	12.2	12.5	----
^ ANC as CaCO3	----	0.1	% CaCO3	1.0	1.6	1.2	1.3	----
Fizz Rating	----	0	Fizz Unit	0	0	0	0	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.86	0.02	0.02	0.06	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1104981**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: Drayton South Project	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 15-MAR-2011
Sampler	: Anglocoal	Issue Date	: 29-MAR-2011
Site	: Drayton South		
		No. of samples received	: 6
Quote number	: BN/567/10	No. of samples analysed	: 6

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Stafford Minerals - AY

Page	:	2 of 4
Work Order	:	EB1104981
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	Drayton South Project

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **ANC Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong.**

Page : 3 of 4
Work Order : EB1104981
Client : RGS ENVIRONMENTAL PTY LTD
Project : Drayton South Project

Analytical Results

Sub-Matrix: **SOIL**

Compound	CAS Number	LOR	Unit	Client sample ID	DD1163 EO 001 17.46 - 17.88	DD1163 EO 002 25.02 - 25.37	DD1163 EO 003 28.71 - 29.11	DD1163 EO 004 39.76 - 40.07	DD1163 EO 005 54.08 - 54.44
				Client sampling date / time	02-MAR-2011 15:00	02-MAR-2011 15:00	02-MAR-2011 15:00	02-MAR-2011 15:00	02-MAR-2011 15:00
					EB1104981-001	EB1104981-002	EB1104981-003	EB1104981-004	EB1104981-005
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		9.4	9.3	9.1	8.8	8.4
EA009: Nett Acid Production Potential									
^ Net Acid Production Potential	----	0.5	kg H2SO4/t		-17.0	-49.0	-29.6	-14.4	-12.8
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		227	167	167	142	145
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		17.0	49.0	30.0	14.7	14.4
^ ANC as CaCO3	----	0.1	% CaCO3		1.7	5.0	3.1	1.5	1.5
Fizz Rating	----	0	Fizz Unit		0	2	2	0	0
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		<0.01	<0.01	0.01	0.01	0.05

Page	:	4 of 4
Work Order	:	EB1104981
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	Drayton South Project

Analytical Results

Sub-Matrix: **SOIL**			Client sample ID	**DD1163 EO 006 60.81 - 61.24**	----	----	----	----
			Client sampling date / time	02-MAR-2011 15:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1104981-006**	**----**	**----**	**----**	**----**
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**9.0**	----	----	----	----
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	**-13.3**	----	----	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**134**	----	----	----	----
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**13.7**	----	----	----	----
^ ANC as CaCO3	----	0.1	% CaCO3	**1.4**	----	----	----	----
Fizz Rating	----	0	Fizz Unit	**0**	----	----	----	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.01**	----	----	----	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1107153**	Page	: 1 of 8
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: DRAYTON SOUTH	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 10-APR-2011
Sampler	: ----	Issue Date	: 06-MAY-2011
Site	: ----		
		No. of samples received	: 13
Quote number	: BN/057/11 V2	No. of samples analysed	: 13

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics

Page	:	2 of 8
Work Order	:	EB1107153
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	DRAYTON SOUTH

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **$$: NATA accreditation does not cover performance of this service.**

Page : 3 of 8
Work Order : EB1107153
Client : RGS ENVIRONMENTAL PTY LTD
Project : DRAYTON SOUTH

Analytical Results

Sub-Matrix: **PULP**

Compound	CAS Number	LOR	Unit	Client sample ID	EB1104975-1	EB1104975-3	EB1104977-3	EB1104977-4	EB1104978-2
				Client sampling date / time	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00
					EB1107153-001	EB1107153-002	EB1107153-003	EB1107153-004	EB1107153-005
EA026 : Chromium Reducible Sulfur									
Chromium Reducible Sulphur	----	0.005	%		----	0.016	----	----	0.006
ED007: Exchangeable Cations									
^ Exchangeable Calcium	----	0.1	meq/100g		9.7	20.1	1.8	10.4	21.5
^ Exchangeable Magnesium	----	0.1	meq/100g		6.0	6.3	4.3	8.9	3.5
^ Exchangeable Potassium	----	0.1	meq/100g		0.6	0.5	0.8	1.0	0.5
^ Exchangeable Sodium	----	0.1	meq/100g		0.8	2.4	1.4	4.7	1.6
^ Cation Exchange Capacity	----	0.1	meq/100g		17.0	29.3	8.4	25.1	27.2
^ Exchangeable Sodium Percent	----	0.1	%		4.6	8.1	17.3	18.9	6.0
ED037: Alkalinity									
Total Alkalinity as CaCO3	----	1	mg/kg		3240	10200	1350	2450	39300
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg		2960	9450	1300	1730	38600
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg		288	721	48	721	673
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		110	100	80	20	150
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	10	mg/kg		50	40	60	60	170
ED093S: Soluble Major Cations									
Calcium	7440-70-2	10	mg/kg		20	<10	<10	<10	20
Magnesium	7439-95-4	10	mg/kg		20	<10	<10	<10	20
Sodium	7440-23-5	10	mg/kg		110	260	160	270	250
Potassium	7440-09-7	10	mg/kg		20	20	30	10	30
ED093T: Total Major Cations									
Sodium	7440-23-5	10	mg/kg		340	880	470	1300	900
Potassium	7440-09-7	10	mg/kg		950	1120	1550	1260	900
Calcium	7440-70-2	10	mg/kg		6260	32800	3820	2790	38600
Magnesium	7439-95-4	10	mg/kg		3800	9870	4540	1540	3750
EG005S : Soluble Metals by ICPAES									
Aluminium	7429-90-5	1	mg/kg		<1	2	9	6	<1
Antimony	7440-36-0	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic	7440-38-2	0.1	mg/kg		1.2	0.2	0.1	0.2	<0.1
Boron	7440-42-8	1	mg/kg		<1	<1	<1	<1	<1
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	7440-48-4	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Copper	7440-50-8	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Iron	7439-89-6	1	mg/kg		<1	<1	2	<1	<1
Lead	7439-92-1	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1

Page : 4 of 8
Work Order : EB1107153
Client : RGS ENVIRONMENTAL PTY LTD
Project : DRAYTON SOUTH

Analytical Results

Sub-Matrix: PULP				Client sample ID	EB1104975-1	EB1104975-3	EB1104977-3	EB1104977-4	EB1104978-2
				Client sampling date / time	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00
Compound	CAS Number	LOR	Unit		EB1107153-001	EB1107153-002	EB1107153-003	EB1107153-004	EB1107153-005
EG005S : Soluble Metals by ICPAES - Continued									
Manganese	7439-96-5	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Molybdenum	7439-98-7	0.1	mg/kg		0.6	0.5	0.4	<0.1	0.1
Nickel	7440-02-0	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Selenium	7782-49-2	0.1	mg/kg		0.1	0.1	0.2	<0.1	0.1
Zinc	7440-66-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		2920	3740	3530	4230	6480
Antimony	7440-36-0	5	mg/kg		<5	<5	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		12	<5	<5	<5	17
Boron	7440-42-8	50	mg/kg		<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		14	8	9	<2	31
Cobalt	7440-48-4	2	mg/kg		36	20	21	<2	13
Copper	7440-50-8	5	mg/kg		16	21	30	5	12
Iron	7439-89-6	50	mg/kg		51000	22500	110000	1110	17400
Lead	7439-92-1	5	mg/kg		10	8	12	52	10
Manganese	7439-96-5	5	mg/kg		837	367	2200	<5	558
Molybdenum	7439-98-7	2	mg/kg		<2	<2	<2	<2	<2
Nickel	7440-02-0	2	mg/kg		36	28	24	<2	28
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Zinc	7440-66-6	5	mg/kg		64	67	132	104	41

Page : 5 of 8
Work Order : EB1107153
Client : RGS ENVIRONMENTAL PTY LTD
Project : DRAYTON SOUTH

Analytical Results

Sub-Matrix: PULP			Client sample ID	EB1104978-4	EB1104978-5	EB1104978-8	EB1104980-2	EB1104980-3
			Client sampling date / time	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00
Compound	CAS Number	LOR	Unit	EB1107153-006	EB1107153-007	EB1107153-008	EB1107153-009	EB1107153-010
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.117	0.029	----	----	0.236
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	18.4	19.7	2.9	5.8	11.5
^ Exchangeable Magnesium	----	0.1	meq/100g	9.2	5.4	6.0	14.4	24.5
^ Exchangeable Potassium	----	0.1	meq/100g	0.4	0.4	0.7	1.2	1.0
^ Exchangeable Sodium	----	0.1	meq/100g	3.4	2.0	2.6	3.6	5.6
^ Cation Exchange Capacity	----	0.1	meq/100g	31.4	27.4	12.2	25.0	42.6
^ Exchangeable Sodium Percent	----	0.1	%	10.8	7.3	21.6	14.4	13.2
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	6010	4690	1830	2550	2760
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	5720	4690	1730	2480	2670
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	288	<1	96	72	96
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	270	500	210	230	500
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	120	130	80	140	80
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	10	70	<10	<10	<10
Magnesium	7439-95-4	10	mg/kg	10	70	<10	<10	<10
Sodium	7440-23-5	10	mg/kg	420	320	270	240	350
Potassium	7440-09-7	10	mg/kg	10	30	10	10	10
ED093T: Total Major Cations								
Sodium	7440-23-5	10	mg/kg	1000	720	820	960	1410
Potassium	7440-09-7	10	mg/kg	690	730	1550	1920	1440
Calcium	7440-70-2	10	mg/kg	9370	9720	6380	2330	3790
Magnesium	7439-95-4	10	mg/kg	2340	2180	8250	4990	5470
EG005S : Soluble Metals by ICPAES								
Aluminium	7429-90-5	1	mg/kg	<1	<1	4	1	<1
Antimony	7440-36-0	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic	7440-38-2	0.1	mg/kg	1.4	<0.1	0.2	<0.1	0.3
Boron	7440-42-8	1	mg/kg	<1	<1	<1	<1	<1
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	7440-47-3	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	7440-48-4	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	7440-50-8	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Iron	7439-89-6	1	mg/kg	<1	<1	<1	<1	<1
Lead	7439-92-1	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1

Page : 6 of 8
Work Order : EB1107153
Client : RGS ENVIRONMENTAL PTY LTD
Project : DRAYTON SOUTH

Analytical Results

Sub-Matrix: PULP				Client sample ID	EB1104978-4	EB1104978-5	EB1104978-8	EB1104980-2	EB1104980-3
				Client sampling date / time	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00
Compound	CAS Number	LOR	Unit		EB1107153-006	EB1107153-007	EB1107153-008	EB1107153-009	EB1107153-010
EG005S : Soluble Metals by ICPAES - Continued									
Manganese	7439-96-5	0.1	mg/kg		<0.1	0.1	<0.1	<0.1	<0.1
Molybdenum	7439-98-7	0.1	mg/kg		0.1	1.0	<0.1	<0.1	0.2
Nickel	7440-02-0	0.1	mg/kg		<0.1	0.3	<0.1	<0.1	<0.1
Selenium	7782-49-2	0.1	mg/kg		0.1	0.2	0.1	1.3	0.2
Zinc	7440-66-6	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		4190	3620	6220	12400	9940
Antimony	7440-36-0	5	mg/kg		<5	7	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		8	6	<5	<5	7
Boron	7440-42-8	50	mg/kg		<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg		<1	<1	3	<1	<1
Chromium	7440-47-3	2	mg/kg		12	40	9	17	21
Cobalt	7440-48-4	2	mg/kg		15	74	19	17	24
Copper	7440-50-8	5	mg/kg		15	84	20	29	30
Iron	7439-89-6	50	mg/kg		5860	6060	163000	17400	12800
Lead	7439-92-1	5	mg/kg		6	22	13	8	13
Manganese	7439-96-5	5	mg/kg		78	141	2000	93	192
Molybdenum	7439-98-7	2	mg/kg		<2	<2	<2	<2	<2
Nickel	7440-02-0	2	mg/kg		64	283	20	40	204
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	<5	<5
Zinc	7440-66-6	5	mg/kg		41	150	144	42	109

Page : 7 of 8
Work Order : EB1107153
Client : RGS ENVIRONMENTAL PTY LTD
Project : DRAYTON SOUTH

Analytical Results

Sub-Matrix: PULP			Client sample ID	EB1104980-6	EB1104980-9	EB1022785-33	----	----
			Client sampling date / time	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00	----	----
Compound	CAS Number	LOR	Unit	EB1107153-011	EB1107153-012	EB1107153-013	----	----
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.398	----	----	----	----
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	4.8	4.7	3.5	----	----
^ Exchangeable Magnesium	----	0.1	meq/100g	6.9	9.9	2.8	----	----
^ Exchangeable Potassium	----	0.1	meq/100g	0.7	1.6	1.1	----	----
^ Exchangeable Sodium	----	0.1	meq/100g	2.0	4.2	<0.1	----	----
^ Cation Exchange Capacity	----	0.1	meq/100g	14.3	20.4	7.5	----	----
^ Exchangeable Sodium Percent	----	0.1	%	13.7	20.7	0.7	----	----
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	2380	2550	697	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	2380	2450	697	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	<1	96	<1	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	270	170	190	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	60	110	<10	----	----
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	10	<10	20	----	----
Magnesium	7439-95-4	10	mg/kg	20	<10	10	----	----
Sodium	7440-23-5	10	mg/kg	270	170	<10	----	----
Potassium	7440-09-7	10	mg/kg	30	10	60	----	----
ED093T: Total Major Cations								
Sodium	7440-23-5	10	mg/kg	690	1150	40	----	----
Potassium	7440-09-7	10	mg/kg	1220	2460	1160	----	----
Calcium	7440-70-2	10	mg/kg	1570	1250	1170	----	----
Magnesium	7439-95-4	10	mg/kg	3160	5060	2290	----	----
EG005S : Soluble Metals by ICPAES								
Aluminium	7429-90-5	1	mg/kg	<1	18	<1	----	----
Antimony	7440-36-0	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
Arsenic	7440-38-2	0.1	mg/kg	<0.1	1.0	<0.1	----	----
Boron	7440-42-8	1	mg/kg	<1	<1	<1	----	----
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
Chromium	7440-47-3	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
Cobalt	7440-48-4	0.1	mg/kg	<0.1	<0.1	0.1	----	----
Copper	7440-50-8	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
Iron	7439-89-6	1	mg/kg	<1	2	<1	----	----
Lead	7439-92-1	0.1	mg/kg	<0.1	<0.1	<0.1	----	----

Page : 8 of 8
Work Order : EB1107153
Client : RGS ENVIRONMENTAL PTY LTD
Project : DRAYTON SOUTH

Analytical Results

Sub-Matrix: **PULP**				Client sample ID	EB1104980-6	EB1104980-9	EB1022785-33	----	----
				Client sampling date / time	09-APR-2011 15:00	09-APR-2011 15:00	09-APR-2011 15:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EB1107153-011**	**EB1107153-012**	**EB1107153-013**	**----**	**----**
EG005S : Soluble Metals by ICPAES - Continued									
Manganese	7439-96-5	0.1	mg/kg		**0.1**	<0.1	**0.5**	----	----
Molybdenum	7439-98-7	0.1	mg/kg		**0.3**	<0.1	<0.1	----	----
Nickel	7440-02-0	0.1	mg/kg		<0.1	<0.1	**0.3**	----	----
Selenium	7782-49-2	0.1	mg/kg		<0.1	**0.1**	**0.1**	----	----
Zinc	7440-66-6	0.1	mg/kg		<0.1	<0.1	<0.1	----	----
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		**6280**	**12200**	**4030**	----	----
Antimony	7440-36-0	5	mg/kg		<5	<5	<5	----	----
Arsenic	7440-38-2	5	mg/kg		<5	**5**	**14**	----	----
Boron	7440-42-8	50	mg/kg		<50	<50	<50	----	----
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	----	----
Chromium	7440-47-3	2	mg/kg		**12**	**11**	**15**	----	----
Cobalt	7440-48-4	2	mg/kg		**9**	**4**	**18**	----	----
Copper	7440-50-8	5	mg/kg		**25**	**29**	**26**	----	----
Iron	7439-89-6	50	mg/kg		**13000**	**18200**	**20500**	----	----
Lead	7439-92-1	5	mg/kg		**11**	**16**	**23**	----	----
Manganese	7439-96-5	5	mg/kg		**125**	**139**	**392**	----	----
Molybdenum	7439-98-7	2	mg/kg		<2	<2	<2	----	----
Nickel	7440-02-0	2	mg/kg		**36**	**14**	**76**	----	----
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	----	----
Zinc	7440-66-6	5	mg/kg		**60**	**105**	**105**	----	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1105959**	Page	: 1 of 3
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: Drayton South Project	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 28-MAR-2011
Sampler	: SGS Newcastle R.Hall	Issue Date	: 11-APR-2011
Site	: Drayton South		
		No. of samples received	: 2
Quote number	: BN/567/10	No. of samples analysed	: 2

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Stafford Minerals - AY

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **ANC Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong.**

Page	:	3 of 3
Work Order	:	EB1105959
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	Drayton South Project

Analytical Results

Sub-Matrix: SOIL				Client sample ID	SCK Coal Reject	SCK Roof/Floor	----	----	----
				Client sampling date / time	[25-MAR-2011]	[25-MAR-2011]	----	----	----
Compound	CAS Number	LOR	Unit		EB1105959-001	EB1105959-002	----	----	----
EA002 : pH (Soils)									
pH Value	----	0.1	pH Unit		8.0	7.7	----	----	----
EA009: Nett Acid Production Potential									
^ Net Acid Production Potential	----	0.5	kg H2SO4/t		-13.6	-64.1	----	----	----
EA010: Conductivity									
Electrical Conductivity @ 25°C	----	1	µS/cm		842	784	----	----	----
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		17.8	68.9	----	----	----
^ ANC as CaCO3	----	0.1	% CaCO3		1.8	7.0	----	----	----
Fizz Rating	----	0	Fizz Unit		0	2	----	----	----
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		0.14	0.16	----	----	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1107132**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: Drayton South Project	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 12-APR-2011
Sampler	: ----	Issue Date	: 29-APR-2011
Site	: ----		
		No. of samples received	: 2
Quote number	: BN/057/11 V2	No. of samples analysed	: 2

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics

Page	:	2 of 4
Work Order	:	EB1107132
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	Drayton South Project

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

Analytical Results

Sub-Matrix: PULP			Client sample ID	Coal Reject	Roof and Floor	----	----	----
			Client sampling date / time	27-MAR-2011 15:00	27-MAR-2011 15:00	----	----	----
Compound	CAS Number	LOR	Unit	EB1107132-001	EB1107132-002	----	----	----
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.062	0.084	----	----	----
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	8.1	4.9	----	----	----
^ Exchangeable Magnesium	----	0.1	meq/100g	11.5	5.9	----	----	----
^ Exchangeable Potassium	----	0.1	meq/100g	0.7	0.6	----	----	----
^ Exchangeable Sodium	----	0.1	meq/100g	3.6	3.7	----	----	----
^ Exchangeable Sodium Percent	----	0.1	%	15.2	24.3	----	----	----
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	2020	6900	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	2020	6900	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	<1	<1	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	110	610	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	1230	690	----	----	----
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	80	50	----	----	----
Magnesium	7439-95-4	10	mg/kg	80	50	----	----	----
Sodium	7440-23-5	10	mg/kg	600	690	----	----	----
Potassium	7440-09-7	10	mg/kg	70	50	----	----	----
ED093T: Total Major Cations								
Sodium	7440-23-5	10	mg/kg	990	1330	----	----	----
Potassium	7440-09-7	10	mg/kg	1150	1090	----	----	----
Calcium	7440-70-2	10	mg/kg	5460	16800	----	----	----
Magnesium	7439-95-4	10	mg/kg	3620	9430	----	----	----
EG005S : Soluble Metals by ICPAES								
Aluminium	7429-90-5	1	mg/kg	<1	<1	----	----	----
Antimony	7440-36-0	0.1	mg/kg	0.1	<0.1	----	----	----
Arsenic	7440-38-2	0.1	mg/kg	<0.1	<0.1	----	----	----
Boron	7440-42-8	1	mg/kg	<1	<1	----	----	----
Cadmium	7440-43-9	0.1	mg/kg	<0.1	<0.1	----	----	----
Chromium	7440-47-3	0.1	mg/kg	<0.1	<0.1	----	----	----
Cobalt	7440-48-4	0.1	mg/kg	<0.1	<0.1	----	----	----
Copper	7440-50-8	0.1	mg/kg	<0.1	<0.1	----	----	----
Iron	7439-89-6	1	mg/kg	<1	<1	----	----	----
Lead	7439-92-1	0.1	mg/kg	<0.1	<0.1	----	----	----
Manganese	7439-96-5	0.1	mg/kg	0.1	0.1	----	----	----

Page : 4 of 4
Work Order : EB1107132
Client : RGS ENVIRONMENTAL PTY LTD
Project : Drayton South Project

Analytical Results

Sub-Matrix: PULP				Client sample ID	Coal Reject	Roof and Floor	----	----	----
				Client sampling date / time	27-MAR-2011 15:00	27-MAR-2011 15:00	----	----	----
Compound	CAS Number	LOR	Unit		EB1107132-001	EB1107132-002	----	----	----
EG005S : Soluble Metals by ICPAES - Continued									
Molybdenum	7439-98-7	0.1	mg/kg		**0.2**	<0.1	----	----	----
Nickel	7440-02-0	0.1	mg/kg		<0.1	<0.1	----	----	----
Selenium	7782-49-2	0.1	mg/kg		<0.1	**0.2**	----	----	----
Zinc	7440-66-6	0.1	mg/kg		<0.1	<0.1	----	----	----
EG005T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		**3940**	**3950**	----	----	----
Antimony	7440-36-0	5	mg/kg		<5	<5	----	----	----
Boron	7440-42-8	50	mg/kg		<50	<50	----	----	----
Cobalt	7440-48-4	2	mg/kg		**2**	**9**	----	----	----
Iron	7439-89-6	50	mg/kg		**25500**	**46400**	----	----	----
Manganese	7439-96-5	5	mg/kg		**321**	**404**	----	----	----
Molybdenum	7439-98-7	2	mg/kg		<2	<2	----	----	----
Selenium	7782-49-2	5	mg/kg		<5	<5	----	----	----
Phosphorus	7723-14-0	50	mg/kg		**280**	**710**	----	----	----
Arsenic	7440-38-2	5	mg/kg		<5	**17**	----	----	----
Cadmium	7440-43-9	1	mg/kg		<1	<1	----	----	----
Chromium	7440-47-3	2	mg/kg		**5**	**12**	----	----	----
Copper	7440-50-8	5	mg/kg		**11**	**25**	----	----	----
Lead	7439-92-1	5	mg/kg		**21**	**10**	----	----	----
Nickel	7440-02-0	2	mg/kg		**7**	**36**	----	----	----
Zinc	7440-66-6	5	mg/kg		**64**	**62**	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	----	0.1	mg/kg		<0.1	<0.1	----	----	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1108503**	Page	: 1 of 3
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: 091018	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: 091018		
C-O-C number	: ----	Date Samples Received	: 03-MAY-2011
Sampler	: A.Robertson	Issue Date	: 16-MAY-2011
Site	: Drayton South		
		No. of samples received	: 3
Quote number	: BN/567/10	No. of samples analysed	: 3

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics

Page	:	2 of 3
Work Order	:	EB1108503
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	091018

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

Page	:	3 of 3
Work Order	:	EB1108503
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	091018

Analytical Results

Sub-Matrix: **LEACHATE**				Client sample ID	Drayton South 1	Drayton South 2	Drayton South 3	----	----
				Client sampling date / time	29-APR-2011 15:00	29-APR-2011 15:00	29-APR-2011 15:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EB1108503-001**	**EB1108503-002**	**EB1108503-003**	**----**	**----**
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**9.52**	**7.86**	**7.67**	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**188**	**239**	**196**	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		**21**	<1	<1	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		**25**	**29**	**22**	----	----
Total Alkalinity as CaCO3	----	1	mg/L		**46**	**29**	**22**	----	----
ED038A: Acidity									
Acidity as CaCO3	----	1	mg/L		<1	<1	<1	----	----
ED040F: Dissolved Major Anions									
Sulfate as SO4 2-	14808-79-8	1	mg/L		**26**	**32**	**24**	----	----
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		**12**	**26**	**26**	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**1**	**3**	**3**	----	----
Magnesium	7439-95-4	1	mg/L		**1**	**2**	**3**	----	----
Sodium	7440-23-5	1	mg/L		**36**	**40**	**30**	----	----
Potassium	7440-09-7	1	mg/L		**2**	**1**	**2**	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**0.16**	**0.04**	**0.04**	----	----
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.036**	**0.005**	**0.005**	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Copper	7440-50-8	0.001	mg/L		**0.002**	**0.001**	**0.002**	----	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Nickel	7440-02-0	0.001	mg/L		**0.003**	**0.003**	**0.003**	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	----	----
Manganese	7439-96-5	0.001	mg/L		<0.001	**0.002**	**0.002**	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.069**	**0.008**	**0.016**	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	**0.01**	**0.01**	----	----
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	<0.05	----	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1108899**	Page	: 1 of 3
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: 091018 DRAYTON SOUTH	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 09-MAY-2011
Sampler	: ----	Issue Date	: 23-MAY-2011
Site	: ----		
		No. of samples received	: 2
Quote number	: BN/057/11 V2	No. of samples analysed	: 2

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics
Stephen Hislop	Senior Inorganic Chemist	Brisbane Inorganics

Page	:	2 of 3
Work Order	:	EB1108899
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	091018 DRAYTON SOUTH

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **EG020A-F (Dissolved Metals): LCS recovery for Se falls outside Dynamic Control Limits. They are however within ALS Static Control Limits and hence deemed acceptable.**
- **LCS recovery for EA010-P (Conductivity), ED037-P (Alkalinity) analyses fall outside Dynamic Control Limits. They are however within ALS Static Control Limits and hence deemed acceptable.**

Page	:	3 of 3
Work Order	:	EB1108899
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	091018 DRAYTON SOUTH

Analytical Results

Sub-Matrix: LIQUID			Client sample ID	DRAYTON SOUTH 4	DRAYTON SOUTH 5	----	----	----
			Client sampling date / time	29-APR-2011 15:00	29-APR-2011 15:00	----	----	----
Compound	CAS Number	LOR	Unit	EB1108899-001	EB1108899-002	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.34**	**6.61**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1290**	**2140**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**15**	**4**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**15**	**4**	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	<1	**4**	----	----	----
ED040F: Dissolved Major Anions								
Sulfate as SO4 2-	14808-79-8	1	mg/L	**43**	**390**	----	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	**635**	**855**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**24**	**39**	----	----	----
Magnesium	7439-95-4	1	mg/L	**28**	**38**	----	----	----
Sodium	7440-23-5	1	mg/L	**239**	**496**	----	----	----
Potassium	7440-09-7	1	mg/L	**10**	**11**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.01**	<0.01	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.037**	**0.051**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	**0.0016**	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.001**	<0.001	----	----	----
Cobalt	7440-48-4	0.001	mg/L	**0.002**	**0.078**	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.005**	**0.108**	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	<0.005	**0.200**	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.044**	**0.205**	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.005**	**0.002**	----	----	----
Selenium	7782-49-2	0.01	mg/L	**0.15**	**0.26**	----	----	----
Boron	7440-42-8	0.05	mg/L	<0.05	**0.05**	----	----	----
Iron	7439-89-6	0.05	mg/L	<0.05	**0.16**	----	----	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1109558**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: 091018 Drayton South	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 16-MAY-2011
Sampler	: A. Robertson	Issue Date	: 30-MAY-2011
Site	: ----		
		No. of samples received	: 5
Quote number	: BN/057/11 V2	No. of samples analysed	: 5

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics

Page	:	2 of 4
Work Order	:	EB1109558
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	091018 Drayton South

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

Page : 3 of 4
Work Order : EB1109558
Client : RGS ENVIRONMENTAL PTY LTD
Project : 091018 Drayton South

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	Drayton South 1	Drayton South 2	Drayton South 3	Drayton South 4	Drayton South 5
				Client sampling date / time	13-MAY-2011 15:00	13-MAY-2011 15:00	13-MAY-2011 15:00	13-MAY-2011 15:00	13-MAY-2011 15:00
					EB1109558-001	EB1109558-002	EB1109558-003	EB1109558-004	EB1109558-005
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		9.27	9.12	8.00	7.63	7.62
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		194	405	122	4140	2440
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		10	7	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		21	19	11	57	45
Total Alkalinity as CaCO3	----	1	mg/L		31	26	11	57	45
ED038A: Acidity									
Acidity as CaCO3	----	1	mg/L		<1	<1	1	2	5
ED040F: Dissolved Major Anions									
Sulfate as SO4 2-	14808-79-8	1	mg/L		35	57	19	130	324
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		15	65	15	1410	877
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		1	3	2	107	60
Magnesium	7439-95-4	1	mg/L		1	4	2	138	61
Sodium	7440-23-5	1	mg/L		37	72	19	523	481
Potassium	7440-09-7	1	mg/L		1	2	2	26	23
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.28	0.03	0.02	<0.01	<0.01
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	0.001	<0.001
Arsenic	7440-38-2	0.001	mg/L		0.016	0.004	0.002	0.049	0.012
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	0.0002	0.0004
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		0.001	<0.001	<0.001	0.002	0.003
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	<0.001	0.005	0.043
Nickel	7440-02-0	0.001	mg/L		0.002	<0.001	<0.001	0.009	0.096
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	0.009	0.036
Manganese	7439-96-5	0.001	mg/L		<0.001	0.001	0.001	0.136	0.165
Molybdenum	7439-98-7	0.001	mg/L		0.131	0.023	0.020	0.018	0.018
Selenium	7782-49-2	0.01	mg/L		0.01	0.04	<0.01	0.22	0.11
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
EN055: Ionic Balance									
^ Total Anions	----	0.01	meq/L		1.77	3.55	1.04	43.6	32.4

Page	:	4 of 4
Work Order	:	EB1109558
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	091018 Drayton South

Analytical Results

Sub-Matrix: WATER	Client sample ID	Drayton South 1	Drayton South 2	Drayton South 3	Drayton South 4	Drayton South 5
	Client sampling date / time	13-MAY-2011 15:00	13-MAY-2011 15:00	13-MAY-2011 15:00	13-MAY-2011 15:00	13-MAY-2011 15:00
Compound / CAS Number	LOR / Unit	EB1109558-001	EB1109558-002	EB1109558-003	EB1109558-004	EB1109558-005
EN055: Ionic Balance - Continued						
^ Total Cations ---	0.01 meq/L	**1.79**	**3.62**	**1.12**	**40.2**	**29.5**
^ Ionic Balance ---	0.01 %	---	**0.98**	---	**4.13**	**4.59**

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1111344**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: 091018 Drayton South	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 10-JUN-2011
Sampler	: A Robertson	Issue Date	: 20-JUN-2011
Site	: ----		
		No. of samples received	: 5
Quote number	: BN/057/11 V2	No. of samples analysed	: 5

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics

Page	:	2 of 4
Work Order	:	EB1111344
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	091018 Drayton South

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

Page : 3 of 4
Work Order : EB1111344
Client : RGS ENVIRONMENTAL PTY LTD
Project : 091018 Drayton South

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID	Drayton South 1	Drayton South 2	Drayton South 3	Drayton South 4	Drayton South 5
				Client sampling date / time	10-JUN-2011 11:00	10-JUN-2011 11:00	10-JUN-2011 11:00	10-JUN-2011 11:00	10-JUN-2011 11:00
					EB1111344-001	EB1111344-002	EB1111344-003	EB1111344-004	EB1111344-005
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		9.06	8.74	8.85	7.13	7.46
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		387	394	154	1320	916
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		20	6	5	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		63	26	13	11	30
Total Alkalinity as CaCO3	----	1	mg/L		84	32	18	11	30
ED038A: Acidity									
Acidity as CaCO3	----	1	mg/L		<1	<1	<1	3	2
ED040F: Dissolved Major Anions									
Sulfate as SO4 2-	14808-79-8	1	mg/L		66	71	32	70	176
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		14	44	9	457	149
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		1	2	2	25	12
Magnesium	7439-95-4	1	mg/L		1	2	3	41	10
Sodium	7440-23-5	1	mg/L		77	71	19	210	153
Potassium	7440-09-7	1	mg/L		3	2	3	11	7
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.12	0.22	0.04	<0.01	0.02
Antimony	7440-36-0	0.001	mg/L		0.004	<0.001	<0.001	<0.001	0.001
Arsenic	7440-38-2	0.001	mg/L		0.083	0.008	0.004	0.035	0.025
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		0.003	0.001	<0.001	0.002	0.002
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	0.005
Nickel	7440-02-0	0.001	mg/L		0.004	<0.001	<0.001	0.003	0.008
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	<0.005	<0.005
Manganese	7439-96-5	0.001	mg/L		<0.001	0.002	<0.001	0.031	0.020
Molybdenum	7439-98-7	0.001	mg/L		0.173	0.014	0.028	0.008	0.029
Selenium	7782-49-2	0.01	mg/L		0.02	0.04	0.01	0.14	0.07
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		<0.05	0.06	<0.05	<0.05	<0.05
EN055: Ionic Balance									
^ Total Anions	----	0.01	meq/L		3.45	3.36	1.28	14.6	8.47

Page	:	4 of 4
Work Order	:	EB1111344
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	091018 Drayton South

Analytical Results

Sub-Matrix: WATER	Client sample ID	Drayton South 1	Drayton South 2	Drayton South 3	Drayton South 4	Drayton South 5
	Client sampling date / time	10-JUN-2011 11:00	10-JUN-2011 11:00	10-JUN-2011 11:00	10-JUN-2011 11:00	10-JUN-2011 11:00
Compound / CAS Number	LOR / Unit	EB1111344-001	EB1111344-002	EB1111344-003	EB1111344-004	EB1111344-005
EN055: Ionic Balance - Continued						
^ Total Cations ---	0.01 meq/L	3.56	3.40	1.25	14.0	8.26
^ Ionic Balance ---	0.01 %	1.53	0.63	----	1.86	1.28

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1112740**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: 091018-Drayton South	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 30-JUN-2011
Sampler	: A. Robertson	Issue Date	: 14-JUL-2011
Site	: ----		
		No. of samples received	: 5
Quote number	: BN/057/11 V2	No. of samples analysed	: 5

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics

Page	:	2 of 4
Work Order	:	EB1112740
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	091018-Drayton South

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **Ionic balances are within acceptable limits as detailed in the 21st Ed. APHA "Standard Methods for the Examination of Water and Wastewater".**

Page : 3 of 4
Work Order : EB1112740
Client : RGS ENVIRONMENTAL PTY LTD
Project : 091018-Drayton South

Analytical Results

Sub-Matrix: **WATER**

Compound	CAS Number	LOR	Unit	Client sample ID: Drayton South 1	Drayton South 2	Drayton South 3	Drayton South 4	Drayton South 5
				Client sampling date / time: 30-JUN-2011 09:00	30-JUN-2011 09:00	30-JUN-2011 09:00	30-JUN-2011 09:00	30-JUN-2011 09:00
				EB1112740-001	EB1112740-002	EB1112740-003	EB1112740-004	EB1112740-005
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	9.32	8.74	8.69	7.30	7.67
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	143	353	82	1450	743
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	20	8	6	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	23	20	8	21	39
Total Alkalinity as CaCO3	----	1	mg/L	43	28	14	21	39
ED038A: Acidity								
^ Acidity as CaCO3	----	1	mg/L	<1	<1	<1	2	2
ED040F: Dissolved Major Anions								
Sulfate as SO4 2-	14808-79-8	1	mg/L	21	73	18	95	194
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	1	mg/L	4	42	4	450	74
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	1	1	30	9
Magnesium	7439-95-4	1	mg/L	<1	2	2	36	9
Sodium	7440-23-5	1	mg/L	28	69	10	205	127
Potassium	7440-09-7	1	mg/L	1	1	2	11	6
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	1.11	0.48	0.37	<0.01	0.02
Antimony	7440-36-0	0.001	mg/L	0.001	<0.001	<0.001	<0.001	0.001
Arsenic	7440-38-2	0.001	mg/L	0.019	0.004	0.003	0.004	0.014
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	0.002
Nickel	7440-02-0	0.001	mg/L	0.002	0.001	<0.001	0.002	0.004
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Manganese	7439-96-5	0.001	mg/L	<0.001	0.003	<0.001	0.030	0.007
Molybdenum	7439-98-7	0.001	mg/L	0.050	0.022	0.012	0.010	0.023
Selenium	7782-49-2	0.01	mg/L	<0.01	0.04	<0.01	0.03	0.01
Boron	7440-42-8	0.05	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L	0.14	0.12	<0.05	<0.05	<0.05
EN055: Ionic Balance								
^ Total Anions	----	0.01	meq/L	1.41	3.26	0.77	15.1	6.91

Page	:	4 of 4
Work Order	:	EB1112740
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	091018-Drayton South

Analytical Results

Sub-Matrix: WATER				Client sample ID	Drayton South 1	Drayton South 2	Drayton South 3	Drayton South 4	Drayton South 5
				Client sampling date / time	30-JUN-2011 09:00	30-JUN-2011 09:00	30-JUN-2011 09:00	30-JUN-2011 09:00	30-JUN-2011 09:00
Compound	CAS Number	LOR	Unit		EB1112740-001	EB1112740-002	EB1112740-003	EB1112740-004	EB1112740-005
EN055: Ionic Balance - Continued									
^ Total Cations	---	0.01	meq/L		**1.24**	**3.24**	**0.70**	**13.7**	**6.87**
^ Ionic Balance	---	0.01	%		---	**0.39**	---	**4.99**	**0.31**

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1113865**	Page	: 1 of 3
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services
Address	: 18 INGLIS STREET GRANGE QLD, AUSTRALIA 4051	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: alan@rgsenv.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 07 3856 5591	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 3856 5591	Facsimile	: +61 7 3243 7218
Project	: 091018 Drayton South	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 15-JUL-2011
Sampler	: ----	Issue Date	: 27-JUL-2011
Site	: ----		
		No. of samples received	: 5
Quote number	: BN/057/11 V2	No. of samples analysed	: 5

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Greg Vogel	Laboratory Manager	Brisbane Inorganics
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics

Page	:	2 of 3
Work Order	:	EB1113865
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	091018 Drayton South

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **Ionic Balance out of acceptable limits for EB1113865-004 due to analytes not quantified in this report.**

Page	:	3 of 3
Work Order	:	EB1113865
Client	:	RGS ENVIRONMENTAL PTY LTD
Project	:	091018 Drayton South

Analytical Results

Sub-Matrix: **LIQUID**

Compound	CAS Number	LOR	Unit	Client sample ID	Drayton South 1	Drayton South 2	Drayton South 3	Drayton South 4	Drayton South 5
				Client sampling date / time	14-JUL-2011 15:00	14-JUL-2011 15:00	14-JUL-2011 15:00	14-JUL-2011 15:00	14-JUL-2011 15:00
					EB1113865-001	EB1113865-002	EB1113865-003	EB1113865-004	EB1113865-005
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		9.24	8.35	8.29	7.43	7.86
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		78	278	70	1200	539
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	<1
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		8	<1	<1	<1	<1
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		15	26	11	24	48
Total Alkalinity as CaCO3	----	1	mg/L		24	27	11	24	48
ED038A: Acidity									
Acidity as CaCO3	----	1	mg/L		<1	1	1	2	2
ED040F: Dissolved Major Anions									
Sulfate as SO4 2-	14808-79-8	1	mg/L		9	58	12	78	136
ED045G: Chloride Discrete analyser									
Chloride	16887-00-6	1	mg/L		2	23	4	409	30
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		<1	<1	1	23	7
Magnesium	7439-95-4	1	mg/L		<1	1	2	27	6
Sodium	7440-23-5	1	mg/L		15	50	8	147	86
Potassium	7440-09-7	1	mg/L		1	2	2	11	6
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		0.77	1.81	0.38	<0.01	0.07
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	0.001
Arsenic	7440-38-2	0.001	mg/L		0.009	0.004	0.002	0.014	0.016
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	7440-47-3	0.001	mg/L		<0.001	0.002	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L		<0.001	0.002	<0.001	<0.001	<0.001
Cobalt	7440-48-4	0.001	mg/L		<0.001	0.001	<0.001	<0.001	0.002
Nickel	7440-02-0	0.001	mg/L		0.001	0.004	<0.001	0.002	0.003
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	<0.005	<0.005	<0.005
Manganese	7439-96-5	0.001	mg/L		<0.001	0.007	0.001	0.019	0.005
Molybdenum	7439-98-7	0.001	mg/L		0.027	0.022	0.007	0.009	0.017
Selenium	7782-49-2	0.01	mg/L		<0.01	0.03	<0.01	0.06	0.01
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	<0.05
Iron	7439-89-6	0.05	mg/L		0.09	0.49	<0.05	<0.05	<0.05