Report

Red Hill Mining Lease

Geochemical Characterisation of Overburden and Reject Materials

25 SEPTEMBER 2013

Prepared for

BM Alliance Coal Operations Pty Ltd

42627136

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Abbreviations and Units

Abbreviation	Description
ABA	acid base account
ABCC	acid buffering characteristic curve
AC	acid consuming
AGC	AGC Woodward-Clyde
AHD	Australian Height Datum
ALS	Australian Laboratory Services
AMD	acid and metalliferous drainage
AMIRA	Australian Mineral Industries Research Association International Limited
ANC	acid neutralising capacity
ANZECC	Australian and New Zealand Environment Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
As	arsenic
BBCGP	Bowen Basin coal growth project
bcm	bulk cubic metres
BM 1	Broadmeadow 1
BM 2	Broadmeadow 2
BMA	BHP Billiton Mitsubishi Alliance
BOM	Bureau of Meteorology
BRM	Broadmeadow Underground Mine
Cd	cadmium
CEC	cation exchange capacity
CHPP	coal handling and preparation plant
Co	cobalt
Cr	chromium
CRS	chromium reducible sulfide
Cu	copper
DEEDI	Department of Employment, Economic Development and Innovation
DERM	Department of Environment and Resource Management
DITR	Department of Industry, Tourism and Resources
dS/cm	deciSiemens per centimetre
eCEC	effective cation exchange capacity
EC	electrical conductivity
EC (1:5)	EC measured on a solid to water ratio of 1:5 (water extract)
EC_e	EC measured on a saturated soil paste
EC_{se}	average root zone salinity
EHP	Department of Environment and Heritage Protection
EIS	Environmental Impact Statement
ESP	exchangeable sodium percentage
GAI	geochemical abundance index
GRB	Goonyella Riverside and Broadmeadow Mine Complex
GRM	Goonyella Riverside Mine
GS1	Goonyella Tailings Dam
GLS	Goonyella Lower Seam
GMS	Goonyella Middle Seam
GUS	Goonyella Upper Seam
HIL(s)	health-based investigation level(s)
LC	low capacity
LOM	life of mine
LOR	limit of reporting

Abbreviation	Description
LTCC	longwall top coal caving
m	metres
mbcm	million bulk cubic metres
MDLA	mineral development lease application
MIA	mine industrial area
ML	mining lease
MLA	mining lease application
Mn	manganese
Mo	molybdenum
MPA	maximum potential acidity
mt	million tonnes
mtpa	million tonnes per annum
NAF	non acid forming
NAG	net acid generation
NAG_{org}	extended boil net acid generation
NAPP	net acid producing potential
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
Ni	nickel
Pa	pascals
PAF	potentially acid forming
PAF-LC	potentially acid forming – low capacity
Pb	lead
pH	'per hydrogen' (a measure of hydrogen ion concentration in an aqueous solution)
pH (1:5)	pH measured on a solid to water ratio of 1:5 (water extract)
pH_e	pH measured on a saturated soil paste
RHM	Red Hill Mine
ROM	run-of-mine
RS1	Riverside tailings dam
%	per cent
SAR	sodium adsorption ratio
Sb	antimony
Se	selenium
t	tonne
t/m^3	tonnes per cubic metre
TC	total carbon
TIC	total inorganic carbon
TOC	total organic carbon
TOS	total oxidisable sulfur
TSM	thick seam mining
U	uranium
UC	uncertain
URS	URS Australia Pty Ltd
μS/cm	microSiemens per centimetre
V	vanadium
Zn	zinc

Executive Summary Mineral Waste

BHP Billiton Mitsubishi Alliance (BMA) commissioned URS Australia Pty Ltd to undertake a geochemical study to assess the acid and metalliferous drainage and mineral waste potential risks for its proposed Red Hill Mining Lease (the project).

The geochemical study involved:

- review of previous geochemical investigations conducted in the area broadly covered by the project;
- geochemical testing of 46 overburden, 19 coal roof and floor materials, eight coarse rejects, and 10 tailings samples. Testing included pH (1:5), electrical conductivity (1:5), acid neutralising capacity, total sulfur, sulfide-sulfur, net acid producing potential, net acid generation test, and sodicity; and
- assessing the potential environmental risk that may be associated with mining, handling and storing of these mine waste materials.

The results from this study are consistent with previous investigations. The mineral waste materials tested (except tailings) have negligible sulfide-sulfur concentrations (<0.1 per cent). Eighty-six per cent of all samples tested were non-acid forming (NAF) or acid consuming. The geochemical classification is not dependent on rock type or sample depth. All overburden, coarse rejects, and coal roof and floor samples tested are NAF, while tailings samples are typically potentially acid forming (PAF).

The results show that the risk of the mineral waste materials causing marked water quality impacts on downstream receiving environments is low, and is unlikely to present any environmental issues associated with revegetation and rehabilitation in terms of adverse effects on plant growth. It may; however, be susceptible to spontaneous dispersion when it becomes wet or after applied mechanical work, and thus would not be suitable for use as a final cover material.

Recommendations include:

- Ongoing geochemical evaluation of actual reject materials generated from the project, and overburden, potential reject (i.e. coal roof and coal floor materials) and Goonyella Middle Seam coal samples collected from in-fill drilling core samples ahead of mining, at least on an annual basis, to confirm the NAF nature or delineate any PAF materials prior to mining.
- Non-selective handling of overburden, generated during the underground development phase, as they are expected to be NAF. Overburden materials, with suitable geotechnical properties, will be used for engineering and construction purposes.
- Excavated spoil (waste rock material) with properties unsuitable for engineering and construction purposes will be placed in designated mineral waste disposal areas at the Goonyella, Riverside and Broadmeadow (GRB) mine complex according to the existing approved overburden management practices.
- Storing all coarse reject materials in in-pit spoil dumps at the GRB mine complex where they will be mechanically mixed by dozer into the spoil and compacted. Lime dosing of compacted coarse reject layers (one to two metres) will be used (as a precautionary measure) to extend the lag period in the unlikely event of any acid generation.
- Managing out-of-pit overburden to maximise the mass of saline and/or sodic materials reporting to the core of storage facilities, with measures in place to prevent or minimise water flow over potentially dispersive materials on spoil dumps and by avoiding placement at the final top surface and final surface of the outer slopes and batters.
- Lime amendment of PAF rejects materials (dewatered) if they generate leachate pH values less than 5.0.

Introduction

1.1 Background

The Red Hill Mining Lease is located adjacent to the existing Goonyella, Riverside and Broadmeadow (GRB) mine complex in the Bowen Basin, approximately 20 kilometres north of Moranbah and 135 kilometres south-west by road from Mackay, Queensland.

BHP Billiton Mitsubishi Alliance (BMA), through its joint venture manager, BM Alliance Coal Operations Pty Ltd, proposes to convert the existing Red Hill Mining Lease Application (MLA) 70421 to enable the continuation of existing mining operations associated with the GRB mine complex. Specifically, the mining lease conversion will allow for:

- An extension of three longwall panels (14, 15 and 16) of the existing Broadmeadow underground mine (BRM).
- A future incremental expansion option of the existing Goonyella Riverside Mine (GRM).
- A future Red Hill Mine (RHM) underground expansion option located to the east of the GRM.

The three project elements described above are collectively referred to as 'the project'. The project will include the following components:

- The extension of BRM longwall panels 14, 15, and 16 into MLA70421. Key elements include;
  - No new mining infrastructure is proposed other than infrastructure required for drainage of incidental mine gas (IMG) to enable safe and efficient mining.
  - Management of waste and water produced from drainage of IMG will be integrated with the existing BRM waste and water management systems.
  - The mining of the BRM panel extensions is to sustain existing production rates of the BRM mine and will extend the life of mine by approximately one year.
  - The existing BRM workforce will complete all work associated with the extensions.
- The incremental expansion of the GRM including:
  - underground mining associated with the RHM underground expansion option to target the Goonyella Middle Seam (GMS);
  - a new mine industrial area (MIA);
  - a coal handling and preparation plant (CHPP) adjacent to the Riverside MIA on MLA1764 and mining lease (ML) 1900 − the Red Hill CHPP will consist of up to three 1,200 tonne per hour modules;
  - construction of a drift for mine access;
  - a conveyor system linking RHM to the Red Hill CHPP;
  - associated coal handling infrastructure and stockpiles;
  - a new conveyor linking product coal stockpiles to a new rail load-out facility located on ML 1900; and
  - means for providing flood protection to the mine access and MIA, potentially requiring a levee along the west bank of the Isaac River.

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- A potential new RHM underground expansion option to the east of the GRB mine complex, to target the GMS on MLA70421. Key aspects include:
  - the proposed mine layout consists of a main drive extending approximately west to east with longwall panels ranging to the north and south;
  - a network of bores and associated surface infrastructure over the underground mine footprint for mine gas pre-drainage (IMG) and management of goaf methane drainage to enable the safe extraction of coal;
  - a ventilation system for the underground workings;
  - a bridge across the Isaac River for all-weather access. This will be located above the main headings, and will also provide a crossing point for other mine related infrastructure including water pipelines and power supply;
  - a new accommodation village (Red Hill accommodation village) for the up to 100 per cent remote construction and operational workforces with capacity for up to 3,000 workers; and
  - potential production capacity of 14mtpa of high quality hard coking coal over a life of 20 to 25 years.

BMA commissioned URS Australia Pty Ltd (URS) to undertake a geochemical study to assess the acid and metalliferous drainage (AMD) and mineral waste risks that may be caused by the proposed project. BMA is seeking to use the outcomes of the study as part of the project's EIS submission.

The geochemical study consisted of three components:

- Review of previous geochemical investigation programs to provide a summary of the geochemical characteristics and AMD potential of mineral waste samples collected from the GRB mine complex.
- Geochemical testing of overburden, coarse rejects and tailings, and coal roof and floor materials likely to be disturbed and/or generated by the proposed project in order to assess their AMD potential.
- Assess the potential environmental risks that may be associated with mining, handling and storing of these materials.

The results of the geochemical study and implications for AMD and mineral waste management are presented and discussed in this report.

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BMA
BHP Billiton Mitsubishi Alliance

RED HILL MINING LEASE
GEOCHEMICAL TECHNICAL REPORT

LOCALITY MAP

URS

GEOCHEMICAL ASSESSMENT

Figure: **1-1**

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1.2 Local Geological Setting

The project is situated on the north-western margin of the Bowen Basin on the Collinsville Shelf (BMA 2010a). The geology of the project comprises Permian age sandstone, siltstone, mudstone, claystone and coal, which displays little lithological variability throughout the entire site (west to east and north to south). The Permian age sediments dip towards the east at between 3 and 5 degrees, and are unconformably overlain by poorly consolidated Tertiary and Quaternary age sediments (minor gravels, clays and sands and basalt), which vary in thickness from 0 to 30 metres.

Tertiary age basalt occurs, unconformably over the Permian sediments, primarily in the central area of the project, above the BRM. The depth of weathering is relatively uniform across the site (approximately 240 to 260 metres AHD (Australian Height Datum). Depending upon the local topography, the depth of weathering at any given location is generally about 15 to 30 metres below natural surface.

The local stratigraphical sequence is shown in **Table 1-1**. There are three major coal bearing geological formations of Permian age within the EIS study area boundary, namely:

- Rangal Coal Measures;
- Fort Cooper Coal Measures; and
- Moranbah Coal Measures.

Table 1-1 Local Stratigraphical Sequence

Age	Group	Unit	Lithology	Thickness (m)
Quaternary		Alluvial deposits	Residual soils and colluvium units include all blanketing sandy, loamy and clay soils	0 – 30
Tertiary		Suttor Formation	Mainly unconsolidated sand and clay alluvial deposits, minor basalt flows	
Late Permian	Blackwater	Rangal Coal Measures	Grey sandstone and siltstone, with interbedded mudstone, carbonaceous mudstone and coal	70
		Fort Cooper Coal Measures	Lithic grey sandstone, siltstone and mudstone, with thick inferior coal interbedded with carbonaceous mudstone	400
		Moranbah Coal Measures	Labile grey sandstone and siltstone, mudstone, carbonaceous mudstone and coal seams including: • Goonyella Upper Seam (GUS); • GMS; and • Goonyella Lower Seam (GLS).	200 – 300
	Back Greek	German Creek Formation	Predominantly quartzose sandstones, silty sandstone, mudstone, carbonaceous mudstone and coal	Unknown

The Rangal Coal Measures only outcrops in the far eastern corner of the lease, and do not form a viable (economic) target for a hard coke product due to rank, quality and resource geometry. The Fort Cooper Coal Measures contain thick, stone banded, poor quality coal seams that are not considered economic.

1 Introduction

The Moranbah Coal Measures, the target coal measures, have been the most extensively explored of the coal measures. They are characterised by several laterally persistent, relatively thick coal seams interspersed with several thin minor plys/seams. Most partings are thin tuffaceous claystones. The major seams are:

- GUS;
- Goonyella 'P' Seam;
- GMS; and
- GLS.

The current GRB mine complex targets the GUS, GMS, and GLS through open-cut mining and GMS through underground mining. Some minor inter-seams, which commonly split and coalesce, are also present; however, these seams are typically uneconomic and are unlikely to be mined (e.g. Goonyella 'P' seam between the GUS and GMS). The coal product is quality coking coal. The proposed RHM will target only the GMS.

The depth of overburden (and interburden) cover material at the project ranges from approximately 10 metres at the eastern extent of the current operations to approximately 300 metres on the eastern extent of the proposed open cut, above the GMS.

For this report, the term 'waste rock' is defined and includes:

- all overburden above the GUS;
- all interburden between the GUS and GMS; and
- all interburden between the GMS and GLS.

1.3 Mining and Processing

Coal is currently mined from the Goonyella and Riverside open cut operations and from the BRM operation. The proposed project involves developing the RHM as a longwall operation and extending the BRM using the existing longwall method.

1.3.1 Existing Open Cut Mining

The current open cut operation is a conventional dragline and truck-shovel pre-strip operation with coal haulage by bottom-dump coal hauler to the run-of-mine (ROM) dump stations. Multiple coal seams are extracted in any particular strip.

In general, the open cut mining sequence will involve:

- progressively clearing of any vegetation occurring on areas required for the operation;
- stockpiling topsoil from disturbed areas for storage and use in future rehabilitation of the project;
- pre-stripping / excavation of unconsolidated / soft overburden waste using excavators and trucks;
- dumping over previously stripped dragline spoil;
- drill and blasting of upper competent overburden waste;
- removal of waste rock, using a combination of dozers, excavators and trucks; and dumping over previously excavated pits or out-of-pit spoil dumps;
- coal mining of upper seams using a combination of dozers, excavators, loaders and trucks;
- side casting of lower overburden into the previously mined strip using a dragline;
- coal mining to lower seams; and

1 Introduction

- rehabilitation of spoil piles by re-shaping the waste rock dumps, topsoiling and revegetation using native vegetation.

1.3.2 Existing Broadmeadow Underground Mine

The existing BRM, targeting the GMS, commenced in 2003. The GMS is mined at BRM using the punch longwall method, which uses an existing open-cut pit for access to the underground mine. The operations are developed by driving roadways into the coal seam at the base of the existing open-cut highwall in an easterly direction, down-dip towards the lease boundary. The overburden materials and GLS are not mined as part of the current BRM operation.

High reach longwall equipment is employed as an efficient method providing for additional coal recovery over conventional longwall equipment. Thick seam mining (TSM) equipment has recently been implemented at BRM to increase coal resource recovery.

Longwall coal resource extraction causes the interburden behind the longwall roof supports to progressively collapse. Therefore, following underground mining of the GMS, the overlaying strata (including the GUS) will collapse into the void causing the natural ground level to subside. The amount of subsidence impact is dependent on the type and strength of overlying strata, seam thickness, the seam extraction height, the mining panel widths, and mining depths.

1.3.3 Proposed Red Hill Mine

The proposed RHM will target the GMS to the north east of the existing BRM. The mine will be developed as a conventional underground operation with drifts for access and services, and main drives for coal longwall access and coal transport. It will use the TSM method for coal resource extraction.

Development of the RHM will require the construction of a 2.5 kilometre long drift. The drift will intersect the coal seam at an approximate depth of 250 metres. This will be followed by development of underground roadways using continuous miners, followed by the commencement of longwall mining.

1.3.4 Proposed Broadmeadow Extension

The BRM footprint will be extended eastward into MLA70421 to allow additional reserves to be incorporated into the mine plan.

1.3.5 Coal Handling and Processing

As part of the coal handling and processing activities, the following infrastructure is expected to be developed as part of the GRM incremental expansion:

- A new coal handling and preparation plant (CHPP), referred to as Red Hill CHPP, at the expanded Riverside mine industrial area (MIA). The current conceptual design has two modules, each capable of processing 1,200 tonnes of coal per hour, giving a total capacity of 2,400 tonnes per hour. A third module, also of capacity 1,200 tonnes per hour, may be installed at a later date.
- A new coal clearance system from the new RHM to the ROM stockpile at Red Hill CHPP.
- New coal handling infrastructure.

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- Two new raw coal stockpiles (conical) with the capacity to hold approximately 120,000 tonne each and the ability to expand to 450,000 tonne each.
- Capacity upgrades at the existing Goonyella CHPP and Riverside CHPP to provide an additional 0.5 mtpa of product coal.

1.3.6 Spoil Disposal

As the project involves only underground mining, the waste rock material located above (overburden) and between the coal seams (interburden) is removed only during the construction of drifts for access and services, and main drives for coal longwall access and coal transport only, in order to access the coal seam. For this report, these waste rock materials will be collectively called spoil (or overburden).

The project will not generate any substantial quantities of overburden, with much of the overburden expected to remain largely intact. Spoil materials, with suitable geotechnical properties, will be used for engineering and construction purposes such as bulk fill, road sub-base and construction material for laydown areas.

Spoil that is unsuitable for engineering purposes or in excess of requirements will be placed in the GRB mine complex existing waste storage facilities according to the existing approved overburden management practices.

1.3.7 Rejects and Tailings Management for RHM

The rejects materials from the Red Hill CHPP will consist of coarse rejects (>2.5 millimetres) from the dense medium cyclones, fine rejects (<2.5 to 0.25 millimetres) from the desliming cyclones, and flotation tailings (<0.25 millimetres) from the floatation cells.

These reject materials from Red Hill CHPP will be managed as follows:

- Dense medium coarse reject material will be dewatered on the rejects drain and rinse screens and transported via the rejects conveyor to the rejects bin. In circumstances where the capacity of the rejects bin is exceeded, overflow will be discharged to a designated rejects bunker. The bunker will provide access for a loader for removal of coarse rejects as required.
- Fine reject material from the reflux classifiers will be transferred to the fine coal reject dewatering screen and dewatered using filter, centrifuge, and de-aeration techniques. Dewatered rejects will be transported via the reject conveyor to the rejects bin.
- Flotation tailings material from the flotation cells will be transferred to a high rate tailings thickener. Solids from the thickener underflow will be pumped to multiple belt press filters. Under normal operating conditions, the solids discharged from the belt press filters (dewatered dry tailings) will be transferred by a conveyor and discharged onto the coarse rejects conveyor feeding the rejects bin.

Recovered water from dewatering of reject and tailings materials will be recycled to Red Hill CHPP.

The rejects bin will be designed to ensure an adequate capacity to suit the proposed reject handling fleet. The bin will be emptied on an as-needs basis and will discharge via a pneumatically operated bottom dump gate for loading into haul trucks.

All rejects (dense medium coarse rejects, fine rejects and dewatered tailings) from the rejects bin will be placed within the existing GRB mine complex waste storage facilities. There is no anticipated requirement for an increase to or construction of a new tailings dam as a consequence of the project.

1 Introduction

The tailings and rejects management approach will align with the GRB mine complex Tailings Management and Rehabilitation Management Plans including the following measures:

- All reject material will be trucked to designated GRB mine complex site storage facility.
- Dumps will be developed in line with the GRB mine complex mine plan.
- Reject material will not be placed within 10 metres of the final landform surface (**Figure 1–2**). This will be managed by survey limit pegs.
- Survey control will be used to ensure documented evidence of thickness of cover is recorded.

As a contingency, systems will be in place to pump tailings slurry from the thickener underflow from the Red Hill CHPP to the existing Riverside tailings dam (RS1) and Goonyella tailings dam (GS1) in the event that:

- The dewatered tailings are too wet or have inadequate residue moisture content/consistency and thus present a slumping risk when mixed with spoil for disposal. Slumping may cause a significant safety hazard or result in significant environmental harm.
- The proposed belt press filter dewatering system is rendered inoperable due to maintenance, partial or critical failure.

As this is expected to be required only infrequently, the existing GRB mine complex tailings dams have enough capacity to accommodate tailings generated that cannot be dewatered or are too wet for disposal. Currently, tailings from Goonyella Riverside Mine (GRM) are deposited via perimeter spigots as slurry pumped from the CHPP with solids content between 20 and 35 per cent (BMA 2010b).

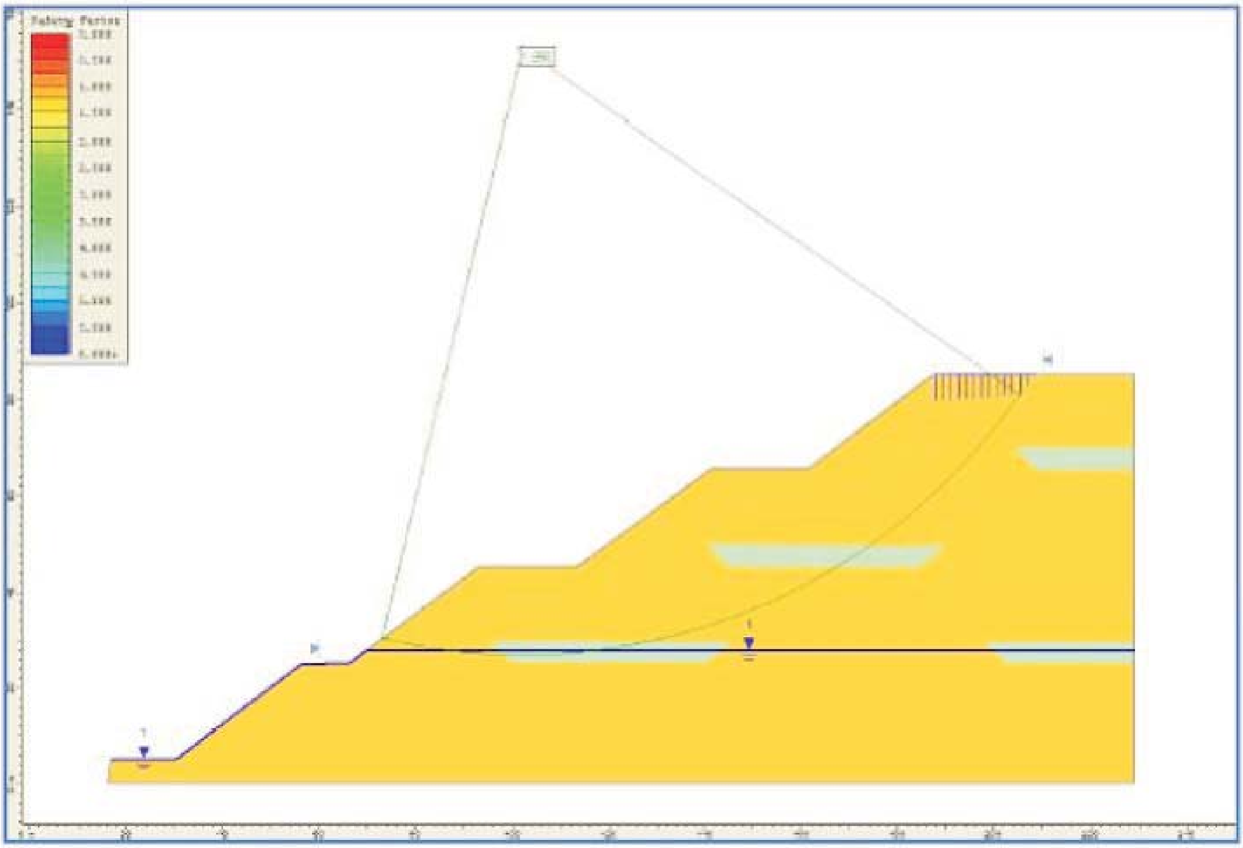
1.3.8 Rehabilitation Strategy for GRB

The rehabilitation strategy, final landform design and planning for in-pit and out-of pit spoil dumps at GRB mine complex is covered by an existing rehabilitation plan (BMA 2007a) prepared to meet requirements of the GRB mine complex environmental authority EPML00853413 (formerly MIN 100921609).

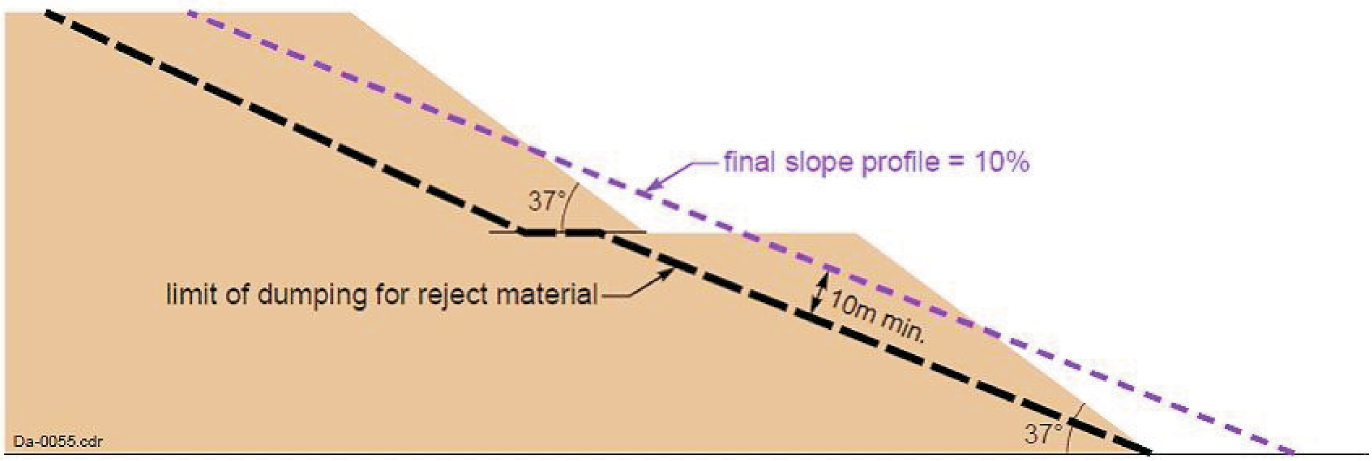
Rejects and spoil dumps will continue to be managed and rehabilitated as per the existing rehabilitation management plan (BMA 2007a and 2011a) and closure plan (BMA 2007b) for the GRB mine complex, the commitments in the environmental authority for the GRM and BRM, and in conformance with the BMA Sustainable Landform Guideline (BMA 2009). Rehabilitation of the existing tailings dams will be undertaken as per the existing commitments in the GRB mine complex Mine Closure Plan (BMA 2007b).

The guideline recommends that coal wastes typically require a minimum of two metres of cover, ensuring that these areas are externally draining or in-pit, and where necessary, treating areas with small amount of alkaline material to lower the acidity and increase the pH of any localised acidic near-surface reject areas. This is to ensure the potential for acidity to impact upon the performance of the rehabilitated reject cover system is minimised.

The reject dumps will consist of three covering layers: a barrier layer to minimise moisture inflow and oxygen egress; a protection layer suitable for plant root growth and to provide some protection to the underlying barrier layer from seasonal variations in moisture content; and a topsoil layer suitable as a plant growth medium. The rejects dumps will be revegetated with pasture for a post-mining land use of grazing as the establishment of bushland on reject dumps is not recommended as tree roots (and tree falls) can affect the integrity of the cover layer (BMA 2011a).



Cross Section of Typical Spoil Dump with Reject Placement



Cross section of typical spoil dump showing minimum 10m cover over coarse rejects and dewatered tailings material

Source: Supplied by BMA

BHP Billiton Mitsubishi Alliance

RED HILL MINING LEASE
GEOCHEMICAL TECHNICAL REPORT

CONCEPTUAL CROSS-SECTION OF TYPICAL SPOIL DUMP SHOWING MINIMUM 10 METRE COVER OVER REJECTS MATERIAL

GEOCHEMICAL ASSESSMENT

Figure: 1-2

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1 Introduction

1.4 Mineral Waste Quantities

The following description on the amount of mineral waste estimated to be generated by the project (and GRB mine complex) draws largely from information supplied by BMA (2011b).

As RHM will be an underground mine, the project will not generate any substantial quantities of overburden, with much of the overburden expected to remain largely intact. Overburden will only be generated during the construction of drifts for access and services, and main drives for coal longwall access and coal transport.

Over an approximate 25 year life of mine (LOM), the project will produce a total of 234 million tonnes of ROM coal (i.e. raw coal), 190 million tonnes of product coal and 43 million tonnes of rejects (BMA 2011b). The Broadmeadow extension (panels 14 and 15) will also produce approximately 5 million tonnes of ROM coal and 1 million tonnes of rejects over approximately one year from commencement of mining. These estimates are based on an assumed average density of 1.8 tonnes per cubic metre (t/m^3) for coarse rejects and dry tailings, and the Broadmeadow extension area representing approximately four per cent of the total BRM surface area with an equivalent coal seam thickness being extracted.

The amount of rejects produced by the project will represent approximately 36 per cent of the total rejects generated by the GRB mine complex during this period. The rejects from the project are relatively minor compared to the overburden and reject waste produced by the existing GRB mine complex. Approximately 32 million tonnes (1.3 mtpa) of coarse rejects and 12 million tonnes (0.5 mtpa) of dewatered tailings will be generated based on a coarse reject to total reject ratio of 0.72. It is estimated that for every one tonne of raw coal mined at the project, 0.13 tonnes of coarse rejects and 0.05 tonnes of dewatered tailings will be produced.

The total amount of rejects (coarse rejects and dewatered tailings) produced by the project is shown in **Table 1-2**.

Table 1-2 Estimated Total Mineral Waste Quantities Generated for the LOM

Location	Waste Type[1]	Quantity (mbcm)	Quantity (mt)
Project[2]	Total Rejects	24	44
	Coarse Rejects[3]	18	32
	Dewatered Tailings	7	12

Note (1): Assumed average density of 1.8 t/m^3 for coarse rejects and tailings
Note (2): Based on Broadmeadow extension area representing ~4 per cent of the total BRM surface area, and assuming an equivalent coal seam thickness is extracted
Note (3): Based on coarse reject to total reject ratio of 0.72

Over an approximate 25 year life of mine, the amount of rejects generated by the project is expected to comprise about one per cent of all mineral waste (i.e. overburden and rejects) produced by the GRB mine complex. The proportion of rejects to product coal is 20 per cent for the project. This is substantially less than the yearly average value (from 2010 to 2012) of 40 per cent for other operating underground coal mines located in the northern district (five mines) and central district (eight mines) of the Bowen Basin (NRM 2013). In terms of the GRB mine complex, the percentage of rejects to product coal is comparatively lower (15 per cent) on average when compared to all operating coal mines (underground and open cut) in Queensland.

1 Introduction

1.5 Acid and Metalliferous Drainage

Coal is deposited within environments that may have some potential to produce sulfides within the sediments. The mining or disturbance of overburden materials and coal can expose these sulfides to air and water, resulting in their oxidation. This can potentially lead to the generation of AMD.

AMD is a term used in this report and by the Department of Resources, Energy and Tourism (DRET) (formerly Department of Industry, Tourism and Resources (DITR)) (DITR 2007a) to recognise that not all drainage related to the oxidation of sulfides is acidic. Sometimes, near-neutral but metalliferous drainage can also occur.

Acid generation from mine waste materials is caused by the exposure of sulfide minerals, most commonly pyrite (FeS_2), to atmospheric oxygen and water. The oxidation of pyrite is in itself a complex process; however, it can be represented by the following overall reaction (Equation 1):

$$FeS_2 + \frac{15}{2}O_2 + \frac{7}{2}H_2O \rightarrow Fe(OH)_3 + 2SO_4^{2-} + 4H^+ \qquad [1]$$

As acid (H^+) water migrates through a site (e.g. tailings or waste rock piles), it further reacts with other minerals in the surrounding tailings or rock material, and may dissolve a range of metals and salts. Acid drainage is characterised by low pH and elevated dissolved metals.

When the acid generated is completely neutralised by the dissolution of common carbonate minerals (such as calcite, dolomite, ankerite and magnesite), it can lead to precipitation and thus removal of metals such as Al, Cu and Pb from the drainage.

However, at near-neutral pH, concentrations of Zn, As, Ni and Cd can be elevated and thus result in metalliferous drainage. Even when no dissolved metal residues remain, the potential exists for drainage to contain high (sulfate) salinity. Generally, metalliferous drainage will also contain high sulfate salinity.

1.6 Geochemical Terminology Overview

This section provides a general description and overview of the AMD test methods and calculations described in this report.

A number of procedures have been developed to assess the acid forming characteristics of mine waste materials. However, ultimately the overall acid generating potential of a sample is mainly evaluated by its Acid Base Account (ABA) and the net acid generation (NAG) test.

1.6.1 Acid Base Account

The ABA involves determining a samples' maximum capacity to generate acid (MPA) due to the oxidation of sulfide minerals (such as pyrite) relative to its acid neutralising capacity (ANC) due to the dissolution of carbonates (such as calcite) and to a lesser extent silicate minerals. That is, it is a theoretical balance between the potential for a sample to generate acid and neutralise acid.

The total sulfur content is commonly used as an estimate of pyritic sulfur to calculate MPA. Based on the stoichiometry of Equation (1), the amount of acid that could be produced by a sample containing 1 per cent S as pyrite is given by Equation (2). The ANC is typically determined by addition of hydrochloric acid to a sample, then back-titrating with sodium hydroxide to determine the amount of acid consumed.

1 Introduction

$$\text{MPA (kg } H_2SO_4\text{/t)} = S(\%) \times 30.6 \qquad [2]$$

The net acid producing potential (NAPP) and the ANC/MPA ratio are two measures of the ABA. The ratio between the ANC and MPA (ANC/MPA ratio) provides an indication of the relative margin of safety (or risk) within a material to generate acid. The ANC/MPA ratio referenced in the literature for indicating safe values for prevention of acid generation typically range between 1.5 and 3.

The NAPP is the difference between the MPA and ANC. It indicates if a material has potential to produce acidic drainage and is determined using Equation (3).

$$\text{NAPP (kg } H_2SO_4\text{/t)} = [S(\%) \times 30.6] - [\text{ANC (kg } H_2SO_4\text{/t)}] \qquad [3]$$

A sample with NAPP > 0 has a positive net acid producing potential, while a sample with NAPP ≤ 0 is non-acid forming or potentially acid consuming.

A better estimation of the NAPP value can be obtained if chromium reducible sulfur (CRS) is analysed to approximate the sulfur concentration (in Equation 2) of a sample due to sulfide mineral oxidation. In this case, the resulting net acid producing potential is referred to as $NAPP_{CRS}$.

1.6.2 Acid Buffering Characteristics Curve

The ANC of a sample can be further evaluated by slow acid titration to a defined end-point (typically pH 4). This test is commonly called the acid buffering characteristic curve (ABCC). It provides an indication of the portion of ANC within a sample that is readily available for acid neutralisation.

1.6.3 Net Acid Generation Test

The single NAG test involves reaction of a sample with hydrogen peroxide to rapidly oxidise any sulfide minerals contained within a sample. During the NAG test both acid generation and acid neutralisation reactions can occur simultaneously. The end result represents a direct measurement of the net amount of acid generated by the sample.

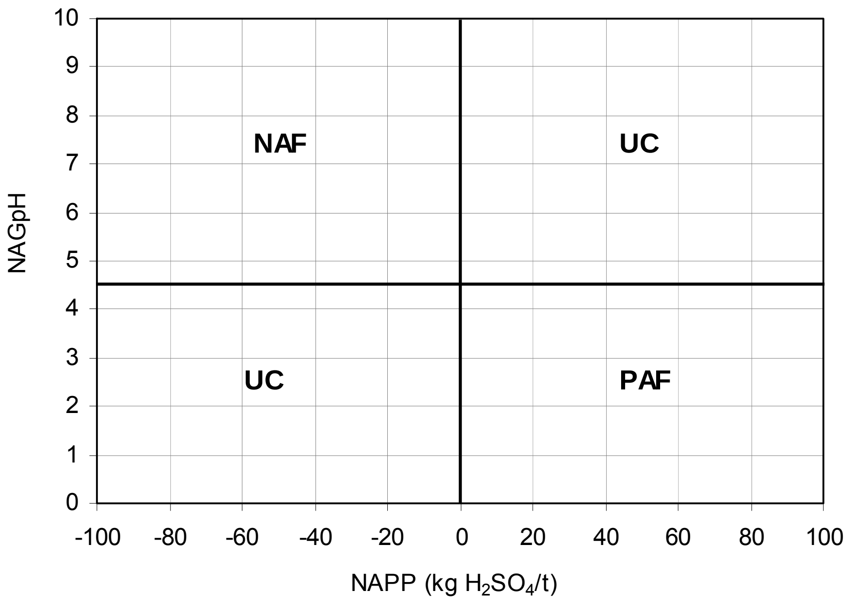
The final pH is referred to as the NAGpH and the amount of acid produced is commonly referred to as the NAG capacity, and is expressed in the same units as the NAPP (kg H_2SO_4/t). A pH after reaction (NAGpH) of less than 4.5 indicates that the sample is net acid-generating.

1.6.4 AMD Sample Classification

For the purpose of this report, the NAG test is used in conjunction with the NAPP to enhance the reliability of classifying the acid-generating potential of the mineral waste sample. A geochemical classification plot (**Figure 1-3**), showing NAGpH versus the NAPP value, is used to depict whether the mineral waste sample lies within the potentially acid forming (PAF), non-acid forming (NAF) or Uncertain (UC) domains.

A sample classified as PAF has acid generating potential that exceeds the inherent acid neutralising capacity of the material. A sample classified as NAF has available ANC that can neutralise all the acid that theoretically could be generated by the sample. A sample classified as uncertain has an apparent conflict between the NAPP and NAG results (i.e. when the NAPP is positive and NAGpH > 4.5, or when the NAPP is negative and NAGpH ≤ 4.5). Uncertain samples require more detailed investigation to determine their acid generating potential.

Figure 1-3 Geochemical Classification Plot



1.7 Previous Geochemical Characterisation Studies

URS reviewed the information compiled from geochemical characterisation programs conducted between 1992 and 2007. The review draws largely from the following reports:

- AGC Woodward-Clyde (AGC) (1992). Spoil and Reject Characterisation – Goonyella/Riverside, Letter Report DF: kc:4368: L1, February 1992;
- Land Reclamation Services (LRS) (1993). Overburden and Interburden Characteristics of the Northern End of the Goonyella/Riverside Mine Area and Suitability of Specific Layers for Capping Report, June 1993;
- Environmental Geochemistry International (EGi) (1995). Environmental Geochemical Characterisation of Out-Of-Pit Spoil at the BHP Goonyella/Riverside Mine, Final Report, May 1995;
- EGi (1996). Environmental Geochemistry of Overburden from the Red Hill Pit and Implications for Spoil Management, Document Number 9202/1/302, December 1996;
- URS (2004): Rehabilitation and Monitoring of Riverside Reject Dump, Draft Report R001-C, 28 June 2004; and
- URS (2007a). Geochemical Characterisation and Assessment of Overburden and Potential Reject Material – Goonyella Riverside Expansion Project, Draft Report, 42626060 Rev D, 31 July 2007.

1 Introduction

The locations of samples referred to in the above reports are shown in **Figure 1–4**. The results from the previous geochemical investigation programs listed above are discussed in the following sections.

1.7.1 AGC Woodward-Clyde (1992)

AGC (1992) conducted a geochemical characterisation program for coal rejects, spoil and tailings from the GRM to provide an indication of the potential for amelioration of acid producing reject dumps with alkaline sodic spoil.

The analytical program included pH_e (saturation paste), EC_e (saturation paste), exchangeable sodium percentage (ESP), and ANC (for nine spoil samples) and NAPP, pH_e, EC_e, ESP, sulfate-sulfur, sulfide-sulfur and total sulfur (for 18 reject samples). In addition, 12 coal tailings samples were analysed for pH, EC, chloride, sulfur and major cations (Mg, Ca, Na, P, and K), with four of the tailings samples also analysed for sulfide-sulfur, ANC, MPA and NAPP.

Spoils were reported to be sodic (ESP from 36.6 to 62.4 per cent) and possess low alkalinity (pH_e from 5.43 to 6.56). The EC_e varied between 2,370 and 6,490 microSiemens per centimetre (µS/cm). All reject samples had excess MPA over ANC, resulting in positive NAPP (0.17 to 18.05 kg H_2SO_4/t). The pH and EC of the four tailings samples tested ranged from 2.03 to 4.93 and 126 to 3490 µS/cm, with sulfide-sulfur concentration of 0.21 to 0.40 per cent. The corresponding NAPP values for tailings ranged from 5.4 to 16.8 kg H_2SO_4/t.

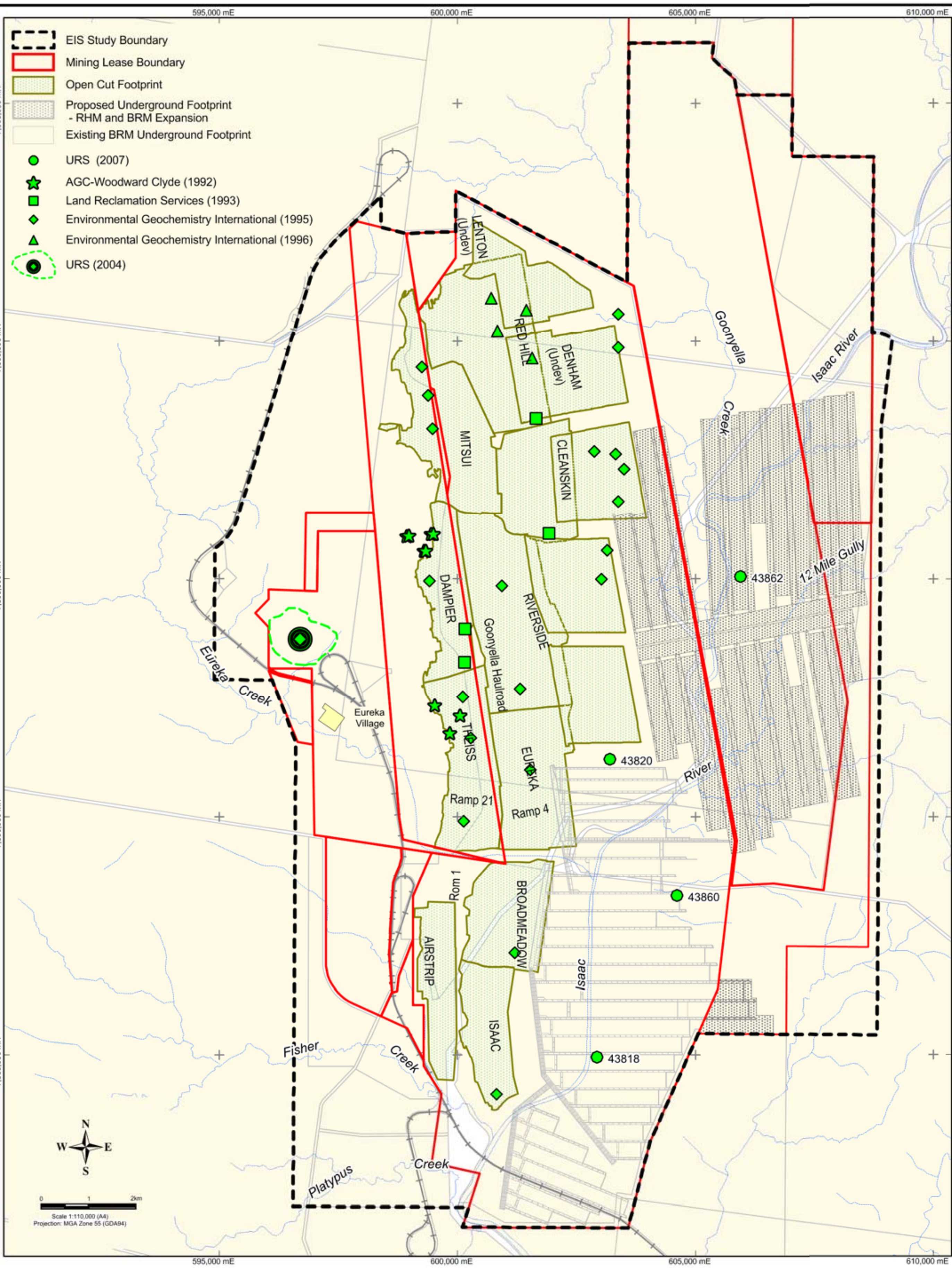
A ratio of six parts spoil to one part reject (i.e. 6:1) was considered optimal or likely to be successful to ameliorate the acid potential of rejects by blending with spoil. However, this finding was based on the assumption that there is complete oxidation of rejects, utilisation of available ANC, and efficient blending of rejects and spoils occurs in the field.

1.7.2 Land Reclamation Services (1993)

LRS (1993) investigated the soil chemistry of weathered and unweathered overburden samples from the northern end of the GRM to assess their suitability as topsoil media to cover the spoil areas. Specific sandstone strata (potential feldspathic and quartzose sandstone) were also tested to evaluate suitability for use as a capping material of spoil areas.

Overburden chip samples were collected from 15 drill holes at three metre intervals. A total of 263 samples were initially screened for pH (1:5) and EC (1:5). The results formed the basis of selecting 17 composited samples for detailed laboratory analysis that included pH (1:5), EC (1:5), chloride, nitrate, ESP, cation-exchange capacity (CEC), total sulfur and total carbon (TC) concentrations. Of the 17 composited samples (from drill hole 37051), 11 represented the full depth of overburden above the coal seams and interburden between the coal seams. In addition, 12 of the 17 composited samples were tested for NAG.

The EC (1:5) values were reported to be higher in the weathered overburden compared to the unweathered materials. The EC (1:5) values ranged from 54 to 2,580 µS/cm, with over 55 per cent distributed between 450 and 900 µS/cm. The pH (1:5) values varied from 4.3 to 9.8, with most values (~81.8 per cent) greater than or equal to 7.0.



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HISTORICAL GEOCHEMICAL SAMPLE LOCATIONS

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Figure: **1-4**

File No: **42626730-g-2008.wor** Drawn: **VH** Approved: **CT** Date: **07-06-2013** Rev.**A** A4

1 Introduction

The total sulfur ranged from five to 28 per cent, with TC concentrations varying from 16 to 64 per cent. The CEC and ESP ranged from 8 to 17 meq/100 g, and <2 to 35 per cent, respectively. A high ESP values (24 to 34 per cent) were found throughout the profile of samples from drill hole 3705, indicating high sodicity.

The NAGpH values of the 12 composited samples ranged from 7.3 to 7.9, which indicates that the samples tested were not acid generating. It was concluded that there was essentially no NAG capacity.

1.7.3 Environmental Geochemistry International (1995)

EGi (1995) evaluated the geochemical characteristics of 20 out-of-pit spoil and the potential impact of spoil exposure on mine water quality and revegetation at the GRM. The out-of-pit samples were selected as a reasonable representation of the range of spoil materials likely to be found in the dump area.

Approximately seven kilograms samples were crushed to a nominal four millimetres and a 200 gram sub-sample was pulverised for geochemical testing. The geochemical test work included pH (1:2), EC (1:2), total sulfur, ANC and NAPP. Of the 20 samples, 10 were selected for analysis for total elemental concentrations, sodium adsorption ratio (SAR), water-extractable dissolved metal concentrations (in 1:2 water extracts), and NAG testing.

The pH was mostly (95 per cent) neutral to alkaline (pH 6.4 to 9.2) with relatively high salinity (630 to 15,470 µS/cm). The out-of pit spoil samples were highly sodic, with SAR values ranging from 7.3 to 27.7.

The out-of pit samples, represented by the samples tested, have very low total sulfur content and were classified as NAF. The total sulfur concentrations were less than 0.08 per cent, with corresponding NAPP values between -55.3 and 1.0 kg H_2SO_4/t.

The NAGpH values ranged from 7.5 to 9.9, with the exception for one sample, which recorded a NAGpH value of 4.3 and a corresponding NAG capacity of 12.7 kg H_2SO_4/t (NAPP 1.0 kg H_2SO_4/t). It was suggested that this excess acidity was due to organic acidity produced by the oxidation of organic material with hydrogen peroxide in the NAG test, and not acidity generated by sulfide oxidation.

Only Ag, B, Bi and Se were found to be enriched (four of the 20 samples) relative to the average crustal abundance (Bowen 1979). However, only B was considered to be relatively mobile given the neutral to alkaline pH of the out-of pit samples.

1.7.4 Environmental Geochemistry International (1996)

EGi (1996) conducted a geochemical characterisation program on 60 overburden samples from the Red Hill Pit area at the GRM. The aim of the study was to confirm the NAF nature of the spoil and further evaluate the solubility of B and high salinity/sodicity issue as indicated by their previous study in 1995.

The overburden sample included sandstone, siltstone, carbonaceous siltstone, coal, clays and minor tuffs. Samples were collected over five metre depth intervals. The analytical program included pH (1:2), EC (1:2) and total sulfur (60 samples), ANC (30 samples), standard single addition NAG (2 samples) and water-extractable dissolved metal concentrations (25 samples).

1 Introduction

Approximately 96 per cent of the samples tested had pH values greater than 7.0. The overburden samples tested were slightly too highly saline with EC (1:2) values of 604 to 4,150 µS/cm. The SAR values ranged between two and 16. Five of the samples had SAR values ≥12, which was considered sodic.

The results indicate a relatively small proportion (seven per cent) of the overburden in the Red Hill Pit area was likely to be PAF with a low capacity to generate acid. The total sulfur concentrations ranged from <0.01 to 0.64 per cent, with NAPP value and NAG capacity ranging from -169 to 17 kg H_2SO_4/t and 1 to 5 kg H_2SO_4/t, respectively.

Analysis of water extracts (1:2) suggest that sulfate, B, Co, Ni, Se and Zn can be mobilised from the overburden samples. However, if the pH of the spoil is maintained between pH 6 and 8, the metals will remain relatively insoluble.

1.7.5 URS Australia (2004)

The geochemical characteristics of reject materials from the Riverside Mine were assessed as part of an overall study to develop a concept design strategy for the rehabilitation of the Riverside Reject Dump (URS, 2004).

A total of 74 reject samples were obtained from the Riverside Reject Dump. Samples were obtained from 19 test pits (two metres depth) and three boreholes (up to 28.5 metres depth).

All samples were tested for pH (1:5), EC (1:5), total sulfur and NAPP. A further 9 samples composited from 37 of the 74 reject samples were tested for total elemental concentrations and water-extractable dissolved metal concentrations.

The pH (1:5) of the Riverside reject samples tested ranged from acidic to slightly alkaline (pH 3.2 to 8.3). The median pH value was 5.9. About 35 per cent of the reject samples had pH less than 5.0, indicating some sulfide oxidation was occurring, with a further 20 per cent of the pH values distributed between 5.0 and 7.0, and 45 per cent having a pH greater than 7.0. The salinity of the reject samples were considered relatively low averaging approximately 500 µS/cm (median 229 µS/cm), but ranged from 69 to 3,260 µS/cm.

The total sulfur concentration ranged from 0.25 to 1.24 per cent with a median value of 0.43 per cent. The NAPP values ranged from -38.9 to 21.6 kg H_2SO_4/t (median -5.2 kg H_2SO_4/t). On this basis, the majority (65 per cent) of the reject samples tested were classified as NAF or have low capacity to generate acid (four per cent).

The total metal concentrations in the nine composited samples suggest that, apart from Mn in one sample, no elemental concentration exceeded the health-based criteria for soils (NEPC 1999), where guideline values exist.

The dissolved metal concentrations (except for Mn) in 1:5 water extracts were below the Australian livestock drinking water guidelines (ANZECC and ARMCANZ 2000). Manganese concentrations were elevated in two samples.

1.7.6 URS Australia (2007)

URS (2007a) completed a geochemical assessment of overburden and potential reject materials from the GRM. The study was a component of an Environmental Assessment program for the previous 21 mtpa Goonyella Riverside Expansion plan.

1 Introduction

A total of 76 overburden and potential coal reject samples were obtained from four drill holes. The 76 samples included:

- 13 overburden samples from above the GUS;
- 34 overburden samples from between the GUS, GMS, and GLS; and
- 29 potential reject samples from immediately above and below GUS, GMS, and GLS (referred to as coal roof and coal floor material), including three samples from the GP seam (between the GUS and GMS).

In addition, 10 coal samples from three of the four drill holes were also tested including:

- Two coal samples from the GUS;
- Four coal samples from the GMS; and
- Four coal samples from the GLS.

The analytical program included pH (1:5), EC (1:5), total sulfur, ANC and NAPP. Twenty-five composite samples were analysed for total metal concentrations, CEC, ESP and water-extractable dissolved metal concentrations.

The pH (1:5) of the overburden samples was moderately alkaline ranging from 8.1 to 10.1 (mean pH 9.0). The EC (1:5) ranged from 135 to 1460 µS/cm, with a mean EC (1:5) value of 482 µS/cm. The total sulfur content of the overburden samples was low, ranging from <0.01 to 0.87 per cent (average 0.09 per cent). The majority (81 per cent) of total sulfur concentration was less than 0.1 per cent. The corresponding NAPP values ranged from -365 to 7 kg H_2SO_4/t (average -68 kg H_2SO_4/t). On the basis of these results, 44 (93.6 per cent) of the overburden samples were classified as NAF, two samples were classified as PAF (4.3 per cent) and one sample is classified as uncertain (2.1 per cent).

The ABA results for coal roof and floor samples indicate that 27 of the 29 samples (93.1 per cent) tested were NAF (NAPP -116 to -0.2 kg H_2SO_4/t), with the remaining two samples classified as uncertain. The pH (1:5) and EC (1:5) ranged between 8.2 and 9.6, and 151 to 558 µS/cm, respectively. The total sulfur concentration varied from <0.01 to 0.26 per cent, with 90 per cent of the coal roof and coal floor samples having a total sulfur concentration equal to or less than 0.1 per cent.

The coal samples were moderately alkaline ranging from 7.2 to 9.7. The EC (1:5) were low varying from 20 to 331 µS/cm. The total sulfur concentration was generally higher in the coal samples (ranging from 0.26 to 0.48 per cent) compared to concentrations reported for the overburden, coal roof and coal floor samples. The NAPP values ranged from -22 to 13 kg H_2SO_4/t (mean 5 kg H_2SO_4/t). Ninety per cent of the coal samples were classified as potentially PAF.

The total metal concentrations in overburden and potential reject materials were generally within health-based investigation levels for soils (NEPC 1999). Water-extractable dissolved metal concentrations (in 1:5 solid to water solutions), except Se and Mo, were below the Australian livestock drinking water guidelines (ANZECC and ARMCANZ 2000). Dissolved Se and Mo concentrations were marginally higher than livestock drinking water guidelines in some GUS and GLS roof and floor composited samples.

Study Methodology

This section describes the rationale and methodology used to evaluate the AMD potential of overburden, rejects (coarse rejects and tailings), and coal roof and floor materials likely to be produced by the proposed project.

2.1 Sampling Strategy

General guidelines are available from the Department of Environment and Heritage Protection (formerly Department of Environment and Resource Management (DERM)) in regards to the assessment and management of AMD (DERM 1995a). However, recognising that each mine has site-specific features and project specific considerations, there are currently no specific regulatory requirements regarding the number of samples required to be obtained and tested for overburden and reject materials at mines in Queensland.

The number of samples required for analysis depends on a number of factors, including:

- the geological variability and complexity in rock types;
- the potential for significant environmental or health impacts;
- the size of the operation;
- the statistical sample representation requirements;
- the volume of materials;
- the availability and representativeness of existing geochemical data; and
- the level of confidence in predictive ability.

The sampling strategy; therefore, focussed on ensuring the coal deposit was spatially covered by acquiring samples from available drill cores that represented the various mineral waste types likely to be associated with the project.

The geochemical sampling program is designed based on the following factors:

- The geochemical nature of materials in the area of the proposed expansion is expected to be similar and directly comparable to the geochemical nature of the materials on the western side of the mine (i.e. the current Goonyella Riverside coal operations) because the geology and conditions of sediment deposition are relatively uniform throughout the site.
- The geochemical information available from previous geochemical characterisation studies (**Section 1.7**), which suggest the geologic materials are generally benign.
- The project will expand the GRB mine complex by developing the underground RHM within MLA70421, and extending the footprint of the BRM eastward into MLA70421.
- The major coal seam that is expected to be mined by the proposed RHM and Broadmeadow extension is the GMS.
- No significant amount of overburden is mined in the Broadmeadow extension or proposed RHM operations.

2.2 Potential Mineral Wastes Types

The mineral waste types that will be potentially generated by the project are:

- coal seam roof and floor materials;
- coarse rejects;
- dewatered tailings;
- overburden material from above the GUS; and
- interburden samples from between the GUS, GMS and GLS.

The project will not generate substantial quantities of overburden, with much of the overburden expected to remain largely intact. Overburden will only be generated during the construction of drifts for access and services, and main drives for coal longwall access and coal transport.

However, subsidence induced by longwall mining and the subsequent fracturing associated with it can provide preferential pathways for surface water infiltration and ground water movement (albeit temporary). Unsaturated rock and coal material containing pyritic minerals in the subsidence zone are thus susceptible to oxidation and are a potential source of AMD. As such, overburden material from above the GUS, and interburden samples from between the GUS, GMA and GLS are also included in the geochemical sampling program.

All samples for geochemical characterisation testing were selected by URS upon review of drill logs supplied by BMA and the requested samples were collected by BMA geologists.

2.2.1 Overburden and Interburden

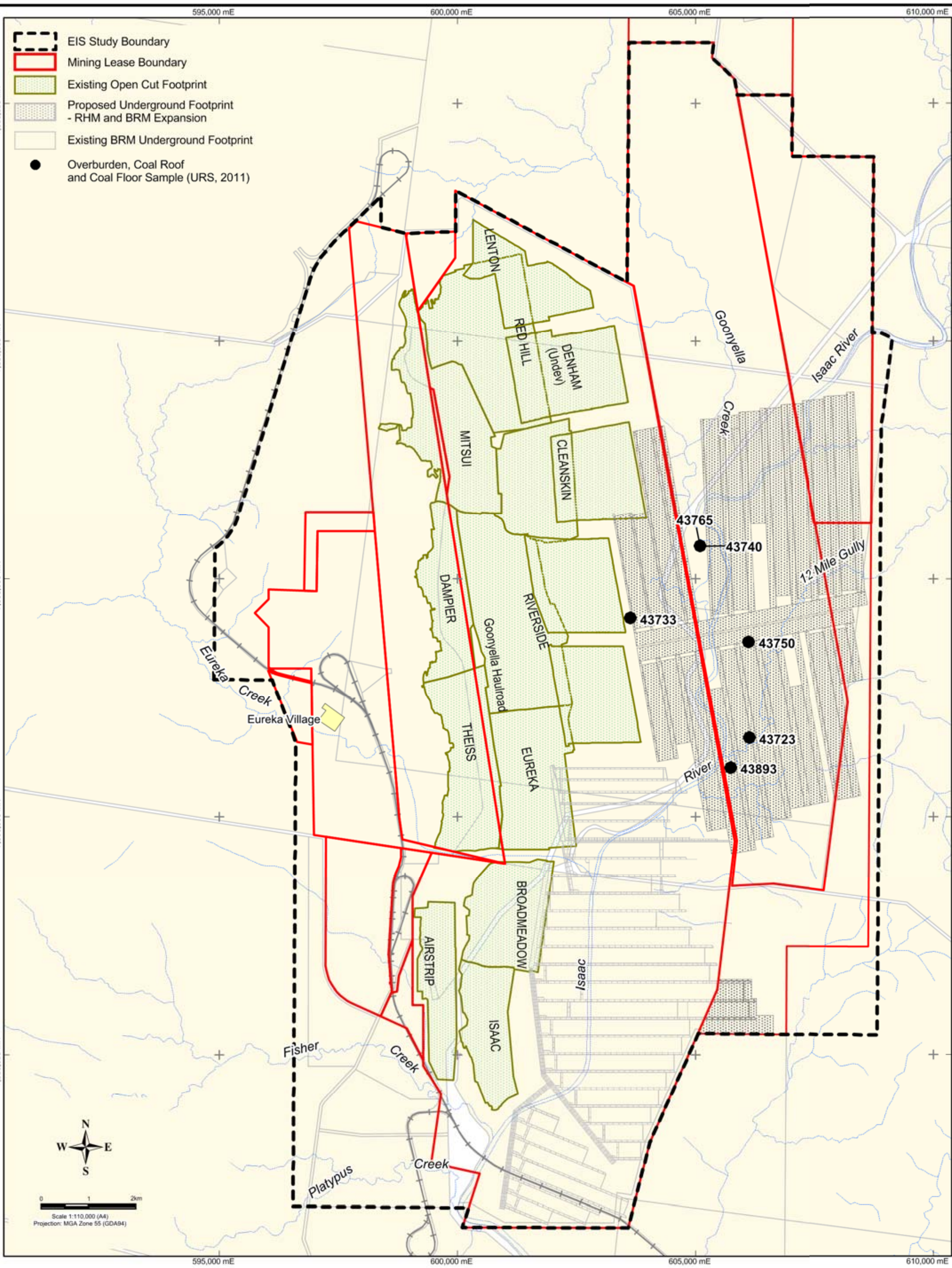
Based on the drill core logs (BMA 2010c) and the material available for sampling, URS selected 46 overburden and interburden (i.e. waste rock) samples from a total of five core drill holes. The location of each sampled drill hole is shown in **Figure 2–1**.

Sample intercepts (0.3 to 0.86 metres) from each particular interval were obtained for each key lithology for analysis. A total of 17 siltstone, 11 sandstone, six claystone, five carbonaceous claystone and two sandstone/siltstone samples were collected from the five drill holes (**Table 2–1**). The remaining five samples comprise of shale, mudstone, conglomerate, carbonaceous siltstone, and a mix of siltstone/claystone/sandstone. A list of all waste rock samples tested is shown in **Appendix A**.

2 Study Methodology

Table 2-1 Waste Rock Samples Selected for Geochemical Testing

Drill Hole ID	Total Sample Interval (m)	Lithology	Number of Samples
43723	208.9 to 230.82; 260.11 to 266.45; 372.00 to 417.14	Siltstone	6
		Sandstone - fine to medium grained	2
		Claystone	2
43733	72.36 to 83.97; 113.06 to 138.67; 214.09 to 299.76	Siltstone	6
		Sandstone - fine to medium grained	3
		Claystone	4
		Carbonaceous claystone	4
43765	226.93 to 339.36; 384.88 to 411.07	Siltstone	3
		Carbonaceous Siltstone	1
		Sandstone - fine to medium grained	1
		Sandstone - medium grained	1
		Claystone	2
		Carbonaceous claystone	1
43750	262.95 to 285.27; 354.91 to 438.16	Siltstone	7
		Sandstone - fine to medium grained	3
		Sandstone - medium grained	1
		Claystone	2
		Carbonaceous claystone	1
		Conglomerate	1
43893	170.04 to 369.44	Siltstone	5
		Sandstone - very fine grained	1
		Sandstone - fine grained	1
		Sandstone - medium grained	1
		Mudstone	1
		Carbonaceous mudstone	1
		Shale	4



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DRILL HOLE LOCATIONS FOR OVERBURDEN, AND COAL ROOF AND COAL FLOOR SAMPLES

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Figure: **2-1**

File No: **42627136-g-2022.wor** Drawn: **VH** Approved: **CT** Date: **07-06-2013** Rev.**A** A4

2 Study Methodology

2.2.2 Coal Roof and Coal Floor Material

Coal seam roof and floor material located immediately above and below the major coal seams are partings or layers of rock strata within the seam. These materials will be more or less included in the mined or raw coal, and are called dilution because they dilute the in-place coal quality. Therefore, they represent potential reject materials.

Coal seam roof and floor samples were obtained from each of the five core drill holes shown in **Figure 2–1**. URS selected a total of nine coal roof and 10 coal floor samples for geochemical testing **Table 2-2**. The selected samples comprise of siltstone, claystone, shale, carbonaceous claystone, and mixed sandstone / siltstone, siltstone / claystone, shale / siltstone / sandstone, and carbonaceous mudstone / siltstone immediately above or below a coal seam.

Table 2-2 Coal Roof and Floor Samples Selected for Geochemical Testing

Drill Hole ID	Depth (m)		Sample Type	Predominant Lithology
	From	To		
43723	217.92	218.30	Coal roof	Siltstone
43723	264.65	265.15	Coal floor	Claystone
43723	400.20	400.70	Coal floor	Siltstone
43733	128.79	129.29	Coal roof	Carbonaceous claystone
43733	133.50	134.00	Coal floor	Siltstone
43733	222.83	223.38	Coal roof	Siltstone
43733	279.66	280.00	Coal floor	Siltstone
43750	282.20	282.50	Coal floor	Claystone
43750	368.69	369.08	Coal roof	Siltstone
43750	378.50	379.00	Coal floor	Sandstone
43750	417.00	417.34	Coal roof	Sandstone/siltstone
43765	392.30	392.63	Coal roof	siltstone/claystone
43893	186.96	187.37	Coal roof	Shale
43893	192.12	192.62	Coal floor	Siltstone
43893	299.46	299.94	Coal roof	Shale/siltstone
43893	307.57	308.07	Coal floor	Shale/sandstone
43893	336.00	336.38	Coal floor	Carbonaceous mudstone/siltstone
43893	357.09	357.59	Coal roof	Siltstone
43893	363.61	364.11	Coal floor	Siltstone

2 Study Methodology

2.2.3 Coarse Rejects

In addition to the potential reject samples, BMA collected a total of eight coarse surface (0 to 30 centimetres depth) reject samples from the reject emplacement facilities at the current GRB mine complex. The samples comprised of four samples from the Goonyella Mine, covering a range of deposition ages from 2003 to 2011 (**Table 2-3**). The remaining four samples from the Riverside Mine covered deposition ages from 2006 to 2011. The locations of the coarse reject samples are shown in **Figure 2-2**.

Table 2-3 Coarse Reject Samples Selected for Geochemical Testing

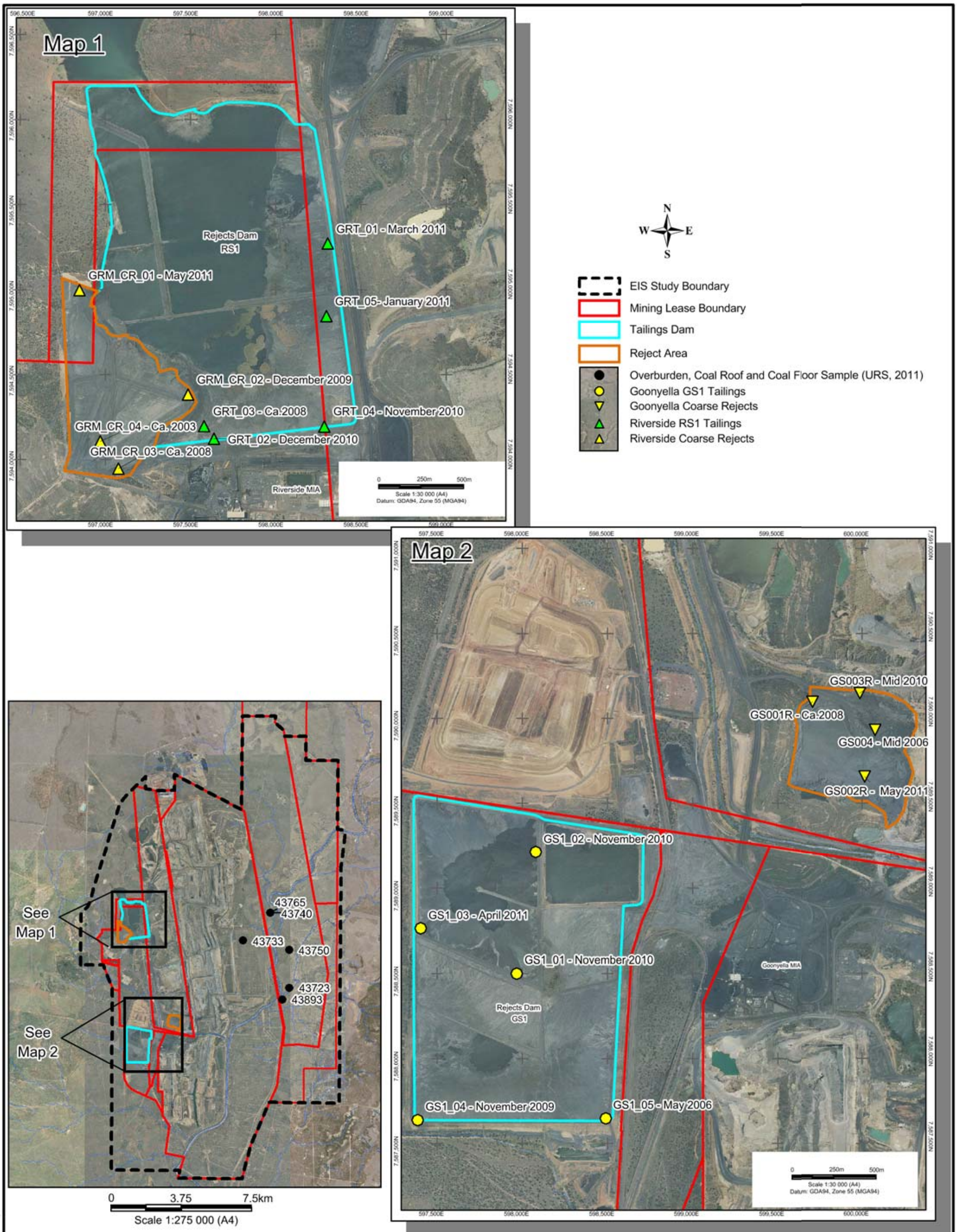
Mine Location	Sample Type	Deposition Time
Riverside	Coarse reject	ca. 2003
		May 2009
		December 2009
		May 2011
Goonyella	Coarse reject (R21 Reject Dump)	Mid 2006
		ca. 2008
		Mid 2010
		May 2011

2.2.4 Tailings

In addition to the potential reject samples, BMA collected a total of 10 surface tailings samples (top 30 centimetres of the deposited surface) from the Riverside and Goonyella tailings dams, covering a range of deposition ages from weeks to years (**Table 2-4**). The locations of the tailings samples are shown in **Figure 2-2**.

Table 2-4 Coarse Reject Samples Selected for Geochemical Testing

Tailings Dam	Sample Type	Deposition Time
Riverside RS1	Tailings	January 2011
		March 2011
		December 2010
		November 2010
		ca. 2008
Goonyella GS1	Tailings	April 2011
		November 2010
		May 2010
		November 2009
		May 2006



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COARSE REJECTS AND TAILINGS SAMPLE LOCATIONS

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GEOCHEMICAL ASSESSMENT

Figure: **2-2**

File No: **42627136-g-2023.wor** Drawn: **VH** Approved: **CT** Date: **07-06-2013** Rev.**A** A4

2 Study Methodology

2.2.5 Geochemical Testing

All samples were submitted to a National Association of Testing Authority (NATA) accredited laboratory, Australian Laboratory Services (ALS), in Brisbane in a single batch. Samples were crushed to at least 90 per cent passing 2 millimetres size, then riffle split to produce a 300 to 500 grams sub-sample for pulverising to <75 micrometres for geochemical testing at ALS Brisbane.

All samples were initially screened using a series of standard static geochemical tests shown in **Table 2-5**. Selected samples were also tested using more specialised geochemical tests (as required), such as ABCC, as shown in **Table 2-6**.

Table 2-5 Initial Acid Base Accounting Geochemical Tests

Parameter	Method Reference
pH (1:5 solid to deionised water)	APHA 4500-H+ B
Electrical Conductivity (EC; 1:5 solid to water)	APHA 2510 B
Total sulfur	Leco
Chromium reducible sulfur (S_{CRS})	Ahern et al (2004)
ANC	I. AMIRA (2002)
Single Addition NAG; includes pH 4.5 & 7)	I. AMIRA (2002)

Table 2-6 Specialised Geochemical Tests

Parameter	Method Reference
ABCC	I. AMIRA (2002)
Total organic carbon (TOC)	In house
Total inorganic carbon (TIC)	In house
Total carbon (TC)	In house
Extended Boil NAG	In house

Upon receipt of initial screening results for waste rock, and coal roof and floor samples, selected samples were combined, according to rock type, depth and geochemical nature, into 34 composite waste rock, five composite coal roof, and seven composite coal floor samples (see **Appendix B**). The composite samples were analysed for the parameters shown in **Table 2–7** including pH (1:5), EC (1:5), total metal concentrations, water-extractable dissolved metal concentrations, major cations and anions concentrations, and CEC.

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Table 2-7 Geochemical Testing for Composited Samples

Parameter	Method Reference
Total carbon (TC)	In house
pH (1:5)	APHA 4500-H+ B
EC (1:5)	APHA 2510 B
Major cations (Ca, Mg, Na, K)	APHA 3120
Major anions (Cl^-, SO_4^{2-}, Alkalinity)	APHA 4500-Cl^- B; APHA 3120; APHA 2320 B
Four acid 'near total' digest with ICPAES/ICPMS finish (Ag, Al, As, B, Cd, Co, Cr, Cu, Fe, Pb, Hg, Ni, Mn, Mo, Sb, Se, U, V and Zn)	In house
Multi-element scan of 1:5 water extracts (Ag, Al, As, B, Cd, Co, Cr, Cu, Fe, Pb, Hg, Ni, Mn, Mo, Sb, Se, U, V and Zn)	USEPA 6020 (ICPMS)
Cation-exchange capacity (CEC) and Exchangeable Sodium Percentage (ESP)	Rayment & Higginson Method 15A1 (1992) 1M ammonium chloride extraction; APHA 21st ed., Method 3120; USEPA SW 846 - 6010 (ICPAES)

2.3 Standards of Investigation

The geochemical results of this study were compared with the following sources or guidelines:

- NEPC (1999). National Environment Protection (Assessment of Site Contamination) Measure (1999): Schedule B(1) Guideline on Investigation Levels for Soil and Groundwater, Australian Government, Canberra;
- DERM (1995a). Assessment and management of acid drainage, Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland, Qld, Australia;
- DERM (1995b), Assessment and Management of Exploration and Saline and Sodic Wastes, Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland, Qld, Australia;
- DERM (2010). Establishing Environmental Values, Water Quality Guidelines and Water Quality Objectives for Fitzroy Basin Waters – Draft for Consultation, December 2010;
- DITR (2007a). Managing acid and metalliferous drainage, Leading Practice Sustainable Development Program for the Mining Industry, Canberra, Australia;
- Australian Mineral Industries Research Association International Limited (AMIRA) (2002). Prediction and Kinetic Control of Acid Mine Drainage. ARD Test Handbook, May 2002; and
- ANZECC and ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Canberra, ACT.

The assessment method used in this study are consistent with those described in the GARD Guide (INAP 2009).

3

Geochemical Test Results

The geochemical results for each mineral waste type tested are summarised in this Section. All ALS laboratory reports are provided in **Appendix B** to **D**.

3.1 Overburden

The ABA results for overburden (including interburden) samples are summarised in **Table 3-1**. The full data set is provided in **Appendix B**.

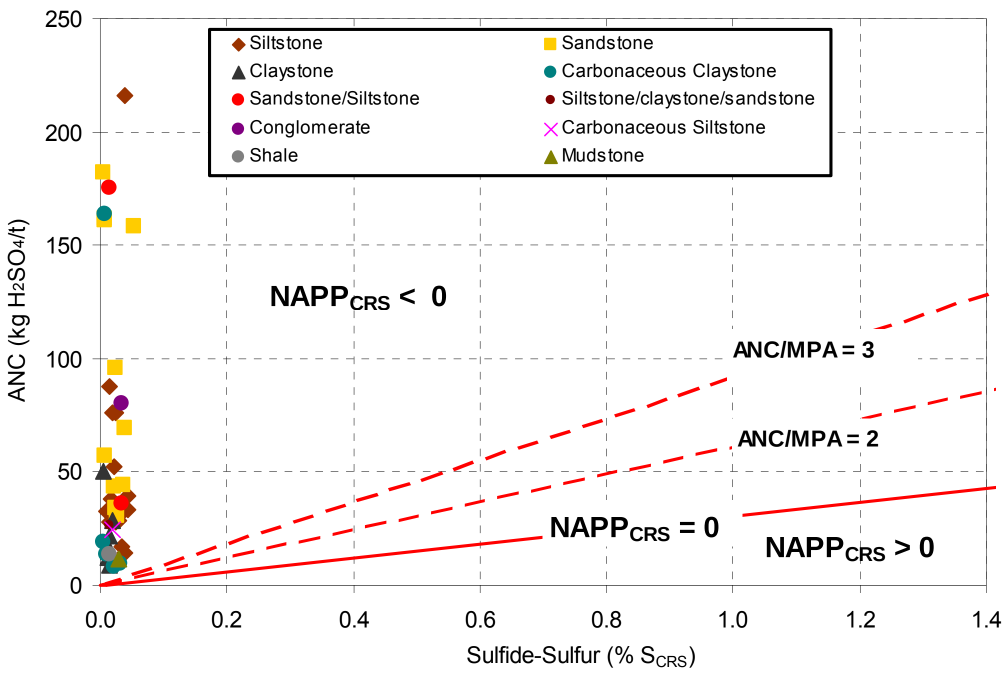
3.1.1 Acid Base Accounting

The overburden pH (1:5) was evaluated by equilibrating crushed solid sample in deionised water for approximately one hour at a solid to water ratio of 1:5 (solid/water). The resultant water pH (1:5) value ranged from 9.1 to 10.1, which is very strongly alkaline. The EC (1:5) varied from 259 to 708 µS/cm, with a mean value of 456 µS/cm.

The total sulfur and CRS concentrations of the overburden were less than 0.09 and 0.054 per cent, respectively. There was marginal difference between the NAPP (-214 to -7.4 kg H_2SO_4/t) and $NAPP_{CRS}$ values (-215 to -7.3kg H_2SO_4/t).

Figure 3-1 is an ABA plot showing sulfide-sulfur (per cent S_{CRS}) versus ANC, with $NAPP_{CRS}$ positive and $NAPP_{CRS}$ negative domains indicated. Samples that plot above the ANC/MPA = 2 line have at least a two-fold excess in acid neutralising capacity over acid generating potential, and those that plot above the ANC/MPA = 3 line have a three-fold excess. The overburden samples tested fall within the $NAPP_{CRS}$ negative domain, and has an acid neutralising capacity that is greater than three times its acid generating potential.

Figure 3-1 ABA Plot of ANC versus S_{CRS} for Overburden Samples



URS

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Table 3-1 Summary of ABA Results for Overburden Samples

Lithology	No. of Samples	Statistics	pH (1:5)	EC (1:5) (µS/cm)	Total S (%)	S_{CRS} (%)	MPA (kg H_2SO_4/t)	MPA_{CRS} (kg H_2SO_4/t)	ANC (kg H_2SO_4/t)	NAPP (kg H_2SO_4/t)	$NAPP_{CRS}$ (kg H_2SO_4/t)	ANC/MPA Ratio	ANC/MPA_{CRS} Ratio
Siltstone	17	Min	9.2	302	0.03	0.009	0.92	0.28	14.4	-214.2	-215	6.72	12.4
		Max	9.9	661	0.08	0.044	2.45	1.35	216	-12.3	-13.2	118	191
		Mean	9.6	474	0.05	0.026	1.55	0.79	50.6	-49.1	-49.9	34.7	72.7
Sandstone	11	Min	9.5	259	0.01	0.005	0.31	0.15	30.9	-182	-182	22.1	38.8
		Max	10.1	708	0.09	0.054	2.76	1.65	182	-29.7	-30.1	594	1213
		Mean	9.8	512	0.04	0.023	1.23	0.70	94.3	-93.0	-93.6	136.9	314
Claystone	6	Min	9.1	331	0.03	0.005	0.92	0.15	8.90	-49.7	-50.4	8.38	20.8
		Max	9.8	533	0.06	0.019	1.84	0.58	50.6	-7.98	-8.47	55.1	337
		Mean	9.5	405	0.04	0.013	1.28	0.41	22.9	-21.6	-22.5	20.1	86.4
Carbonaceous claystone	5	Min	9.4	286	0.02	0.006	0.61	0.18	8.00	-163	-164	6.30	10.3
		Max	9.8	458	0.07	0.031	2.14	0.95	164	-7.39	-7.30	179	669
		Mean	9.6	371	0.04	0.016	1.35	0.48	42.8	-41.5	-42.4	43.2	168
Sandstone/siltstone	2	Min	9.6	432	0.02	0.014	0.61	0.43	35.8	-174	-175	23.4	34.4
		Max	9.8	529	0.05	0.034	1.53	1.04	175	-34.3	-34.8	286	408
		Mean	9.7	481	0.04	0.024	1.07	0.74	105	-104	-105	155	221
Siltstone/claystone/sandstone	1	-	9.4	402	0.03	0.015	0.92	0.46	26.5	-25.6	-26.0	28.8	57.7
Conglomerate	1	-	9.7	597	0.06	0.035	1.84	1.07	80.2	-78.4	-79.1	43.6	74.8
Carbonaceous Siltstone	1	-	9.8	321	0.04	0.015	1.23	0.46	24.7	-23.5	-24.2	20.2	53.8
Shale	1	-	9.6	374	0.02	0.014	0.61	0.43	13.6	-13.0	-13.2	22.2	31.7
Mudstone	1	-	9.7	328	0.07	0.030	2.14	0.92	11.4	-9.26	-10.5	5.3	12.4

Where values were less than the limit of reporting (LOR), the LOR value was used for calculation purposes. MPA = maximum potential acidity. CRS = chromium reducible sulfur.

MPA_{CRS} = maximum potential acidity determined using the S_{CRS} value. ANC = acid neutralising capacity; NAPP = net acid producing potential.

$NAPP_{CRS}$ = net acid producing potential determined using the S_{CRS} value.

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3.1.2 Net Acid Generation Test Results

Standard single addition NAGpH, and NAG capacity to pH 4.5 ($NAG_{pH4.5}$) and pH 7.0 ($NAG_{pH7.0}$) results are summarised in **Table 3-2**.

The NAGpH of the overburden samples for all lithologies tested was greater than pH 7.5, with effectively no NAG capacity. The only exception was a single carbonaceous claystone sample, which recorded a NAGpH of 4.6 with a corresponding $NAG_{pH\ 7.0}$ capacity of 10.2 kg H_2SO_4/t.

Table 3-2 Summary of NAG Results for Overburden Samples

Lithology	No. of Samples	Statistics	NAGpH	$NAG_{pH\ 4.5}$ (kg H_2SO_4/t)	$NAG_{pH\ 7.0}$ (kg H_2SO_4/t)
Siltstone	17	Min	8.8	<0.1	<0.1
		Max	9.6	<0.1	<0.1
		Mean	9.2	<0.1	<0.1
Sandstone	11	Min	8.9	<0.1	<0.1
		Max	10.5	<0.1	<0.1
		Mean	9.4	<0.1	<0.1
Claystone	6	Min	7.5	<0.1	<0.1
		Max	9.3	<0.1	<0.1
		Mean	8.6	<0.1	<0.1
Carbonaceous claystone	5	Min	4.6	<0.1	<0.1
		Max	9.4	<0.1	10.2
		Mean	8.1	<0.1	2.1
Sandstone/siltstone	2	Min	9.0	<0.1	<0.1
		Max	9.1	<0.1	<0.1
		Mean	9.1	<0.1	<0.1
Siltstone/claystone/sandstone	1	-	9.8	<0.1	<0.1
Conglomerate	1	-	9.0	<0.1	<0.1
Carbonaceous siltstone	1	-	8.9	<0.1	<0.1
Shale	1	-	8.8	<0.1	<0.1
Mudstone	1	-	8.6	<0.1	<0.1

Where values were less than the LOR, the LOR value was used for calculation purposes.

NAG = net acid generation.

3.1.3 Acid Buffering Characteristic Curve

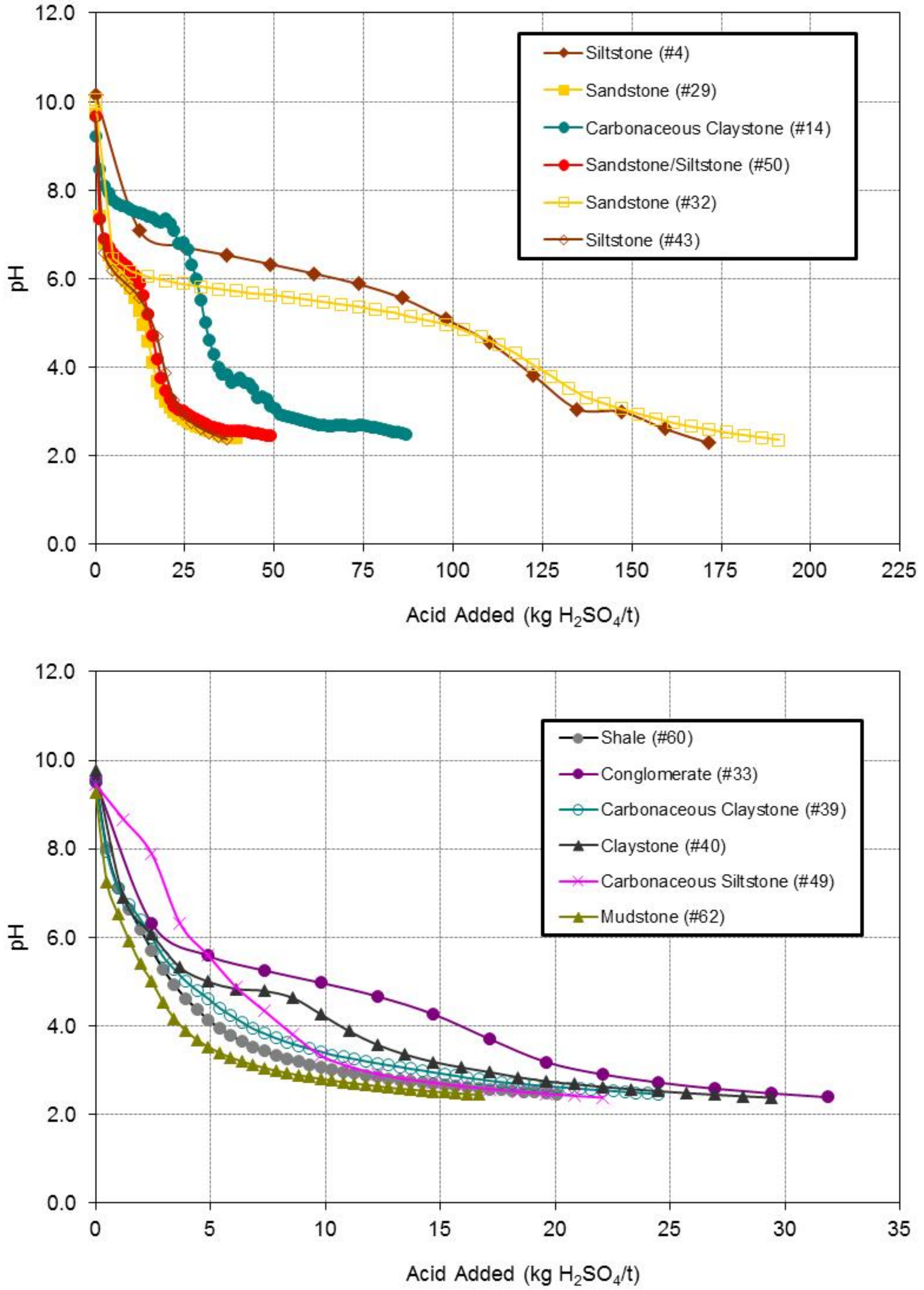
ABCC tests were conducted on 12 overburden samples to evaluate the availability of the ANC measured. **Figure 3-2** shows the ABCC profiles of the major lithologies in overburden samples tested.

The ABCC results indicates that 26 to 62 per cent of the total ANC for all overburden samples tested is readily available for acid buffering (to pH ~4.5) and it will be slow reacting, except for four samples. The profiles for carbonaceous claystone, siltstone and sandstone located above the GUS (i.e. none

3 Geochemical Test Results

coal roof and floor material), and the conglomerate located between the GMS and GUS suggest 17 to 34 per cent of the total ANC is available for acid buffering and is fast reacting.

Figure 3-2 ABCC Profiles of Major Lithologies in Overburden Samples



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3.1.4 Total Metal Concentrations

The total metal concentrations in composited overburden samples (for each lithology) compared to the mean upper continental crust abundance (Taylor and McLennan 1995) are shown in **Table 3-3**. Also shown is the NEPC (1999) Health-based Investigation Levels (HILs) for contaminated soil assessments for land used for parklands and recreational open spaces (referred to as HIL-E).

The Geochemical Abundance Index (GAI) (Förstner *et al.* 1993) was used to assess the level of metal enrichment relative to the mean upper continental crust abundance. The GAI is expressed on a log 2 scale which includes 7 integer increments (0 through to 6, respectively). A GAI of 0 indicates the element is present at a concentration similar to, or less than, mean upper continental crust abundances; a GAI of 3 corresponds to a 12-fold enrichment; and so forth, up a GAI of 6, which corresponds to a 96-fold, or greater, enrichment above mean upper continental crust abundances.

The GAI values are presented in **Table 3-4**. Generally, the overburden samples had total metal concentrations below, or close to, the corresponding mean upper continental crust abundance, except for a number of samples, which showed enrichment in Sb (GAI = 1) and As (GAI 1 to 4). Only one sample (mudstone) was enriched in Ni (GAI = 1).

Comparison of results to the NEPC HIL-E for soils shows that total metal concentrations in the overburden sample are between two and 500 times less than the guideline values, where such guideline levels exist.

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Table 3-3 Summary of Total Metal Concentrations in Composited Overburden Samples

URS Composite Number			GRM01, GRM05-08	GRM02, GRM14-16	GRM03, GRM17	GRM04, GRM09-13	GRM18	GRM19	GRM20	GRM21	GRM22
No. of Samples			5	4	2	6	1	1	1	1	1
Element	NEPC HIL[a]	Mean Upper Continental Crust Abundance[c]	Siltstone[#]	Claystone[#]	Carbonaceous Claystone[#]	Sandstone[#]	Sandstone/ siltstone	Conglomerate	Siltstone/ Claystone/ Sandstone	Shale	Mudstone
Al (%)	--	8.04	7.70	7.82	8.30	7.47	8.09	7.7	7.5	6.24	6.63
Fe (%)	--	3.50	3.55	3.70	3.82	5.29	3.38	5.46	2.03	5.88	2.73
Sb	--	0.2	0.60	0.62	0.57	0.54	0.24	0.91	1.18	0.32	0.59
As	200	1.5	8.9	7.3	6.3	10.1	6.8	8.6	44.6	2.6	4
Cd	40	0.098	0.13	0.16	0.11	0.09	0.08	0.11	0.14	0.12	0.14
Cr	--[b]	35	79	67	44	58	66	53	65	52	24
Co	200	10	14.5	16.3	12.2	13.8	13.8	25	17.5	9.8	10.7
Cu	2000	25	49.6	49.7	50.0	28.8	31.2	33.8	48.9	33.4	95.1
Pb	600	20	18.1	21.5	19.3	13.1	10.5	15.7	18	17.1	15.6
Mn	3000	600	735	700	1038	1041	1110	987	442	1320	678
Ni	600	20	60.5	52.6	35.5	32.2	23.7	48.6	66.6	34.5	27.1
Se	--	50	2	2	2	1	1	2	2	1	2
Sn	--	5.5	2.6	3.1	3.1	2.0	1.5	2.3	2.8	2.6	2.4
U	--	2.8	2.9	3.1	2.7	2.2	1.6	2.6	2.9	2.6	1.9
V	--	60	112	121	106	117	159	126	114	113	144
Zn	14000	71	80.00	97.25	81.50	74	84	80	85	68	103

All values in mg/kg, unless otherwise stated. [a]National Environment Protection Council (1999) Health Investigation Levels-E for parks, recreational open space and playing fields. [b]Guideline value for Cr(VI) = 200 mg/kg. Cr(III) = 24% of total Cr. [c]Taylor and McLennan (1995). [#]Mean values. "--" means no guideline value.

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Table 3-4 Geochemical Abundance Indices for Composited Overburden Samples

URS Composite Number	GRM01, GRM05-08	GRM02, GRM14-16	GRM03, GRM17	GRM04, GRM09-13	GRM18	GRM19	GRM20	GRM21	GRM22
No. of Samples	5	4	2	6	1	1	1	1	1
Element	Siltstone	Claystone	Carbonaceous Claystone	Sandstone	Sandstone/ siltstone	Conglomerate	Siltstone/ Claystone/ Sandstone	Shale	Mudstone
Al	0	0	0	0	0	0	0	0	0
Fe	0	0	0	0	0	0	0	0	0
Sb	0	0	0	0	0	1	1	0	0
As	1	1	1	1	1	1	4	0	0
Cd	0	0	0	0	0	0	0	0	0
Cr	0	0	0	0	0	0	0	0	0
Co	0	0	0	0	0	0	0	0	0
Cu	0	0	0	0	0	0	0	0	1
Pb	0	0	0	0	0	0	0	0	0
Mn	0	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	1	0	0
Se	0	0	0	0	0	0	0	0	0
Sn	0	0	0	0	0	0	0	0	0
U	0	0	0	0	0	0	0	0	0
V	0	0	0	0	0	0	0	0	0
Zn	0	0	0	0	0	0	0	0	0

Geochemical Abundance Index (GAI) = $\log_2 [C_{sample}/(1.5 \times C_{crust})]$; where C_{sample} = metal concentration measured in the sample, and C_{crust} = mean metal concentration in the upper continental crust (Taylor and McLennan 1995).

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3.1.5 Metal Leachability

The mobility of metals (and selected dissolved solids) in the composited overburden samples were evaluated by analysing the dissolved metal concentrations in the water extracts (solids to deionised water ratio of 1:5). The results are summarised in **Table 3-5**. Also shown is the Australian livestock drinking water guideline (ANZECC and ARMCANZ 2000).

The dissolved metal concentrations in the water extract (1:5) solutions are orders of magnitude below the selected criteria, where guidelines values exist.

Table 3-5 Water-Extractable Dissolved Metal Concentrations in Composited Overburden Samples

URS composite number		GRM 01, GRM 05-08	GRM 02, GRM 14-16	GRM 03, GRM 17	GRM 04, GRM 09-13	GRM 18	GRM 19	GRM 20	GRM 21	GRM 22
No. of Samples		5	4	2	6	1	1	1	1	1
Parameters	**Livestock Drinking Water[a]**	Siltstone[#]	Claystone[#]	Carbonaceous Claystone[#]	Sandstone[#]	Sandstone/ siltstone	Conglomerate	Siltstone/ Claystone/ Sandstone	Shale	Mudstone
Ca	1000[b]	1.4	1.0	2.7	1.3	<1	<1	<1	<1	<1
Mg	2000[c]	1.0	1.0	1.2	1.0	<1	<1	<1	<1	<1
SO_4^{2-}	1000[d]	137	75	79	75	11.6	22.4	23.3	4.6	10.2
Al	5	0.75	0.18	0.16	0.50	0.04	0.04	0.04	0.08	0.11
As	0.5 to 5[e]	0.096	0.026	0.009	0.090	0.006	0.005	0.089	0.003	0.004
B	5	0.10	0.03	0.01	0.06	<0.1	<0.1	<0.1	<0.1	<0.1
Cd	0.01	0.0003	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cr	1	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Co	1	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cu	0.4 to 5[f]	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Pb	0.1	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hg	0.002	0.0003	0.0001	0.0001	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Mo	0.15	0.043	0.015	0.014	0.029	0.002	0.010	0.010	0.002	0.009
Ni	1	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Se	0.02	0.02	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
U	0.2	0.001	0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	20	0.005	0.003	0.003	0.005	<0.005	<0.005	<0.005	<0.005	<0.005

All values in mg/L. [#]Mean value; where values were less than the limit of reporting (LOR), the LOR value was used for calculation purposes. [a]ANZECC & ARMCANZ (2000). [b]Stock should tolerate concentration if calcium is the dominant cation and dietary phosphorus levels are adequate. [c]Insufficient information is available to set trigger value; however, concentrations up to 2000 mg/L have been found to have no adverse effects on cattle. [d]No adverse effects to stock are expected if the concentration does not exceed 1000 mg/L. [e]May be tolerate if not provided as a food additive and natural levels in the diet are low. [f]Dependent on livestock species.

3.1.6 Sodicity

The effective cation exchange capacity (eCEC), ESP and SAR of the composited overburden samples are presented in **Table 3-6**. The results indicate that the eCEC of the composited overburden samples is moderate to high (12.9 to 27.4 meq/100 grams), with very high ESP ranging from 20.3 to 51.5 per cent. The SAR values varied from 9.3 to 65.6.

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Table 3-6 Sodicity of Composited Overburden Samples

URS composite number	GRM01, GRM05 -08	GRM02, GRM14 -16	GRM03 , GRM17	GRM04, GRM09 -13	GRM1 8	GRM 19	GRM 20	GRM 21	GRM 22
No. of Samples	5	4	2	6	1	1	1	1	1
Parameters	Siltstone#	Claystone#	Carbonaceous Claystone#	Sandstone#	Sandstone/siltst one	Conglomerate	Siltstone/ Claystone/ Sandstone	Shale	Mudstone
Exchangeable Ca (meq/100 g)	7.8	4.9	15.0	8.0	17.6	6	4.2	4.1	19
Exchangeable Mg (meq/100 g)	1.9	2.2	2.4	2.4	1.1	2.8	2	1.7	2.1
Exchangeable K (meq/100 g)	1.0	0.9	0.9	0.7	0.8	1	1	1	0.8
Exchangeable Na (meq/100 g)	6.2	5.9	4.4	5.2	6.7	5.3	5.8	7.1	5.5
eCEC (meq/100 g)	16.8	13.9	22.7	16.4	26.1	15.1	12.9	13.8	27.4
ESP (%)	39.2	43.6	26.7	34.7	25.7	35.4	45	51.5	20.3
SAR	41.2	35.4	22.7	36.2	49.1	39.6	9.3	65.6	36.0

#Mean value. eCEC = effective cation exchange capacity. ESP = exchangeable sodium percentage. SAR = sodium adsorption ratio

3.1.7 Carbon Content

The TC concentrations in the composited overburden samples varied from 1.20 to 6.63 per cent, with a mean value of 3.03 per cent (**Figure 3-3**). The TC concentration in four samples consisting of siltstone (GRM05), sandstone (GRM10), carbonaceous claystone (GRM17) and mudstone (GRM22) exceeded five per cent.

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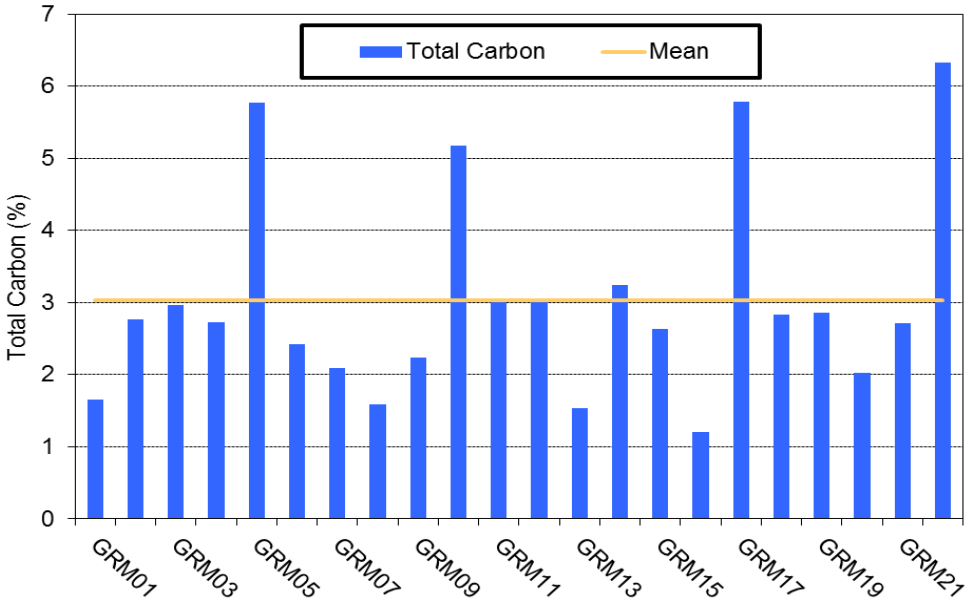
Figure 3-3 Total Carbon Concentrations in Composited Overburden Samples



3.2 Coal Roof and Floor Material

The ABA results for coal roof and floor samples are shown in **Table 3-1**. The full data set is provided in **Appendix B**.

3.2.1 Acid Base Account

The pH (1:5) values for coal roof and coal floor samples ranged from 8.1 to 9.9 and 8.8 to 9.9, respectively, which are moderately alkaline. The EC (1:5) value for coal roof samples ranged from 255 to 623 µS/cm to 273 to 588 µS/cm for coal floor samples.

The total sulfur and CRS concentrations of both the coal roof and floor samples were less than 0.40 and 0.341 per cent, respectively. There was marginal difference between the NAPP and $NAPP_{CRS}$ values (within ± 2 kg H_2SO_4/t). The mean NAPP values for coal roof and coal floor samples were -16.2 and -20.8 kg H_2SO_4/t, respectively.

Figure 3-4 is an ABA plot showing sulfide-sulfur (per cent S_{CRS}) versus ANC, with $NAPP_{CRS}$ positive and $NAPP_{CRS}$ negative domains indicated. Except for one sample (shale), all coal roof and coal floor samples tested fall within the $NAPP_{CRS}$ negative domain, and has an acid neutralising capacity that is greater than or equal to three times its acid generating potential.

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Figure 3-4 ABA plot of ANC versus S_{CRS} for Coal Roof and Coal Floor Samples

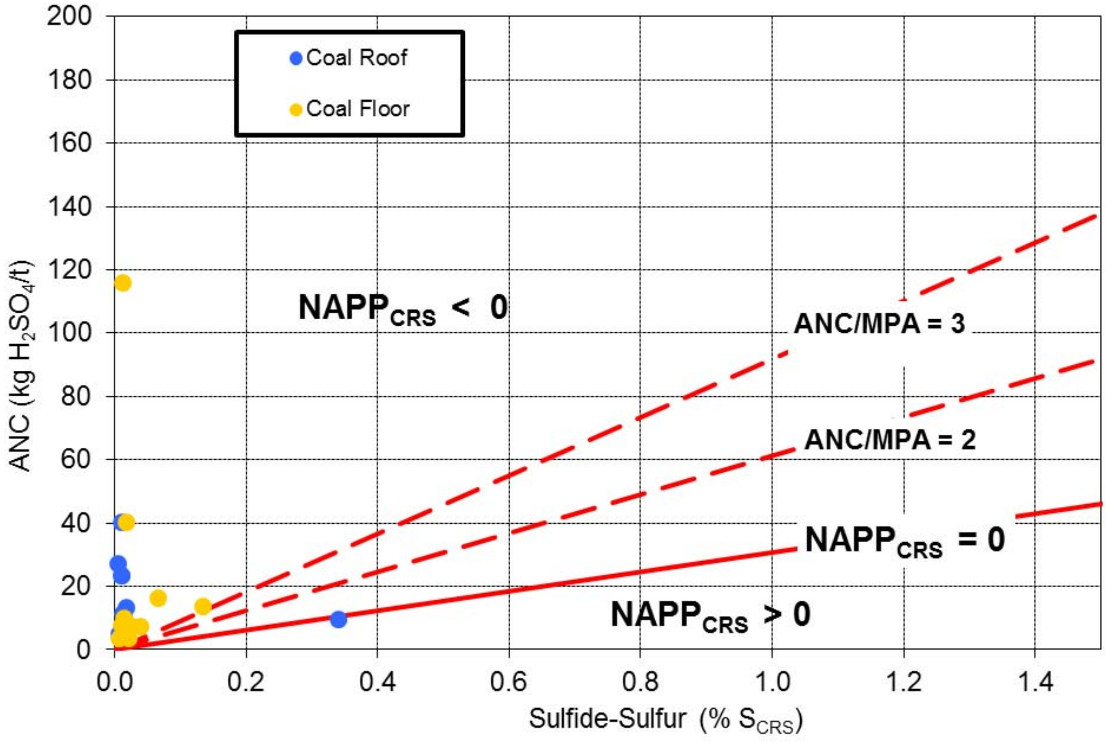

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Table 3-7 ABA Results for Coal Roof and Coal Floor Samples

Core Hole ID	Sample Interval (m)		Sample Type	Lithology	pH (1:5)	EC (1:5)	Total S	S_{CRS}	MPA	MPA_{CRS}	ANC	NAPP	$NAPP_{CRS}$	ANC/MPA Ratio	ANC/MPA_{CRS} Ratio
	From	To				(µS/cm)	(%)	(%)	(kg H_2SO_4/t)						
43723	217.92	218.30	Roof	Siltstone	9.6	397	0.03	0.005	0.92	0.15	27.1	-26.2	-26.9	29	181
43723	264.65	265.15	Floor	Claystone	9.6	382	0.05	0.017	1.53	0.52	40.1	-38.6	-39.6	26	77
43723	400.20	400.70	Floor	Siltstone	9.7	340	0.02	0.010	0.61	0.31	7.60	-6.99	-7.29	12	25
43733	128.79	129.29	Roof	Carbonaceous claystone	9.1	387	0.03	0.011	0.92	0.34	23.4	-22.5	-23.1	25	69
43733	133.50	134.00	Floor	Siltstone	8.8	481	0.13	0.066	3.98	2.02	16.1	-12.1	-14.1	4	8
43733	222.83	223.38	Roof	Siltstone	9.5	421	0.02	0.011	0.61	0.34	40.1	-39.5	-39.8	65	119
43733	279.66	280.00	Floor	Siltstone	9.5	333	0.06	0.040	1.84	1.23	7.20	-5.36	-5.98	4	6
43750	282.20	282.50	Floor	Claystone	9.5	311	0.05	0.015	1.53	0.46	9.80	-8.27	-9.34	6	21
43750	368.69	369.08	Roof	Siltstone	9.7	423	0.04	0.017	1.23	0.52	13.4	-12.2	-12.9	11	26
43750	378.50	379.00	Floor	Sandstone	9.7	588	0.02	0.013	0.61	0.40	116	-115	-116	189	291
43750	417.00	417.34	Roof	Sandstone/ siltstone	9.9	363	0.02	0.010	0.61	0.31	23.4	-22.8	-23.1	38	76
43765	392.30	392.63	Roof	siltstone/claystone	9.6	255	0.03	0.013	0.92	0.40	11.4	-10.5	-11.0	12	29
43893	186.96	187.37	Roof	Shale	8.1	623	0.40	0.341	12.25	10.44	9.50	2.75	0.94	1	1
43893	192.12	192.62	Floor	Siltstone	9.9	503	0.04	0.023	1.23	0.70	7.60	-6.38	-6.90	6	11
43893	299.46	299.94	Roof	Shale/siltstone	9.7	322	0.03	0.007	0.92	0.21	5.00	-4.08	-4.79	5	23
43893	307.57	308.07	Floor	Shale/sandstone	9.7	273	0.03	0.021	0.92	0.64	3.70	-2.78	-3.06	4	6
43893	336.00	336.38	Floor	Carbonaceous mudstone/siltstone	9.3	327	0.15	0.135	4.59	4.13	13.6	-9.01	-9.47	3	3
43893	357.09	357.59	Roof	Siltstone	9.9	535	0.03	0.014	0.92	0.43	11.4	-10.5	-11.0	12	27
43893	363.61	364.11	Floor	Siltstone	9.8	320	0.02	0.007	0.61	0.21	3.70	-3.09	-3.49	6	17

MPA = maximum potential acidity; CRS = chromium reducible sulfur. MPA_{CRS} = maximum potential acidity determined using the S_{CRS} value. ANC = acid neutralising capacity. NAPP = net acid producing potential. $NAPP_{CRS}$ = net acid producing potential determined using the S_{CRS} value.

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3.2.2 Net Acid Generation Test

Standard single addition NAGpH, and NAG capacity to pH 4.5 ($NAG_{pH4.5}$) and pH 7.0 ($NAG_{pH7.0}$) results are summarised in **Table 3-8**.

The NAGpH for the majority of coal roof and coal floor samples tested was greater than pH 6.6, with effectively no NAG capacity. The only exceptions were for a shale (NAGpH = 3.7) and siltstone (NAGpH = 3.5) sample, with corresponding $NAG_{pH7.0}$ capacities of 5.9 and 5.6 kg H_2SO_4/t, respectively.

Table 3-8 NAG Results for Coal Roof and Coal Floor Samples

Core Hole ID	Sample Interval (m)		Sample Type	Lithology	NAGpH	$NAG_{pH\ 4.5}$	$NAG_{pH\ 7.0}$
	From	To				(kg H_2SO_4/t)	
43723	217.92	218.30	Roof	Siltstone	9.0	<0.1	<0.1
43723	264.65	265.15	Floor	Claystone	8.8	<0.1	<0.1
43723	400.20	400.70	Floor	Siltstone	8.9	<0.1	<0.1
43733	128.79	129.29	Roof	Carbonaceous claystone	8.6	<0.1	<0.1
43733	133.50	134.00	Floor	Siltstone	7.5	<0.1	<0.1
43733	222.83	223.38	Roof	Siltstone	9.1	<0.1	<0.1
43733	279.66	280.00	Floor	Siltstone	7.1	<0.1	<0.1
43750	282.20	282.50	Floor	Claystone	7.8	<0.1	<0.1
43750	368.69	369.08	Roof	Siltstone	9.5	<0.1	<0.1
43750	378.50	379.00	Floor	Sandstone	10.5	<0.1	<0.1
43750	417.00	417.34	Roof	Sandstone/ siltstone	8.8	<0.1	<0.1
43765	392.30	392.63	Roof	siltstone/claystone	8.8	<0.1	<0.1
43893	186.96	187.37	Roof	Shale	3.7	1.3	5.9
43893	192.12	192.62	Floor	Siltstone	3.5	1.8	5.6
43893	299.46	299.94	Roof	Shale/siltstone	7.0	<0.1	<0.1
43893	307.57	308.07	Floor	Shale/sandstone	6.6	<0.1	0.6
43893	336.00	336.38	Floor	Carbonaceous mudstone/ siltstone	8.1	<0.1	<0.1
43893	357.09	357.59	Roof	Siltstone	9.4	<0.1	<0.1
43893	363.61	364.11	Floor	Siltstone	8.4	<0.1	<0.1

NAG = net acid generation.

A total of three of the coal roof and coal floor samples, containing the highest sulfur concentrations (0.13 to 0.40 per cent), were selected for extended boil NAG testing. The extended boil NAGpH and calculated NAG acidity (NAG_{org}) results are shown in **Table 3-9**. The results indicate the extended boil NAGpH value of the sample containing shale material was less than 4.5, with a calculated NAG acidity of 2.9 kg H_2SO_4/t. The NAG solution pH of the two coal floor samples remained at the same pH as the standard single addition NAGpH value after the extended boiling step.

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Table 3-9 Carbon Concentrations in Selected Coal Roof and Coal Floor Samples

Core Hole ID	Sample Interval (m)		Sample Type	Lithology	Extended Boil NAGpH	NAG_{org} (kg H_2SO_4/t)
	From	To				
43733	133.50	134.00	Floor	Siltstone	7.5	-
43893	186.96	187.37	Roof	Shale	3.0	2.9
43893	336.00	336.38	Floor	Carbonaceous Mudstone/ Siltstone	8.1	-

3.2.3 Acid Buffering Characteristic Curve

ABCC tests were conducted on six coal roof and coal floor samples comprising of mainly siltstone, claystone, sandstone carbonaceous mudstone/siltstone, and sandstone/siltstone. **Figure 3-5** shows the ABCC profiles of the coal roof and coal floor samples tested.

The ABCC profiles indicates that 10 to >100 per cent of the total ANC in most coal roof and coal floor materials tested is readily available for acid buffering (to pH ~4.5) and it will be slow reacting. The exception was a coal floor sample consisting of sandstone material, which was relatively fast reacting dropping from pH 9.87 to 4.65 when only 34.3 kg H_2SO_4/t of acid was added (i.e. 30 per cent of the total ANC).

3.2.4 Total Metal Concentrations

The total metal concentrations in five composite coal roof and seven composite coal floor samples compared to the mean upper continental crust abundance (Taylor and McLennan, 1995) and HIL-E guidelines (NEPC 1999) are shown in **Table 3-10**.

The GAI values are presented in **Table 3-11**. In general, the composited coal roof and coal floor samples tested had total metal concentrations below, or close to, the corresponding mean upper continental crust abundance, except for a number of samples, which showed enrichment in Sb (GAI = 1 to 2) and As (GAI 1 to 4). One coal roof sample consisting of siltstone (and shale/siltstone) was enriched in Cr (GAI = 1) and Ni (GAI = 1). Cu and V were enriched in a siltstone (GAI =1) and sandstone (GAI =1) coal floor sample, respectively.

Comparison of results to the NEPC HIL-E for soils shows that total metal concentrations in the composited coal roof and coal floor samples are between 2 and 444 times less than the guideline values, where such guideline levels exist.

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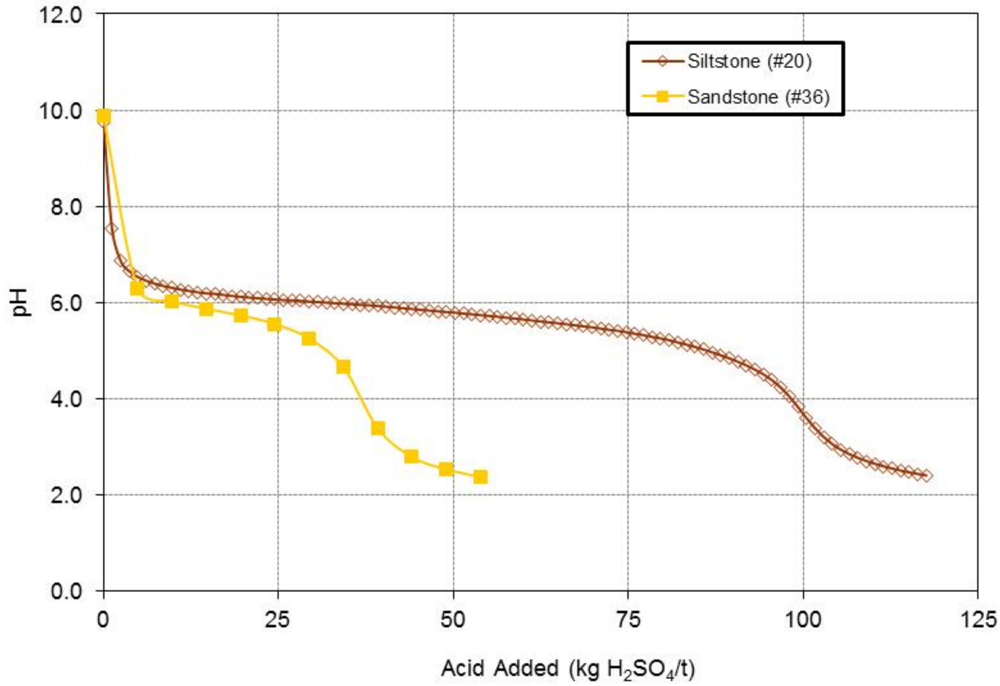
Figure 3-5 ABCC Profiles for Coal Roof and Floor Samples



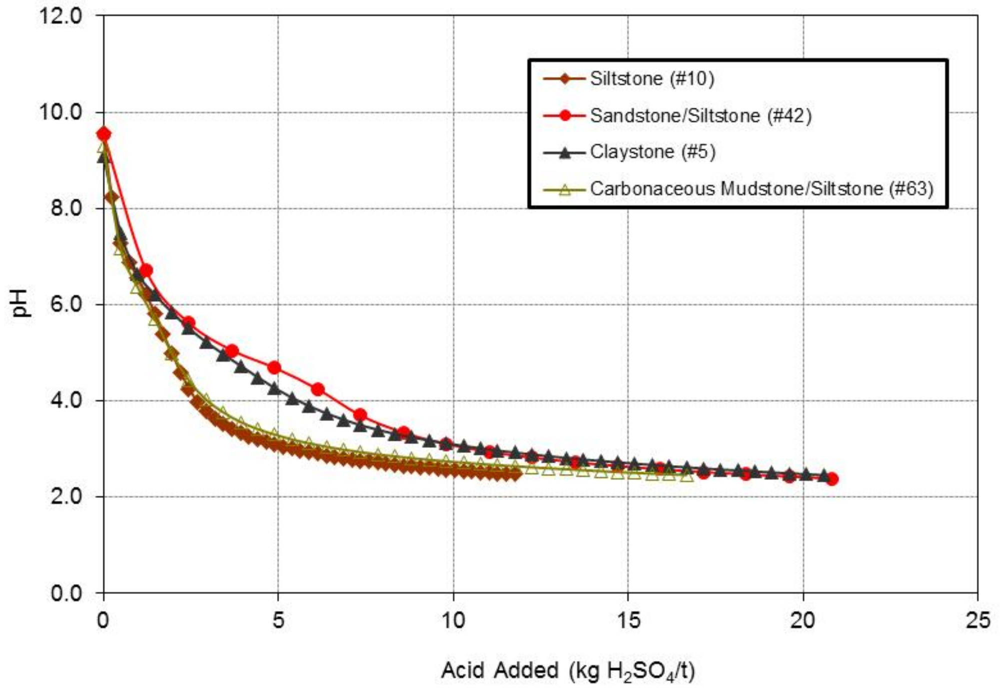


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Table 3-10 Summary of Total Metal Concentrations in Composited Coal Roof and Coal Floor Samples

URS Composite Number			GRM23	GRM24	GRM25	GRM26	GRM27	GRM28	GRM29	GRM30	GRM31	GRM32	GRM33	GRM34
Sample Type			Coal Roof	Coal Roof	Coal Roof	Coal Roof	Coal Roof	Coal Floor	Coal Floor	Coal Floor	Coal Floor	Coal Floor	Coal Floor	Coal Floor
Element	NEPC[a] HIL-E	Mean Upper Continental Crust Abundance[c]	Carbonaceous Claystone	Siltstone Mudstone	Siltstone (Shale/Siltstone)	Sandstone/ Siltstone/ Claystone	Shale	Siltstone	Siltstone	Shale/Sandstone	Sandstone	Claystone	Siltstone	Carbonaceous / Siltstone
Al (%)	--	8.04	6.88	6.38	7.58	7.32	8.34	8.57	7.37	8.43	7.31	9.19	8.91	6.53
Fe (%)	--	3.50	5.71	4.32	2.31	1.71	4.18	0.98	0.89	0.65	1.73	2.41	1.21	7.84
Sb	--	0.2	0.83	0.54	0.63	0.45	1.28	0.32	0.57	0.68	0.87	0.68	0.57	1.02
As	200	1.5	5.1	4.2	9.7	3.6	28.6	2.9	3.6	5	6.8	3.7	39.4	26.7
Cd	40	0.098	0.11	0.09	0.11	0.18	0.12	0.17	0.14	0.13	0.11	0.15	0.16	0.11
Cr	--[b]	35	53	44	131	45	45	47	45	46	96	60	58	52
Co	200	10	13.1	10.7	12.2	10.1	15.5	1.9	4.1	6.1	14.5	17.1	11.7	13.6
Cu	2000	25	45.7	51	47.1	54.3	51.6	79.1	29.9	33.9	22.5	51.8	62.9	27.4
Pb	600	20	20.1	16.9	16	25.1	19.3	20.3	24.7	15.6	14.5	17.9	14.5	17.4
Mn	3000	600	1440	369	429	435	150	23	56	43	188	168	76	1600
Ni	600	20	38.1	34.9	110.5	31.7	40.1	9.1	13.1	17.5	26.8	45.3	35.5	44.5
Se	--	50	2	2	2	2	2	1	2	2	2	2	2	2
Sn	--	5.5	3.3	2.7	2.7	3.2	2.9	2.8	3.7	3	2.5	2.9	2.3	2.7
U	--	2.8	2.7	2.8	2.5	3.6	2.9	3.6	3.6	2.8	2.1	3.2	2.5	2.6
V	--	60	123	92	116	106	100	135	89	133	183	123	155	106
Zn	14000	71	88	69	96	91	73	84	80	64	96	94	114	80

All values in mg/kg, unless otherwise stated. [a]National Environment Protection Council (1999) Health Investigation Levels-E for parks, recreational open space and playing fields. [b]Guideline value for Cr(VI) = 200 mg/kg. Cr(III) = 24 per cent of total Cr. [c]Taylor and McLennan (1995). [#]Mean values; "--" means no guideline value.

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Table 3-11 Geochemical Abundance Indices for both Composited Coal Roof and Coal Floor Samples

URS Composite Number	GRM 23	GRM 24	GRM 25	GRM 26	GRM 27	GRM 28	GRM 29	GRM 30	GRM 31	GRM 32	GRM 33	GRM 34
Sample Type	Coal Roof	Coal Roof	Coal Roof	Coal Roof	Coal Roof	Coal Floor	Coal Floor	Coal Floor	Coal Floor	Coal Floor	Coal Floor	Coal Floor
Element	Carbonaceous Claystone	Siltstone	Siltstone (Shale/Siltstone)	Sandstone/ Siltstone/ Claystone	Shale	Siltstone	Siltstone	Shale/ Sandstone	Sandstone	Claystone	Siltstone	Carbonaceous Mudstone/ Siltstone
Al	0	0	0	0	0	0	0	0	0	0	0	0
Fe	0	0	0	0	0	0	0	0	0	0	0	0
Sb	1	0	1	0	2	0	0	1	1	1	0	1
As	1	0	2	0	3	0	0	1	1	0	4	3
Cd	0	0	0	0	0	0	0	0	0	0	0	0
Cr	0	0	1	0	0	0	0	0	0	0	0	0
Co	0	0	0	0	0	0	0	0	0	0	0	0
Cu	0	0	0	0	0	1	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0	0	0	0	0
Mn	0	0	0	0	0	0	0	0	0	0	0	0
Ni	0	0	1	0	0	0	0	0	0	0	0	0
Se	0	0	0	0	0	0	0	0	0	0	0	0
Sn	0	0	0	0	0	0	0	0	0	0	0	0
U	0	0	0	0	0	0	0	0	0	0	0	0
V	0	0	0	0	0	0	0	0	1	0	0	0
Zn	0	0	0	0	0	0	0	0	0	0	0	0

Geochemical Abundance Index (GAI) = $\log_2 [C_{sample}/(1.5 \times C_{crust})]$; where C_{sample} = metal concentration measured in the sample, and C_{crust} = mean metal concentration in the upper continental crust (Taylor and McLennan 1995).

3.2.5 Metal Leachability

The mobility of metals in both the composited coal roof and coal floor samples were evaluated by analysing the dissolved metal concentrations in the water extracts (solids to deionised water ratio of 1:5). The results are summarised in **Table 3–12**. Also shown is the Australian livestock drinking water guideline (ANZECC and ARMCANZ 2000).

The dissolved metal concentrations in the water extract (1:5) solutions were below the selected criteria for all coal roof and coal samples tested.

3.2.6 Sodicity

The eCEC, ESP and SAR of both the composited coal roof and samples are presented in **Table 3–13**.

The results indicate that the eCEC of the composited coal roof samples is moderate (12.9 to 16.9 meq/100 g), and low to moderate for the composited coal floor samples (10.9 to 22.1 meq/100 g). The sodicity of both the composited coal roof and floor samples was very high with ESP ranging from 24.5 to 63.4 per cent. The mean SAR value was 25.8.

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Table 3-12 Water-Extractable Dissolved Metal Concentrations in Both Composited Coal Roof and Coal Floor Samples

URS composite number		GRM23	GRM24	GRM25	GRM26	GRM27	GRM28	GRM29	GRM30	GRM31	GRM32	GRM33	GRM34
Sample Type		**Roof**	**Roof**	**Roof**	**Roof**	**Roof**	**Floor**	**Floor**	**Floor**	**Floor**	**Floor**	**Floor**	**Floor**
Para-meters	Livestock Drinking Water[a]	Carbon-aceous Claystone	Siltstone	Siltstone (Shale/ Siltstone)	Sandstone/ Siltstone/ Claystone	Shale	Siltstone	Siltstone	Shale/ Sandstone	Sandstone	Claystone	Siltstone	Carbon-aceous Mudstone/ Siltstone
Ca	1,000[b]	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mg	2,000[c]	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
SO_4^{2}	1,000[d]	20.9	15.2	14.6	14.9	104	8.0	11.2	9.1	21.0	18.7	43.3	18.4
Al	5	0.02	0.12	0.05	0.07	<0.01	0.26	0.15	0.19	0.04	0.16	0.03	0.09
As	0.5 to 5[e]	<0.001	0.002	0.019	0.039	<0.001	<0.001	0.003	0.009	0.010	0.003	0.019	0.005
B	5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cd	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cr	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Co	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cu	0.4 to 5[f]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Pb	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hg	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Mo	0.15	0.002	0.008	0.005	0.010	0.006	0.003	0.002	0.008	0.006	0.008	0.006	0.004
Ni	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Se	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
U	0.2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	20	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

All values in mg/L. [a]ANZECC & ARMCANZ (2000). [b]Stock should tolerate concentration if calcium is the dominant cation and dietary phosphorus levels are adequate. [c]Insufficient information is available to set trigger value; however, concentrations up to 2,000 mg/L have been found to have no adverse effects on cattle. [d]No adverse effects to stock are expected if the concentration does not exceed 1,000 mg/L. [e]May be tolerate if not provided as a food additive and natural levels in the diet are low. [f]Dependent on livestock species.

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Table 3-13 Sodicity of Both Composited Coal Roof and Coal Floor Samples

URS Composite Number		GRM23	GRM24	GRM25	GRM26	GRM27	GRM28	GRM29	GRM30	GRM31	GRM32	GRM33	GRM34
Sample Type		Coal Roof	Coal Roof	Coal Roof	Coal Roof	Coal Roof	Coal Floor	Coal Floor	Coal Floor	Coal Floor	Coal Floor	Coal Floor	Coal Floor
Parameter	Units	Carbonaceous Claystone	Siltstone	Siltstone (Shale/ Siltstone)	Sandstone/ Siltstone/ Claystone	Shale	Siltstone	Siltstone	Shale/ Sandstone	Sandstone	Claystone	Siltstone	Carbonaceous Mudstone/ Siltstone
Exchangeable Ca	meq/100 g	5.8	3.7	6.2	5.5	2.8	4.7	4.0	3.6	7.2	3.5	8.4	2.7
Exchangeable Mg	meq/100 g	3.3	1.0	2.5	1.6	1.2	1.6	0.9	1.0	3.4	1.1	3.6	1.1
Exchangeable K	meq/100 g	1.0	1.1	1.0	1.1	1.0	1.8	1.1	0.8	0.6	1.0	0.7	1.0
Exchangeable Na	meq/100 g	3.8	7.0	7.1	6.7	7.7	14.0	8.6	7.3	5.2	9.3	4.1	6.1
eCEC	meq/100 g	13.8	12.8	16.9	14.8	12.8	22.1	14.6	12.7	16.5	14.9	16.7	10.9
ESP	%	27.2	54.8	42.3	45.1	60.8	63.4	59.0	57.7	31.8	62.4	24.5	55.9
SAR	-	24.4	25.5	26.4	34.1	64.9	27	7.62	9.23	28.7	15.7	19.8	26

eCEC = effective cation exchange capacity. ESP = exchangeable sodium percentage. SAR = sodium adsorption ratio

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3.2.7 Carbon Content

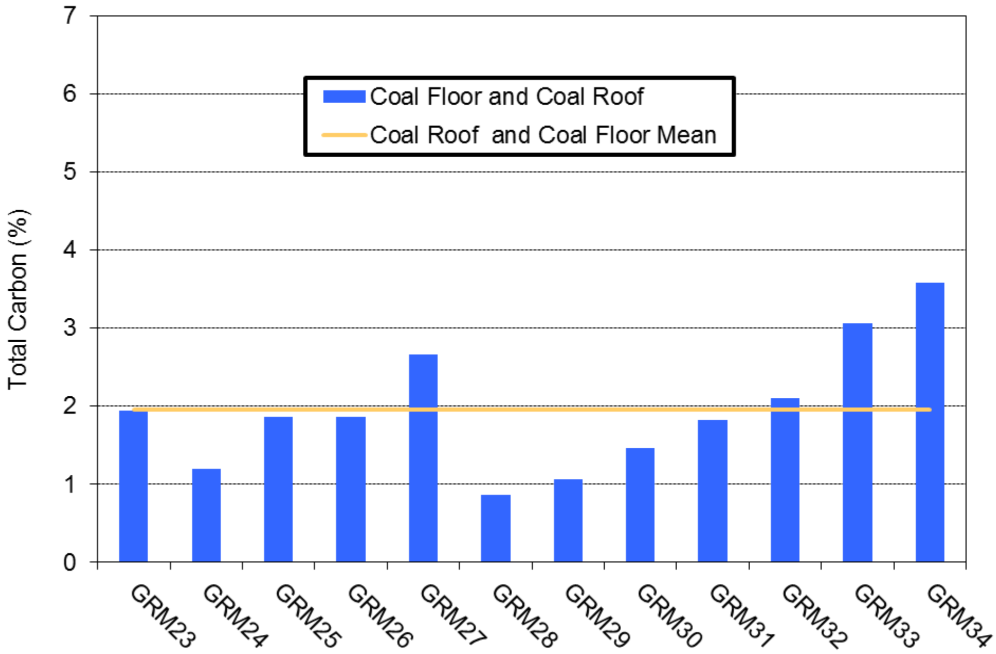
Carbon speciation analysis was conducted on the same coal roof and coal floor samples selected for extended boil NAG testing. The results are shown in **Table 3-14**. Total organic Carbon (TOC) concentration ranged from 1.45 to 3.24 per cent and is the main carbon species in the siltstone (coal floor) and shale (coal roof) samples tested. The Total Inorganic Carbon (TIC) concentration in the mixed carbonaceous mudstone/siltstone (coal floor) sample accounted for over 58 per cent of its Total Carbon (TC) content.

Table 3-14 Carbon Concentrations in Selected Coal Roof and Coal Floor Samples

Core Hole ID	Sample Interval (m)		Sample Type	Lithology	Total Carbon (TC)	Total Inorganic Carbon (TIC)	Total Organic Carbon (TOC)
	From	To					
43733	133.50	134.00	Floor	Siltstone	3.35	0.12	3.24
43893	186.96	187.37	Roof	Shale	2.55	0.04	2.52
43893	336.00	336.38	Floor	Carbonaceous Mudstone/ Siltstone	3.53	2.07	1.45

The TC concentrations in the five composited coal roof and seven composited coal floor samples varied from 1.20 to 2.67 per cent and 0.87 to 3.58 per cent, respectively (**Figure 3-6**). The mean TC concentration was 1.96 per cent.

Figure 3-6 Total Carbon Concentrations in Composited Coal Roof and Coal Floor Samples



3.3 Coarse Rejects

The acid base accounting results for coarse rejects are presented in **Table 3-15**. The full data set is provided in **Appendix C**.

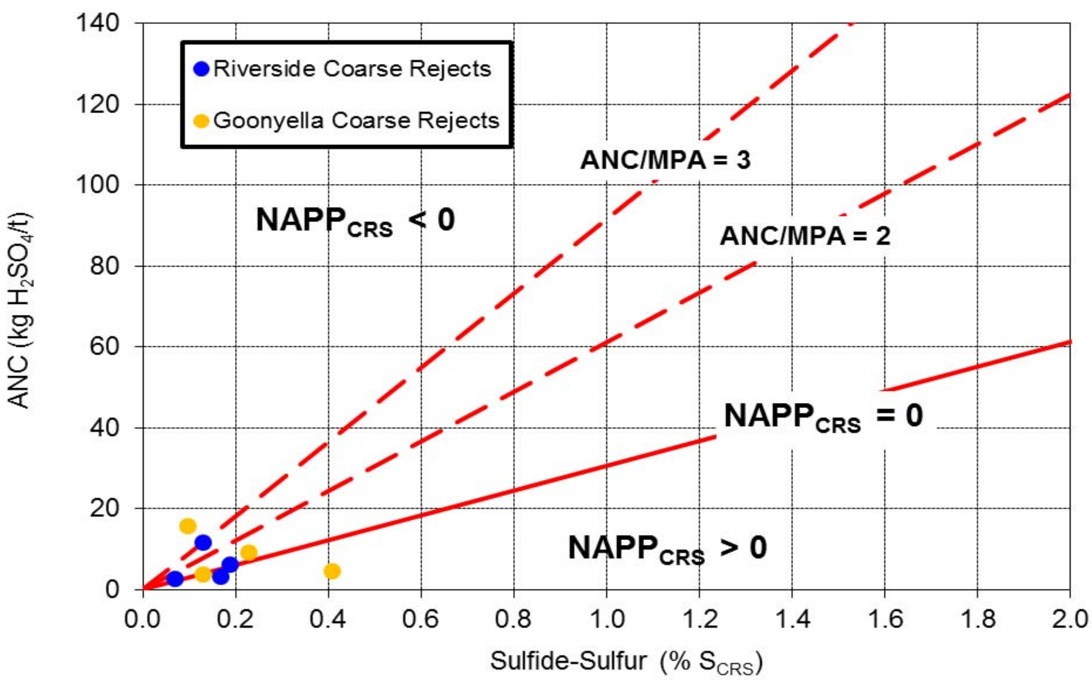
3.3.1 Acid Base Accounting

The pH (1:5) value for Riverside coarse rejects ranged from 6.7 to 8.5, which is near neutral to moderately alkaline. For Goonyella coarse reject samples, the pH (1:5) ranged between 7.2 and 9.4. The EC (1:5) value varied from 138 to 320 µS/cm, with a mean value of 235 µS/cm.

The total sulfur and CRS concentrations of the coarse rejects were less than 0.60 and 0.41per cent, respectively. The mean NAPP value for Riverside and Goonyella coarse rejects were 4.23 and 2.72 kg H_2SO_4/t, respectively, with corresponding mean $NAPP_{CRS}$ values of -1.70 and -1.59 kg H_2SO_4/t.

Figure 3-7 is an ABA plot showing sulfide-sulfur (per cent S_{CRS}) versus ANC, with $NAPP_{CRS}$ positive and $NAPP_{CRS}$ negative domains indicated. Approximately 62 per cent of coarse reject samples tested fall within the $NAPP_{CRS}$ negative domain, and has an acid neutralising capacity that is between one and five times its acid generating potential.

Figure 3-7 ABA Plot of ANC versus S_{CRS} for Coarse Reject Samples



3 Geochemical Test Results

Table 3-15 Summary of ABA Results for Coarse Reject Samples

Location	Deposition Time	Sample Type	pH (1:5)	EC (1:5)	Total S	S_{CRS}	MPA	MPA_{CRS}	ANC	NAPP	$NAPP_{CRS}$	ANC/MPA Ratio	ANC/MPA_{CRS} Ratio
				(µS/cm)	(%)	(%)	(kg H_2SO_4/t)						
Riverside	ca. 2003	Coarse reject	6.7	307	0.27	0.07	8.27	2.14	2.60	5.67	-0.46	0.3	1.2
Riverside	May 2009	Coarse reject	8.5	138	0.28	0.129	8.58	3.95	11.6	-3.03	-7.65	1.4	2.9
Riverside	Dec 2009	Coarse reject	8.5	293	0.39	0.189	11.9	5.79	6.30	5.64	-0.51	0.5	1.1
Riverside	May 2011	Coarse reject	7.9	320	0.39	0.167	11.9	5.11	3.30	8.64	1.81	0.3	0.6
Goonyella	Mid 2006	Coarse reject	7.2	173	0.60	0.409	18.4	12.5	4.50	13.9	8.03	0.2	0.4
Goonyella	ca. 2008	Coarse reject	8.6	212	0.29	0.13	8.88	3.98	3.70	5.18	0.28	0.4	0.9
Goonyella	Mid 2010	Coarse reject	7.6	288	0.30	0.229	9.19	7.01	9.10	0.09	-2.09	1.0	1.3
Goonyella	May 2011	Coarse reject	9.4	145	0.24	0.098	7.35	3.00	15.6	-8.25	-12.6	2.1	5.2

MPA = maximum potential acidity. CRS = chromium reducible sulfur. MPA_{CRS} = maximum potential acidity determined using the S_{CRS} value.

ANC = acid neutralising capacity. NAPP = net acid producing potential. $NAPP_{CRS}$ = net acid producing potential determined using the S_{CRS} value.

3 Geochemical Test Results

3.3.2 Net Acid Generation Test

Standard single addition NAGpH, and NAG capacity to pH 4.5 ($NAG_{pH4.5}$) and pH 7.0 ($NAG_{pH7.0}$) results are summarised in **Table 3-16**. Also shown are the extended boil NAGpH and NAG_{org} results.

The NAGpH of the Riverside coarse reject samples tested ranged from 2.5 to 6.6, with $NAG_{pH7.0}$ capacity of 0.2 to 83.8 kg H_2SO_4/t. NAG tests conducted on the Riverside sample deposited in 2003 had the highest $NAG_{pH7.0}$ capacity (83.8 kg H_2SO_4/t), followed by a Goonyella sample deposited in mid-2006 (22.9 kg H_2SO_4/t).

The extended boil NAGpH ranged from 3.0 to 6.2. The calculated NAG acidities (<0.1 to 9.2 kg H_2SO_4/t) were less than their corresponding $NAG_{pH7.0}$ capacity values.

Table 3-16 Summary of NAG Results for Coarse Reject Samples

Location	Deposition Time	Lithology	NAGpH	Extended Boil NAGpH	$NAG_{pH\ 4.5}$	$NAG_{pH\ 7.0}$	NAG_{org}
					(kg H_2SO_4/t)		
Riverside	ca. 2003	Coarse reject	2.5	5.4	49.4	83.8	4.5
Riverside	May 2009	Coarse reject	6.6	-	<0.1	0.2	-
Riverside	Dec 2009	Coarse reject	3.4	6.2	4.8	13.1	2.1
Riverside	May 2011	Coarse reject	3.5	6.1	2.4	11	<0.1
Goonyella	Mid 2006	Coarse reject	2.8	3.0	10.4	22.9	9.2
Goonyella	ca. 2008	Coarse reject	3.3	5.7	4.4	13.4	2.8
Goonyella	Mid 2010	Coarse reject	5.5	-	<0.1	0.5	-
Goonyella	May 2011	Coarse reject	8.0	-	<0.1	<0.1	-

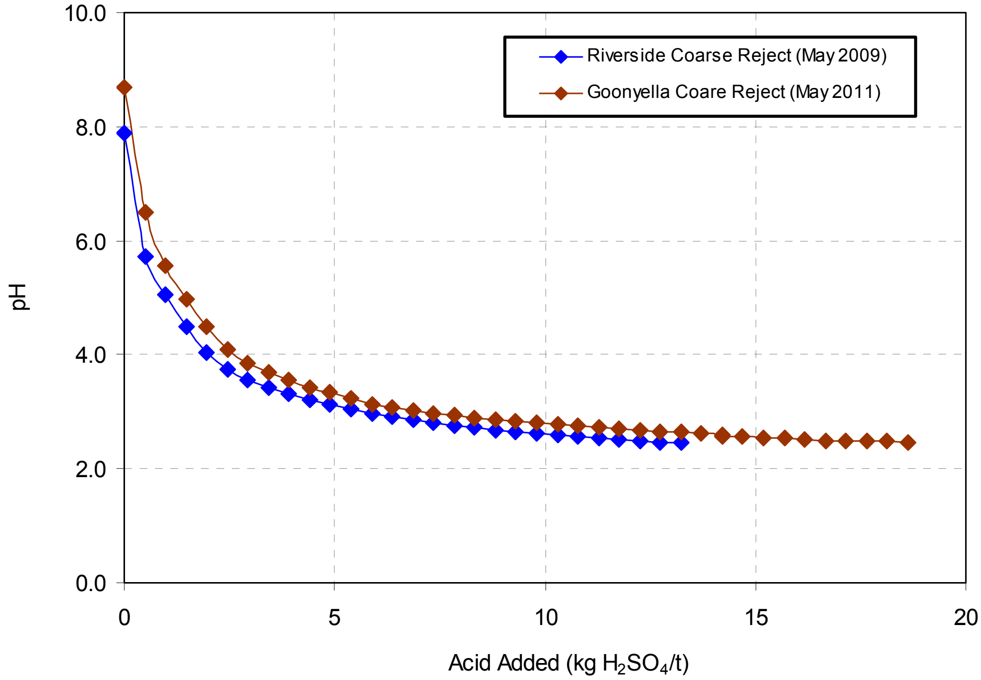
3.3.3 Acid Buffering Characteristics Curve

ABCC tests were conducted on two coarse reject samples (containing the highest ANC values) to evaluate the availability of the ANC measured. The ABCC profiles are presented in **Figure 3-8**.

The ABCC results indicates that about 13 per cent of the total ANC for the coarse reject samples tested is readily available for acid buffering (to pH ~4.5) and it will be slow reacting.

3 Geochemical Test Results

Figure 3-8 ABCC Profiles of Selected Coarse Reject Samples



3.3.4 Total Metal Concentrations

The total metal concentrations in coarse reject samples compared to the mean upper continental crust abundance (Taylor and McLennan 1995) are shown in **Table 3-17**. Also shown are HIL-E guideline for contaminated soil assessments for land used for parklands and recreational open spaces (NEPC 1999).

The GAI values were used to assess the level of metal enrichment relative to the mean upper continental crust abundance. The GAI values are presented in **Table 3-18**. The coarse reject samples had total metal concentrations below, or close to, the corresponding mean upper continental crust abundance, except for a number of samples, which showed some enrichment in Sb (GAI = 1) and As (GAI 1). Only one sample (Goonyella mid-2010) was elevated in Cd (GAI = 1).

Comparison of results to the NEPC HIL-E for soils shows that total metal concentrations in the coarse reject samples are up to 570 times less than the guideline values, where such guideline levels exist.

3 Geochemical Test Results

Table 3-17 Summary of Total Metal Concentrations for Coarse Reject Samples

Element	NEPC Health-Based Investigation Level[a]	Mean Upper Continental Crust Abundance[c]	Deposition Time							
			Riverside				Goonyella			
			ca. 2003	May 2009	Dec 2009	May 2011	Mid 2006	ca. 2008	Mid 2010	May 2011
Al (%)	--	8.04	4.5	5.16	5.81	5.88	6.93	7.48	6.64	7.4
Fe (%)	--	3.50	0.53	4.43	1.32	1.91	1.22	1.26	1.29	2.73
Sb	--	0.2	0.47	0.5	0.56	0.58	0.58	0.71	0.89	0.37
As	200	1.5	2.2	5.2	4.1	3.7	5.2	4.5	4	2.6
Cd	40	0.098	0.11	0.14	0.15	0.14	0.18	0.11	0.34	0.07
Cr	--[b]	35	9	17	15	28	18	16	13	26
Co	200	10	6.9	3.9	3.7	4.6	4.4	3.2	2.6	4.5
Cu	2,000	25	31.2	37.7	41.6	41.8	38.5	40.4	145	25.2
Pb	600	20	15.2	13.5	17.6	16.7	25.3	17.2	16.2	15
Mn	3,000	600	79	1015	227	267	183	187	240	452
Ni	600	20	10.7	13.8	9.7	12.9	13.2	8.4	7.2	12
Se	--	50	1	1	1	1	1	1	1	1
Tl	--	0.750	0.31	0.37	0.41	0.32	0.43	0.41	0.6	0.32
Sn	--	5.5	2.2	2	2.7	2.2	3.1	3.2	2.1	1.8
U	--	2.8	2.2	2.2	2.7	2.4	2.5	3.2	2.3	2.1
V	--	60	66	67	67	71	66	69	77	76
Zn	14,000	71	34	48	52	50	52	40	68	34

All values in mg/kg, unless otherwise stated. [a]National Environment Protection Council (1999) Health Investigation Levels-E for parks, recreational open space and playing fields.

[b]Guideline value for Cr(VI) = 200 mg/kg. Cr(III) = 24 per cent of total Cr. [c]Taylor and McLennan (1995).

[#]Mean values; "--" means no guideline value.

3 Geochemical Test Results

Table 3-18 Geochemical Abundance Indices for Coarse Rejects Samples

Element	Deposition Time							
	Riverside				Goonyella			
	ca. 2003	May 2009	Dec 2009	May 2011	Mid 2006	ca. 2008	Mid 2010	May 2011
Al	0	0	0	0	0	0	0	0
Fe	0	0	0	0	0	0	0	0
Sb	0	0	0	0	0	1	1	0
As	0	1	0	0	1	1	0	0
Cd	0	0	0	0	0	0	1	0
Cr	0	0	0	0	0	0	0	0
Co	0	0	0	0	0	0	0	0
Cu	0	0	0	0	0	0	0	0
Pb	0	0	0	0	0	0	0	0
Mn	0	0	0	0	0	0	0	0
Ni	0	0	0	0	0	0	0	0
Se	0	0	0	0	0	0	0	0
Tl	0	0	0	0	0	0	0	0
Sn	0	0	0	0	0	0	0	0
U	0	0	0	0	0	0	0	0
V	0	0	0	0	0	0	0	0
Zn	0	0	0	0	0	0	0	0

Geochemical Abundance Index (GAI) = $\log_2 [C_{sample}/(1.5 \times C_{crust})]$; where C_{sample} = metal concentration measured in the sample, and C_{crust} = mean metal concentration in the upper continental crust (Taylor and McLennan, 1995).

3.3.5 Metal Leachability

The mobility of metals in the composited overburden samples were evaluated by analysing the dissolved metal concentrations in the water extracts (solids to deionised water ratio of 1:5). The results are summarised in **Table 3-19**. Also shown is the Australian livestock drinking water guideline (ANZECC and ARMCANZ 2000).

The dissolved metal concentrations in the water extract (1:5) solutions are generally orders of magnitude below the selected criteria, where guidelines values exist.

3 Geochemical Test Results

Table 3-19 Water-Extractable Dissolved Metal Concentrations in Coarse Reject Samples

Parameters	Livestock Drinking Water[a]	Riverside				Goonyella			
		ca. 2003	May 2009	Dec 2009	May 2011	Mid 2006	ca. 2008	Mid 2010	May 2011
Ca	1,000[b]	12	<1	<1	2	24	31	143	13
Mg	2,000[c]	23	<1	<1	2	17	33	83	12
SO_4^{2-}	1,000[d]	1043	108	383	357	597	83	699	171
Al	5	<0.01	0.87	0.01	0.04	0.02	<0.01	0.21	0.01
As	0.5 to 5[e]	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
B	5	0.3	0.2	0.2	0.2	0.1	<0.1	<0.1	0.2
Cd	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cr	1	<0.001	0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
Co	1	0.002	<0.001	<0.001	<0.001	<0.001	0.023	<0.001	<0.001
Cu	0.4 to 5[f]	0.002	0.003	<0.001	0.001	0.001	<0.001	0.003	0.002
Pb	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Hg	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Mo	0.15	<0.001	0.012	<0.001	0.005	0.011	0.001	0.018	0.001
Ni	1	0.001	0.001	<0.001	<0.001	<0.001	0.059	0.001	<0.001
Se	0.02	0.02	0.01	0.01	<0.01	<0.01	<0.01	0.01	<0.01
U	0.2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	20	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

All values in mg/L. [a]ANZECC & ARMCANZ (2000). [b]Stock should tolerate concentration if calcium is the dominant cation and dietary phosphorus levels are adequate.

[c]Insufficient information is available to set trigger value; however, concentrations up to 2000 mg/L have been found to have no adverse effects on cattle.

[d]No adverse effects to stock are expected if the concentration does not exceed 1000 mg/L.

[e]May be tolerated if not provided as a food additive and natural levels in the diet are low.

[f]Dependent on livestock species.

3 Geochemical Test Results

3.3.6 Sodicity

The eCEC, ESP and SAR of coarse reject samples are presented in **Table 3-20**. The results indicate that the eCEC for the Riverside (7.8 to 10.0 meq/100 g) and Goonyella (10.2 to 17.0 meq/100 g) coal reject samples is low to moderate. The ESP ranged from 12.4 to 27.2 per cent for Riverside coarse reject samples compared to 0.8 to 22.5 per cent for Goonyella samples. The SAR values varied from 0.11 to 28.3.

Table 3-20 Sodicity of Coarse Rejects Samples

Parameter	Units	Deposition Time							
		Riverside				Goonyella			
		ca. 2003	May 2009	Dec 2009	May 2011	Mid 2006	ca. 2008	Mid 2010	May 2011
Exchangeable Ca	meq/100 g	2.1	4	3	4	5.5	5	10.8	4
Exchangeable Mg	meq/100 g	3.9	4.5	3.7	3.5	3.8	4.8	5.3	3.6
Exchangeable K	meq/100 g	0.2	0.3	0.3	0.2	0.4	0.4	0.4	0.3
Exchangeable Na	meq/100 g	1.6	1.2	2.6	2	2.1	<0.1	0.6	2.3
eCEC	meq/100 g	7.8	10	9.7	9.7	11.9	10.3	17	10.2
ESP	%	20.8	12.4	27.2	20.5	17.8	0.8	3.2	22.5
SAR	-	8.39	11.9	28.3	23	6.16	0.11	0.62	9.39

eCEC = effective cation exchange capacity. ESP = exchangeable sodium percentage.

SAR = sodium adsorption ratio.

3.3.7 Carbon Content

Carbon speciation analysis was conducted on the coarse reject samples. The results are shown in **Table 3-21**. TOC concentration ranged from 11.9 to 31.7 per cent and is the main carbon species in the coarse reject samples tested. The mean TOC concentration for the Riverside coarse reject samples was 25.8 per cent compared to 16.9 per cent for the Goonyella samples. The TIC concentration in the coarse reject samples accounted for less than 6.5 per cent of the TC content.

Table 3-21 Carbon Concentrations in Coarse Reject Samples

Location	Deposition Time	Total Carbon (TC)	Total Inorganic Carbon (TIC)	Total Organic Carbon (TOC)
Riverside	ca. 2003	33.9	2.17	31.7
	May-09	21.8	1.38	20.5
	Dec-09	25.7	1.39	24.3
	May-11	27.2	0.51	26.6
Goonyella	Mid 2006	24.6	1.03	23.6
	ca. 2008	16.4	0.06	16.3
	Mid 2010	12.0	0.11	11.9
	May-11	16.5	0.79	15.7

3.4 Tailings

The ABA results for tailings samples are presented in **Table 3-15**. The full data set is provided in **Appendix D**.

3.4.1 Acid Base Account

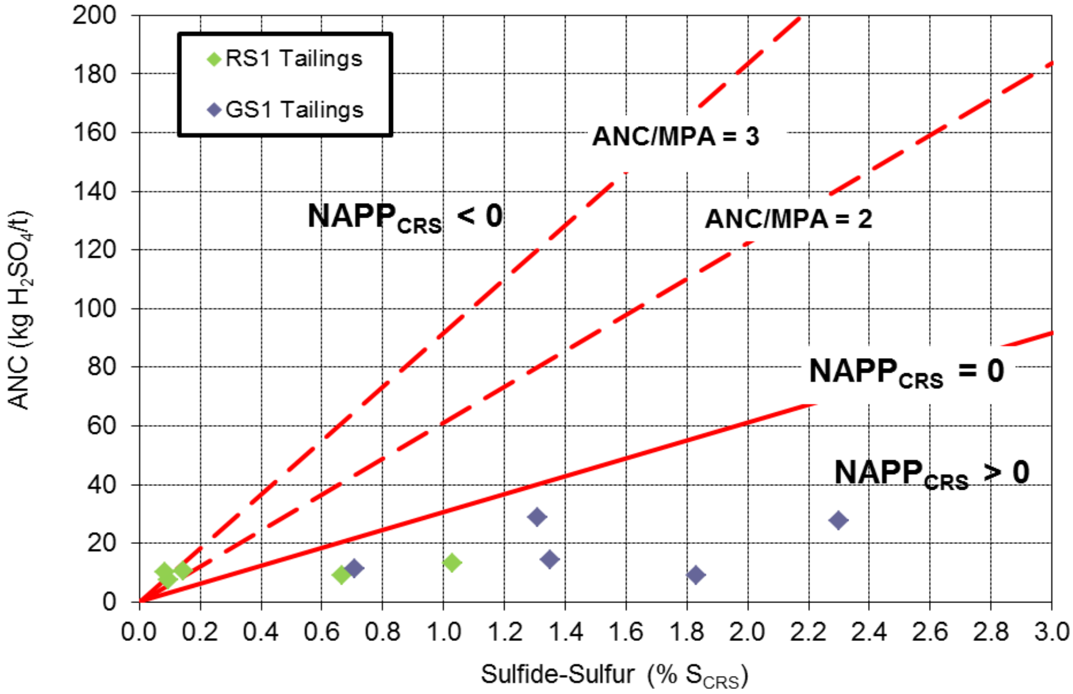
The pH (1:5) value for Riverside (RS1) and Goonyella (GS1) tailings samples tested ranged from 7.8 to 8.8 and 7.6 to 9.1, respectively, which is mildly to strongly alkaline. The EC (1:5) value for RS1 tailings samples ranged from 609 to 1,490 µS/cm, and 425 to 2,370 µS/cm for GS1 tailings samples.

The mean total sulfur and CRS concentration for RS1 tailings samples was 0.71 and 0.40 per cent, respectively, compared to 1.74 and 1.50 per cent for GS1 tailings samples, respectively. For the GS1 tailings samples, the sulfur concentrations increased with the age of deposition.

The NAPP value for tailings samples ranged between 3.6 and 60 kg H_2SO_4/t, with corresponding $NAPP_{CRS}$ values of -7.66 to 46.9 kg H_2SO_4/t.

Figure 3-9 is an ABA plot showing sulfide-sulfur (per cent S_{CRS}) versus ANC, with $NAPP_{CRS}$ positive and $NAPP_{CRS}$ negative domains indicated. The majority of tailings samples tested (70 per cent) fall within the $NAPP_{CRS}$ positive domain, and has an acid neutralising capacity that is less than one times its acid generating potential. Three RS1 tailings samples (deposited in November and December 2010, and 2008) plotted in the $NAPP_{CRS}$ negative domain, with acid neutralising capacity greater between two and four times its acid generating potential.

Figure 3-9 ABA Plot of ANC versus Total S for RS1 and GS1 Tailings Samples



3 Geochemical Test Results

Table 3-22 Summary of ABA Results for RS1 and GS1 Tailings Samples

Location	Deposition Time	pH (1:5)	EC (1:5)	Total S	S_{CRS}	MPA	MPA_{CRS}	ANC	NAPP	$NAPP_{CRS}$	ANC/MPA Ratio	ANC/MPA_{CRS} Ratio
			(µS/cm)	(%)	(%)	($kg\ H_2SO_4/t$)						
RS1	ca. 2008	8.7	619	0.45	0.083	13.8	2.54	10.2	3.58	-7.66	0.7	4.0
RS1	Nov 2010	8.4	1,490	0.53	0.145	16.2	4.44	10.7	5.53	-6.26	0.7	2.4
RS1	Dec 2010	8.8	711	0.39	0.097	11.9	2.97	7.7	4.24	-4.73	0.6	2.6
RS1	Jan 2011	8.2	703	1.21	1.03	37.1	31.5	13.3	23.8	18.2	0.4	0.4
RS1	Mar 2011	7.8	609	0.98	0.668	30.0	20.5	9.2	20.8	11.3	0.3	0.4
GS1	May 2006	7.6	2,370	2.88	2.3	88.2	70.4	27.7	60.5	42.7	0.3	0.4
GS1	Nov 2009	7.7	2,230	2.11	1.83	64.6	56.0	9.1	55.5	46.9	0.1	0.2
GS1	May 2010	8	556	1.43	1.35	43.8	41.3	14.5	29.3	26.8	0.3	0.4
GS1	Nov 2010	7.9	1,080	1.33	1.31	40.7	40.1	28.9	11.8	11.2	0.7	0.7
GS1	Apr 2011	9.2	425	0.93	0.708	28.5	21.7	11.4	17.1	10.3	0.4	0.5

MPA = maximum potential acidity. CRS = chromium reducible sulfur. MPA_{CRS} = maximum potential acidity determined using the S_{CRS} value.

ANC = acid neutralising capacity. NAPP = net acid producing potential. $NAPP_{CRS}$ = net acid producing potential determined using the S_{CRS} value.

3 Geochemical Test Results

3.4.2 Net Acid Generation Test

Standard single addition NAGpH, and NAG capacity to pH 4.5 ($NAG_{pH4.5}$) and pH 7.0 ($NAG_{pH7.0}$) results are summarised in **Table 3-23**. Also shown are the extended boil NAGpH and NAG_{org} results.

The RS1 and GS1 tailings samples tested had NAGpH values ranging from 2.9 to 6.7 and 2.2 to 4.8, respectively. The $NAG_{pH7.0}$ capacity of the RS1 tailings samples varied between 0.2 to 31.4 kg H_2SO_4/t, and 2.2 to 4.8 kg H_2SO_4/t for the GS1 tailings samples.

The extended boil NAGpH ranged from 2.2 to 6.0. The calculated NAG acidities (<0.1 to 34.4 kg H_2SO_4/t) were less than their corresponding $NAG_{pH7.0}$ capacity values.

Table 3-23 Summary of NAG Results for RS1 and GS1 Tailings Samples

Location	Deposition Time	NAGpH	Extended Boil NAGpH	$NAG_{pH\ 4.5}$	$NAG_{pH\ 7.0}$	NAG_{org}
				(kg H_2SO_4/t)		
RS1	ca. 2008	6.7	-	<0.1	0.2	-
RS1	Nov 2010	4.5	-	1.4	13.0	-
RS1	Dec 2010	3.7	6.0	3.8	16.7	<0.1
RS1	Jan 2011	2.9	2.5	17.3	31.4	17.8
RS1	Mar 2011	4.3	2.7	1.0	16.3	12.2
GS1	May 2006	2.4	2.3	35	39.9	31.4
GS1	Nov 2009	2.2	2.2	35.5	41.6	34.4
GS1	May 2010	3.8	2.5	4.8	21.9	18.9
GS1	Nov 2010	4.5	-	0.8	13.3	-
GS1	Apr 2011	4.8	-	1.2	19.2	-

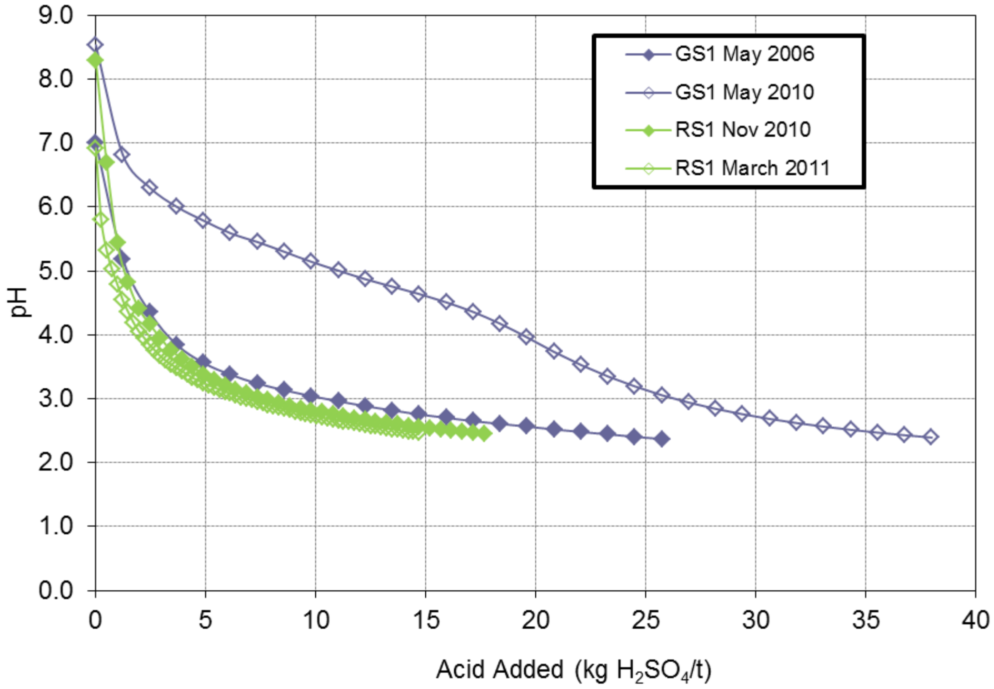
3.4.3 Acid Buffering Characteristics Curve

ABCC tests were conducted on four tailings samples to evaluate the availability of the ANC measured. The ABCC profiles are presented in **Figure 3-10**.

ABCC profiles for GS1 tailings sample deposited in May 2006, and both RS1 tailings samples indicates that about eight to 18 per cent of the total ANC is readily available for acid buffering (to pH ~4.5) and it will be fast reacting. The ABCC profile for the remaining GS1 sample (deposited in May 2010) is slow reacting with about 55 per cent of the total ANC is readily available for acid buffering.

3 Geochemical Test Results

Figure 3-10 ABCC Profiles of Selected RS1 and GS1 Tailings Samples



3.4.4 Total Metal Concentrations

The total metal concentrations in tailings samples compared to the mean upper continental crust abundance (Taylor and McLennan 1995) and HIL-E guidelines (NEPC 2009) are shown in **Table 3-24**. The laboratory data is provided in **Appendix D**.

The GAI values are presented in **Table 3-25**. The tailings samples tested had total metal concentrations below, or close to, the corresponding mean upper continental crust abundance, except for a number of samples, which showed elemental enrichment. All GS1 tailings samples tested were enriched in Sb (GAI = 1) and As (GAI = 1 to 4), with one sample (deposited in May 2006) also enriched in Co (GAI = 3) and Ni (GAI = 3). The Riverside tailings sample was comparatively less enriched in Sb and As.

Comparison of results to the NEPC HIL-E for soils shows that total metal concentrations in the coarse reject samples are three to 364 times less than the guideline values, where such guideline levels exist.

3.4.5 Metal Leachability

The mobility of metals in the RS1 and GS1 tailings samples were evaluated by analysing the dissolved metal concentrations in the water extracts (solids to deionised water ratio of 1:5). The results are summarised in **Table 3-26**. Also shown is the Australian livestock drinking water guideline (ANZECC and ARMCANZ 2000).

The dissolved metal concentrations in the water extract (1:5) solutions are generally orders of magnitude below the selected criteria, where guidelines values exist. However, two GS1 tailings samples (deposited on May 2006 and November 2009) also exceed the guideline value for calcium by a factor of 2.5 on average.

3 Geochemical Test Results

Table 3-24 Summary of Total Metal Concentrations for RS1 and GS1 Tailings Samples

Element	NEPC Health-Based Investigation Level[a]	Mean Upper Continental Crust Abundance[c]	Deposition Time									
			Riverside					Goonyella				
			ca. 2008	Nov 2010	Dec 2010	Jan 2011	Mar 2011	May 2006	Nov 2009	May 2010	Nov 2010	Apr 2011
Al (%)	--	8.04	3.36	4.01	4.32	3.69	6.39	6.73	6.38	6.78	6.29	4.73
Fe (%)	--	3.50	1.15	1	1.04	1.69	4.13	3.77	3.35	4.37	5.78	3.12
Sb	--	0.2	0.52	0.57	0.56	0.52	0.75	1.19	1.19	0.85	0.88	0.8
As	200	1.5	2.2	5.4	2.8	5.2	3.3	44.1	31.8	21.9	8.1	7.1
Cd	40	0.098	0.11	0.12	0.12	0.14	0.21	0.26	0.21	0.17	0.18	0.18
Cr	--[b]	35	14	21	15	36	17	23	31	37	31	20
Co	200	10	4.9	6.5	5.2	6.5	4	155.5	26.4	6.6	3.9	5.2
Cu	2,000	25	32.2	33.4	34.3	37	37.6	40.9	38.2	39.3	33.1	38.6
Pb	600	20	15.1	14.7	17.1	16.8	21.7	21.6	24.1	20.3	20.1	17.5
Mn	3,000	600	150	112	164	224	816	336	367	650	1,060	544
Ni	600	20	11.6	20.4	12.6	25.7	10	279	56.5	25.6	18.4	13.3
Se	--	50	1	1	<1	1	1	2	1	1	1	1
Tl	--	0.750	0.25	0.41	0.32	0.38	0.36	1.18	0.97	0.72	0.58	0.45
Sn	--	5.5	1.8	2.2	2.2	2.2	2.5	2.3	2.6	2.2	2.1	2.1
U	--	2.8	1.8	1.9	2.2	2	2.7	2.4	2.6	2.6	2.4	2.2
V	--	60	58	66	63	68	62	93	75	77	62	58
Zn	14,000	71	42	50	43	57	73	97	81	61	71	70

All values in mg/kg, unless otherwise stated. [a]National Environment Protection Council (1999) Health Investigation Levels-E for parks, recreational open space and playing fields.

[b]Guideline value for Cr(VI) = 200 mg/kg. Cr(III) = 24 per cent of total Cr. [c]Taylor and McLennan (1995).

[#]Mean values; "--" means no guideline value.

3 Geochemical Test Results

Table 3-25 Geochemical Abundance Indices for RS1 and GS1 Tailings Samples

Element	NEPC Health-Based Investigation Level[a]	Mean Upper Continental Crust Abundance[c]	Deposition Time									
			Riverside					Goonyella				
			ca. 2008	Nov 2010	Dec 2010	Jan 2011	Mar 2011	May 2006	Nov 2009	May 2010	Nov 2010	Apr 2011
Al (%)	--	8.04	0	0	0	0	0	0	0	0	0	0
Fe (%)	--	3.50	0	0	0	0	0	0	0	0	0	0
Sb	--	0.2	0	0	0	0	1	1	1	1	1	1
As	200	1.5	0	1	0	1	0	4	3	3	1	1
Cd	40	0.098	0	0	0	0	0	0	0	0	0	0
Cr	--[b]	35	0	0	0	0	0	0	0	0	0	0
Co	200	10	0	0	0	0	0	3	0	0	0	0
Cu	2,000	25	0	0	0	0	0	0	0	0	0	0
Pb	600	20	0	0	0	0	0	0	0	0	0	0
Mn	3,000	600	0	0	0	0	0	0	0	0	0	0
Ni	600	20	0	0	0	0	0	3	0	0	0	0
Se	--	50	0	0	0	0	0	0	0	0	0	0
Tl	--	0.750	0	0	0	0	0	0	0	0	0	0
Sn	--	5.5	0	0	0	0	0	0	0	0	0	0
U	--	2.8	0	0	0	0	0	0	0	0	0	0
V	--	60	0	0	0	0	0	0	0	0	0	0
Zn	14,000	71	0	0	0	0	0	0	0	0	0	0

3 Geochemical Test Results

Table 3-26 Water-extractable Dissolved Metal Concentrations in RS1 and GS1 Tailings Samples

Parameters	Livestock Drinking Water[a]	Riverside					Goonyella				
		ca. 2008	Nov 2010	Dec 2010	Jan 2011	Mar 2011	May 2006	Nov 2009	May 2010	Nov 2010	Apr 2011
Ca	1,000[b]	38	139	29	333	103	2792	2218	76	364	14
Mg	2,000[c]	41	139	25	121	83	392	548	64	207	9
SO_4^{2-}	1,000[d]	1,191	2,472	1,030	1,536	1,205	7,833	8,301	1,012	2,196	363
Al	5	0.10	<0.01	0.02	0.02	0.03	4.89	0.04	0.02	0.02	0.07
As	0.5 to 5[e]	<0.001	<0.001	<0.001	<0.001	<0.001	0.009	<0.001	<0.001	<0.001	<0.001
B	5	0.2	0.2	0.2	0.1	<0.1	<0.1	0.1	0.1	<0.1	0.2
Cd	0.01	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cr	1	0.005	0.002	0.001	0.002	<0.001	0.003	0.001	<0.001	<0.001	0.002
Co	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cu	0.4 to 5[f]	<0.001	<0.001	<0.001	<0.001	0.001	0.004	<0.001	0.002	<0.001	<0.001
Pb	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
Hg	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Mo	0.15	0.124	0.002	0.005	0.009	<0.001	0.032	0.004	0.010	0.006	0.009
Ni	1	<0.001	0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001
Se	0.02	<0.01	<0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01	<0.01	0.01
U	0.2	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	20	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

All values in mg/L. [a]ANZECC & ARMCANZ (2000). [b]Stock should tolerate concentration if calcium is the dominant cation and dietary phosphorus levels are adequate.
[c]Insufficient information is available to set trigger value; however, concentrations up to 2,000 mg/L have been found to have no adverse effects on cattle.
[d]No adverse effects to stock are expected if the concentration does not exceed 1,000 mg/L.
[e]May be tolerated if not provided as a food additive and natural levels in the diet are low.
[f]Dependent on livestock species.

3.4.6 Sodicity

The eCEC, ESP and SAR of the RS1 and GS1 tailings samples are presented in **Table 3-27**.

The results indicate that the eCEC for the RS1 tailings samples was low to moderate (11.3 to 22.5 meq/100 g) and moderate to high (12.2 to 36.9 meq/100 g) for GS1 tailings samples. The ESP ranged from 9.7 to 32 per cent for RS1 tailings samples, compared to 2.2 to 19.6 per cent for GS1 tailings samples. The SAR values varied from 0.32 to 11.6.

Table 3-27 Sodicity of Coarse Rejects Samples

Parameter	Deposition Time									
	Riverside					Goonyella				
	ca. 2008	Nov 2010	Dec 2010	Jan 2011	Mar 2011	May 2006	Nov 2009	May 2010	Nov 2010	Apr 2011
Exchangeable Ca	7.5	9.6	4.4	11.9	4.2	31.1	18.1	5.2	15.5	7.9
Exchangeable Mg	3.6	5.5	3.4	3.7	4.9	4.8	7	4.4	5.1	2.8
Exchangeable K	0.2	0.4	0.3	0.3	0.2	0.2	0.3	0.3	0.2	0.2
Exchangeable Na	2.9	7.0	3.8	1.7	1.9	0.8	3.6	2.4	2.2	2.6
eCEC	14.2	22.5	12	17.6	11.3	36.9	29.1	12.2	23.1	13.6
ESP (%)	20.7	31	32	9.7	17.2	2.2	12.5	19.6	9.6	19.5
SAR	6.89	7.4	11.6	1.23	2.72	0.32	1.51	4.21	1.78	10.5

All values in meq/100 g, unless otherwise stated. eCEC = effective cation exchange capacity.

ESP = exchangeable sodium percentage. SAR = sodium adsorption ratio.

3.4.7 Carbon Content

Carbon speciation analysis was conducted on the RS1 and GS1 tailings samples. The results are shown in **Table 3-28**. TOC concentration ranged from 5.80 to 43.6 per cent and is the main carbon species in the tailings samples tested, accounting for 79 to 91 per cent of the total carbon content. The mean TOC concentration for the RS1 tailings samples was 13.6 per cent, compared to 30.9 per cent for the GS1 tailings samples.

Table 3-28 Carbon Concentrations in RS1 and GS1 Tailings Samples

Location	Deposition Time	Total Carbon (TC)	Total Inorganic Carbon (TIC)	Total Organic Carbon (TOC)
Riverside	Nov 2010	48.7	5.10	43.6
	Dec 2010	37.7	3.66	34.0
	Jan 2011	42.4	4.11	38.3
	Mar 2011	37.4	3.87	33.5
	May 2006	21.0	3.38	17.6
Goonyella	Nov 2009	14.6	1.50	13.2
	May 2010	12.2	1.11	11.1
	Nov 2010	7.25	1.49	5.76
	Apr 2011	12.5	1.92	10.6
	Nov 2010	31.6	4.31	27.2

4 Discussion

The geochemical test results are discussed in the following sections, evaluating the AMD potential of mineral waste samples tested, the potential risks, and implications for environmental and mineral waste management. The results of this study are considered within the context of previous geochemical investigations conducted in the area broadly covered by the project.

4.1 pH (1:5) and EC (1:5)

The pH and EC of a sample is commonly determined in association with NAPP and/or NAG testing. The pH and EC of the mineral waste sample was used to assess the immediate reactivity of sulfides and acid neutralising minerals, and the inherent acidity and salinity of the tailings material when initially exposed to oxygen.

The pH (1:5) results were neutral to very strongly alkaline (pH 6.7 to 10.1), indicating a lack of existing acidity associated with the mineral waste materials tested (i.e. overburden, coal roof and floor, coarse rejects and tailings). The majority of samples (~78.3 per cent) had pH values greater than 9.0 and would be classed as very high according to the Queensland guidelines for the assessment and management of acid Drainage (DERM 1995 and 1995a). About 20.5 per cent of all mineral waste samples tested had a pH value between 7.0 and 9.0, with the remaining samples (1.2 per cent) having pH values between 5.5 and 7.0.

The EC (1:5) value for mineral waste materials ranged from 138 to 2,370 µS/cm, with most samples (> 95 per cent) classed as very low to medium salinity, which is EC (1:5) < 900 µS/cm according to the Queensland guidelines (DERM 1995a). The remaining samples (four tailings) had a high saline EC (1:5) > 900 µS/cm, with two samples (GS1 tailings) exceeding 2,000 µS/cm.

The pH (1:5) and EC (1:5) results recorded during this study are generally consistent with previous studies (AGC Woodward-Clyde 1992; LRS 1993; EGi 1992 and 1993; URS 2004 and 2007).

The results suggest both coal roof and floor, and overburden materials may initially generate drainage with pH values (median pH 9.7 and 9.6, respectively) that may marginally exceed the Australian livestock drinking water guidelines (ANZECC and ARMCANZ 2000) and draft water quality guidelines for the protection of aquatic ecosystems in the Isaac River catchment, which is in the Fitzroy Basin (DERM 2010). In general, livestock health will not be affected by water with pH in the range of four to nine (ANZECC and ARMCANZ 2000). The lower and upper pH limits for lowland freshwaters in the Isaac River catchment is 6.5 to 8.5. The median pH values for coarse rejects (pH 8.2) and tailings (pH 8.1) samples did not exceed these guidelines.

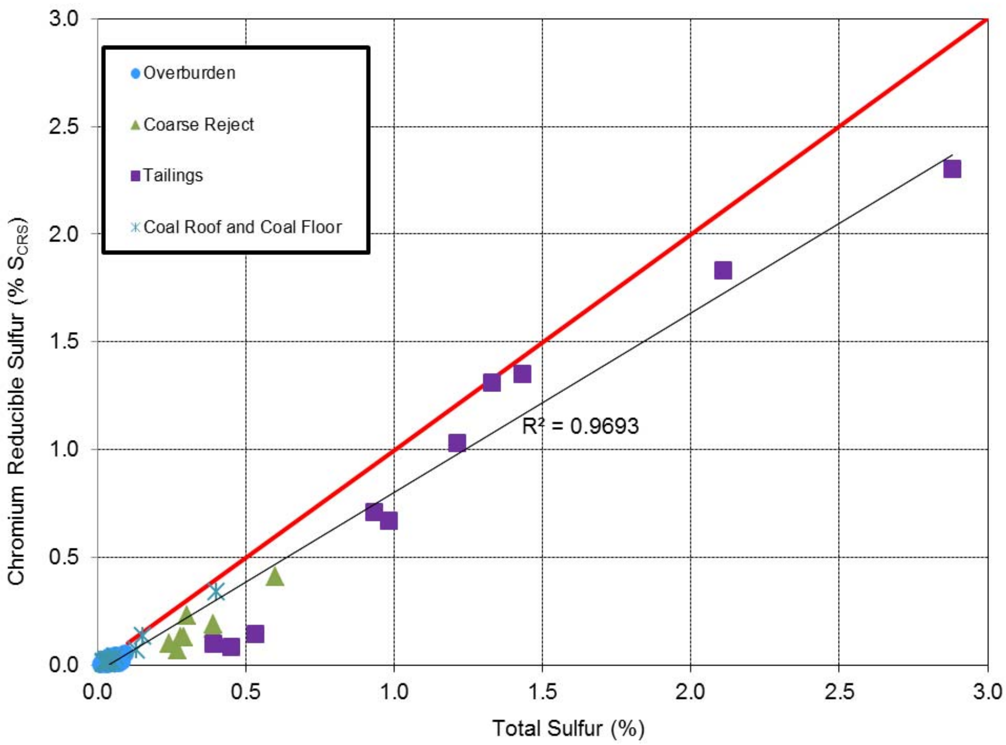
The mineral waste materials test results indicate that the associated water is unlikely to contain significant existing salinity. Although the GS1 tailings (and to lesser extent RS1 tailings) may be problematic with regards to the potential generation of localised saline drainage, it should be noted that the current EC (1:5) levels are within the salinity range (0 to 7,463 µS/cm) recommended for livestock drinking water in Australia (ANZECC and ARMCANZ 2000). The median EC (1:5) for overburden (446 µS/cm), coal roof and floor (382), coarse rejects (250) and tailings (707) samples did not exceed the draft water quality guidelines for EC (835 µS/cm) for the protection of aquatic ecosystems in the Isaac River catchment (DERM 2010).

4.2 Acid Base Accounting

The ABA evaluates the balance between acid generation processes (oxidation of sulfide minerals) and acid neutralising processes (dissolution of carbonates). In coal waste materials, calcium and magnesium bearing carbonates such as calcite, dolomite and ankerite will be the main sources of acid buffering. Calcium and magnesium carbonates are readily reactive and generally buffers the pH to above six. Not all carbonate minerals; however, contribute to neutralisation (iron and manganese carbonates do not provide a net buffering capacity). Other neutralising minerals such as silicates (e.g. clays) tend to react slowly or only at low pH values that occur well after the onset of acidic drainage.

Figure 4-1 is a plot of the total sulfur compared to sulfide-sulfur (S_{CRS}) concentrations for all of the mine waste materials tested during this study. It shows a high degree of correlation between total sulfur and S_{CRS} (R^2 = 0.9693) with a substantial proportion of the sulfur in these samples (50 to 66 per cent) recognised to occur as sulfides. However, the concentration of sulfide remains low with approximately 13.2 per cent of all sulfide concentrations less than 0.01 per cent, and a further 67.5 per cent distributed between 0.01 and 0.1 per cent.

Figure 4-1 Comparison between Total Sulfur and S_{CRS} Concentrations



The limited sulfide concentration present in the mineral waste materials suggest there is minimal source of potential acidity that can be generated under natural oxidation processes. This agrees with findings from previous studies for overburden (EGi 1995; EGi 1996; URS 2007), coarse reject (AGC, 1992; URS 2004), coal roof and floor material (URS,2007) and tailings (AGC 1992).

The use of the total sulfur assay to estimate the MPA (and hence NAPP) is a conservative approach and may overestimate the AMD potential because some sulfur can occur in forms other than pyrite. For a higher level of confidence with regards to the MPA of the mineral waste materials, if the sulfide mineral forms are known, then allowance can be made for non- and lesser acid generating sulfur forms to provide a better estimate of the MPA (and NAPP).

Alternatively, the chromium reducible sulfide (i.e. S_{CRS}) concentration could be used to provide a better estimate of the MPA. The S_{CRS} value provides an estimate of the pyritic sulfur content (i.e. FeS_2) and is not subject to interference from sulfate-sulfur and organic sulfur. For this reason, a second MPA value (MPA_{CRS}) was calculated for each sample using sulfide-sulfur instead of total S.

More than 89 per cent of the MPA_{CRS} is less than 10 kg H_2SO_4/t. The mean MPA_{CRS} was highest in the tailings samples tested (29.2 kg H_2SO_4/t) followed by coarse rejects (5.44 kg H_2SO_4/t), coal roof and floor materials (1.25 kg H_2SO_4/t) and overburden (0.67 kg H_2SO_4/t). The mean MPA_{CRS} for GS1 tailings samples was almost four times higher than the mean value for RS1 tailings samples.

The data indicates there is available ANC present in the mineral waste samples tested, which is consistent with results from previous studies (AGC 1992; EGi 1992 and 1993; URS 2004 and 2007). Approximately 55 per cent of the mineral waste samples tested had an ANC value ranging from 10 to 50 kg H_2SO_4/t, with a further 21 per cent having ANC greater than 50 kg H_2SO_4/t. However, the coarse reject and tailings samples have little ability to buffer acidity (mean ANC of 7.09 and 14.3 kg H_2SO_4/t, respectively), whereas the moderate mean ANC (20.5 to 56.9 kg H_2SO_4/t) of the overburden, and coal roof and floor samples indicate that the samples do have some acid buffering capacity.

The ANC data suggests that most of the inherent primary neutralising capacity present in the mineral waste has not been exhausted. Slower reacting neutralising minerals such as the silicates (e.g. clays) may provide some long term neutralising capacity, but this process is slow and expected to contribute minimally to buffering capacity of the mineral waste to offset any acid generation resulting in the oxidation of sulfides.

The mean $NAPP_{CRS}$ value for overburden, coarse reject, and coal roof and floor materials were negative (-56.2, -1.6 and -19.3 kg H_2SO_4/t, respectively), indicating the samples tested may have sufficient ANC to prevent acid generation. The mean $NAPP_{CRS}$ value for tailings was positive, suggesting they may be acid generating. The GS1 samples have an average $NAPP_{CRS}$ value of 27.6 kg H_2SO_4/t compared to 2.17 kg H_2SO_4/t for the RS1 samples.

The $NAPP_{CRS}$ value of all the mineral waste samples tested was overwhelmingly (86.8 per cent) less than 0 kg H_2SO_4/t (i.e. negative). About 4.82 per cent of the mineral waste samples tested were distributed from 0 to 10 kg H_2SO_4/t, with 8.43 per cent over 10 kg H_2SO_4/t. The range in $NAPP_{CRS}$ values was consistent with the results from previous studies for coarse rejects and tailings (AGC 1992). In terms of NAPP values, the results from this study is consistent with the results for overburden (EGi 1995 and 1996; URS 2007), coarse rejects (AGC 1992; URS 2007), coal roof and floor materials (URS 2007) and tailings (AGC 1992).

4.3 Net Acid Generation Test

The NAGpH result is consistent with ABA results for 78 of the 83 samples tested, indicating the mineral waste materials tested were mostly non-acid generating. Any acid generated through oxidation was consumed by neutralising components in the samples. The NAG results for the overburden samples tested are consistent with the results from previous investigations (LRS 1993; EGi 1995 and 1996). Since no NAG results are available from earlier studies for coarse rejects, coal roof and floor, and tailings; therefore, no direct comparison can be made with the current study.

4 Discussion

The NAG capacity results (< 0.1 kg H_2SO_4/t) for all overburden samples tested, apart from one sample, indicates that acidity due to free acid (i.e. H_2SO_4) and the release of iron and aluminium at pH < 4.5, and other metallic ions (such as copper and zinc) that precipitate out as hydroxides at pH values between 4.5 and 7.0 was negligible.

Only one of the overburden samples had a positive NAG capacity (10.2 kg H_2SO_4/t) and this sample was a carbonaceous claystone obtained from 241 to 242 metres below surface between the GLS and GMS. The low sulfide content (0.023 per cent) of this sample combined with the relatively high total carbon concentration (5.78 per cent) recorded for a composited carbonaceous claystone sample (GRM17) suggests that the acidity may be due to organic acids rather than sulfide acidity.

It should be noted that samples with high organic matter contents (> 5–7 per cent TOC) may interfere with the single addition NAG test, due to the reaction of hydrogen peroxide with organic matter to produce organic acids (AMIRA 2002; Stewart *et al.* 2003). In samples with low sulfide-sulfur (<1 per cent), organic matter acidity may give misleadingly low NAGpH values and a false measure of the sulfidic acid potential. The organic acidity produced in the single addition NAG test does not occur under normal environmental conditions where atmospheric oxidation occurs. Therefore, organic acidity does not contribute to AMD.

Generally, some indicators of organic acid effects on the NAG test include a large difference between the $NAG_{pH4.5}$ and $NAG_{pH7.0}$ values, and $NAG_{pH4.5}$ values that exceed NAPP and MPA or $NAPP_{CRS}$ and MPA_{CRS} values. On this basis, the low NAGpH value of 3.5 obtained for the siltstone coal floor sample (Drill Core 43893, 192.12–192.62 metres) and the two RS1 coarse reject samples (ca. 2003 and December 2009) are likely to be due to mostly organic acid effects.

The effects of organic acid generation on NAG test results can be minimised by performing an extended boil NAG test. It involves a combination of extended heating and NAG solution assay steps to account for the relative proportions of pyrite acidity and organic acidity in a given NAG solution. An extended boil NAGpH <4.5 is indicative of pyrite acidity. A calculated NAG value (NAG_{org}) is determined from assays of anions and cations released to the NAG solution. A calculated NAG value of ≤0 kg H_2SO_4/t is equivalent to a NAGpH of ≥ pH 4.5 from pyrite alone (i.e. NAF).

Table 3-16 shows that the NAGpH value increased for three RS1 coarse reject samples (deposited on ca. 2003, December 2009 and May 2011) and two GS1 coarse reject samples (deposited in mid-2006 and ca. 2008) after the extended boiling step, which confirms the effects of organic acids. The calculated NAG value for the three RS1 coarse reject samples ranged from <0.1 to 4.5 kg H_2SO_4/t compared to values of 11 to 83.8 kg H_2SO_4/t obtained with the standard single addition NAG test. This indicates that a substantial amount acid generated in the standard NAG test for these samples is due to organic matter.

The results from extended boil NAG testing of the three coal roof and floor samples (siltstone, shale and carbonaceous mudstone/siltstone) suggest there is minimal organic acid interference effect on their measured NAG capacity.

One of the five Riverside tailings surface samples, deposited on December 2010, showed an increase in NAGpH from 3.7 to 6.0 after the extended boiling step. Its corresponding acid potential decreased from 16.7 to <0.1 kg H_2SO_4/t, which suggest all of the acidity measured in the standard single addition NAG test for this sample is essentially due to organic matter not pyrite acidity. The remaining RS1 tailings samples tested appear to have sufficient ANC (9.20 to 13.3 kg H_2SO_4/t), which offers some buffering against the organic acids produced.

In contrast, the NAG test results for Goonyella tailings surface samples showed little difference in single addition NAG acidities despite having high organic matter concentrations, suggesting pyrite is preferentially oxidised by hydrogen peroxide when present in significant concentrations. The median sulfide-sulfur concentration for GS1 tailings samples was 1.35 per cent, compared to 0.145 per cent for RS1 tailings samples. Stewart *et al*. (2003) reported that pyrite is preferentially oxidised by the hydrogen peroxide rather than the organic matter in the NAG tests for samples containing greater than one per cent pyritic sulfur.

4.4 Acid Buffering Characteristic Curve Test

The ABCC test provides an indication of the portion of the ANC measured in the mineral waste samples that may be readily available for acid neutralisation. These ABCC profiles were used to assess the ANC available to buffer the pH above the threshold value of approximately pH 4.5.

The sample ABCC profiles can be compared with profiles from carbonate standards to assess the relative reactivity of the ANC measured. Calcite and dolomite readily dissolve in acid and exhibit strongly buffered pH curves in the ABCC test, rapidly decreasing once the ANC value is reached. In comparison, siderite provides very poor acid buffering, exhibiting a very steep pH curve in the ABCC test. The acid buffering availability of ferroan dolomite is between siderite and dolomite.

The ABCC test results were not concurrently presented (by ALS) with profiles of reference standards, such as calcite, dolomite and siderite. However, it is URS' experience that the ABCC profiles indicate that the effectiveness of the total ANC measured in the samples vary from readily available and calcitic/dolomitic, to poorly reactive and sideritic.

The ABCC profile plot (**Figure 3-5**) for a siltstone coal roof sample (43733_222.83m-223.38m_Roof), is an example of a profile that plots close to that of the calcite/dolomite standard, indicating that essentially all of the total ANC of 40.1 kg H_2SO_4/t is likely to be readily available for buffering. In contrast, the ABCC profile (**Figure 3-2**) for a conglomerate interburden sample (43750_364.9m-365.24m_IB), resembles a siderite-type standard curve. This profile indicates that although this sample has a moderate to high total ANC of 80.2 kg H_2SO_4/t, it is expected to provide minimal acid buffering. The ABCC profiles of the other mineral waste samples tested were similar to these two examples, plus profiles in between these extremes, indicating partial ANC effectiveness.

For the majority of the mineral waste samples tested (83 per cent), less than 50 per cent of the total ANC measured by standard titration methods was readily available to buffer the pH to above 4.5 (**Table 4-1**). This suggests that a substantial proportion of the measured ANC comprises slow reacting silicate minerals, which react only at lower pH values.

It has been suggested that siderite is a primary cause of overestimation of effective ANC using standard titration techniques (Stewart *et al.* 2006). Authigenic carbonate minerals are ubiquitous throughout the Late Permian coal measures of the Bowen Basin (Uysal *et al.* 2000). In the northern Bowen Basin, carbonates include siderite, Fe-Mg calcite-ankerite-siderite II mineral association and a later calcite assemblage. The common occurrence of this mineral in coal measures makes this an important consideration for coal roof and floor materials, coarse rejects and tailings.

The ABCC results suggest the ANC value for the mineral waste material tested may overestimate the effective buffering available, and thus the effective ANC may need to be evaluated, particularly for coal roof and floor materials, coarse rejects and tailings samples, when interpreting NAPP values.

4 Discussion

Table 4-1 Availability of Acid Neutralising Capacity

Sample ID	Lithology	ANC (kg H2SO4/t)	Available ANC from ABCC Tests at ~pH 4.5 (kg H_2SO_4/t)	Proportion of Available ANC (%)
43723_260.57m-261.14m_IB	Siltstone	216	110	51
43733_127.02m-127.5m_OB	Carbonaceous claystone	164	32.5	20
43750_273m-273.5m_OB	Sandstone	43.2	14.7	34
43750_361m-361.5m_IB	Sandstone	182	113	62
43750_364.9m-365.24m_IB	Conglomerate	80.2	13.5	17
43750_404m-404.5m_IB	Carbonaceous claystone	18.9	5.15	27
43750_408m-408.43m_IB	Claystone	21.6	9.19	43
43765_228m-228.5m_OB	Siltstone	75.9	18.4	24
43765_389.5m-390m_IB	Carbonaceous siltstone	24.7	6.74	27
43765_390.8m-391.36m_IB	Sandstone/siltstone	35.8	16.5	46
43893_315.8m-316.3m_IB	Shale	13.6	4.17	31
43893_324.46m-324.88m_IB	Mudstone	11.4	2.94	26
43723_264.65m-265.15m_Floor	Claystone	40.1	4.17	10
43723_400.2m-400.7m_Floor	Siltstone	7.6	2.33	31
43733_222.83m-223.38m_Roof	Siltstone	40.1	94.3	100
43750_378.5m-379m_Floor	Sandstone	116	33.0	28
43750_417m-417.34m_Roof	Sandstone/siltstone	23.4	5.51	24
43893_336m-336.38m_Floor	Carbonaceous mudstone/siltstone	13.6	2.45	18
GS002R GY Rejects May 2011	Coarse reject	15.6	1.96	13
RV Rejects May 2009	Coarse reject	11.6	1.96	17
GS1_01_12 Mths Goonyella	GS1 tailings	28.9	15.9	55
GS1_05_5 Yrs Goonyella	GS1 tailings	27.7	2.45	9
GRT_01_March 2011 Riverside	RS1 tailings	9.2	1.23	13
GRT_04_6 Mths Riverside	RS1 tailings	10.7	1.96	18

4.5 Mineral Waste Geochemical Classification

Static geochemical tests were performed to determine the total acid generating and total acid neutralising potential of mineral waste samples from the project. The geochemical tests are static in that it determines the chemical status of the tailings sample at one point in time, irrespective of how the AMD may develop over time.

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The NAPP and NAG tests (corrected for TOC where appropriate) were used to predict the potential of the mineral waste samples to generate acid. Individually, the NAPP and NAG tests have limitations; however, in combination the reliability of AMD prediction is greatly enhanced. For this study, the acid generating potential of a sample is classified based on the geochemical classification criteria adopted by DRET (DITR 2007a) as shown in **Table 4-2.**

Table 4-2 Geochemical Classification Criteria based on $NAPP_{CRS}$ and NAGpH test data.

Geochemical Classification	$NAPP_{CRS}$ (kg H_2SO_4/t)[a]	NAGpH
Potentially acid forming (PAF)	>10	<4.5
Potentially acid forming – low capacity (PAF-LC)	0 to 10	<4.5
Non-acid forming (NAF)	-100 to <0	≥4.5
Acid consuming (AC)	<-100	≥4.5
Uncertain (UC)[b]	>0	≥4.5
	<0	<4.5

[a]NAPPCRS (kg H_2SO_4/t) = [sulfide-sulfur (%) × 30.6] – [ANC ((kg H_2SO_4/t)].

[b]Further testing required to confirm material classification.

Figure 4-2 shows a geochemical classification plot of NAGpH versus the $NAPP_{CRS}$ value for the mineral waste samples tested. It suggests that most mineral waste samples, have sufficient ANC that can neutralise all the acid that could be theoretically generated by the sample.

Overall, approximately 86 per cent of all samples tested were NAF or AC, with another six per cent classified as PAF, two per cent PAF-LC and six per cent UC. The geochemical classification does not appear to be dependent of lithology (i.e. rock type) or sample depth. However, all overburden, coarse reject, and coal roof and coal floor samples are NAF, while tailings samples are typically PAF.

Of the five samples classified as UC, two samples (coarse rejects) may be PAF but are expected to be low capacity based on NAG_{org} capacity (<0.1 kg H_2SO_4/t). A further two samples (GS1 tailings) are expected to be PAF based on the close agreement between $NAPP_{CRS}$ and $NAG_{pH7.0}$ acid potentials. However, the remaining one sample (coal floor) is expected to be NAF based on the low S_{CRS} concentration (<0.1 per cent) and a $NAG_{pH4.5}$ value that exceed the $NAPP_{CRS}$ and MPA_{CRS} values, indicating the possible effects of organic matter of acid potential.

Therefore, apart from GS1 tailings samples and to a lesser extent RS1 tailings samples, all other mineral waste samples tested are generally not expected to be acid generating.

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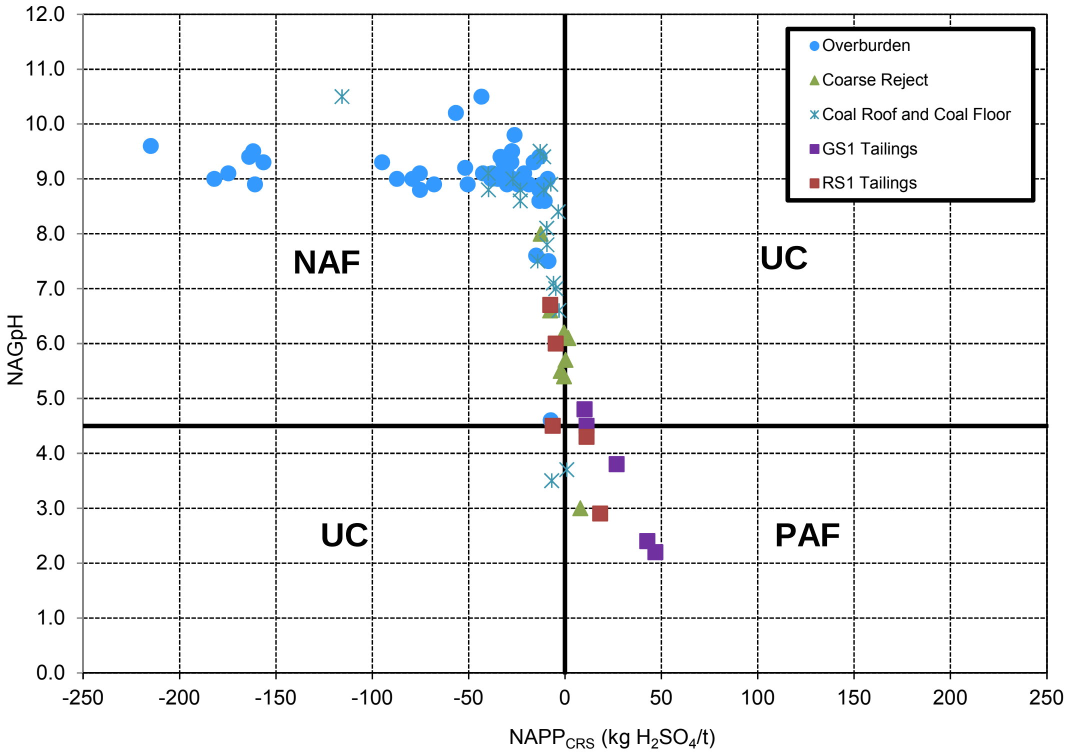
Figure 4-2 Geochemical Classification Plot for Mineral Waste Samples Tested



The high ANC value relative to MPA$_{CRS}$ (ANC/MPA > 10) suggests that the overburden and coal roof and floor samples are considered to have negligible risk of acid generation and a very high factor of safety in terms of its potential to generate acid. Generally, samples with an ANC/MPA ratio of greater than two are considered to have low or negligible risk of acid generation and a high probability that the material will remain circum-neutral in pH (AMIRA 2002; DITR 2007a).

The median ANC to MPA$_{CRS}$ ratio (0.4 to 1.7) for coarse rejects, and RS1 tailings and GS1 tailings samples suggest they have moderate to high risk of acid generation and a low factor of safety in terms of its potential to generate acid. It should be noted that the magnitude of acid generated by coarse rejects is small (i.e. PAF-LC). Given that both the coarse rejects and tailings produced over the project's life of mine are expected to comprise about 0.6 per cent of all mined waste (i.e. overburden and rejects) at the GRB mine complex operation, their overall contribution to potential environmental harm is expected to be small.

While the NAG and NAPP$_{CRS}$ values (and ANC/MPA$_{CRS}$ ratio and ABCC tests) provide an indication of the potential for acid generation from a sample, additional test work is required to predict the potential for metalliferous or saline drainage. In view of this, metal leachability tests (in 1:5 deionised water to solid extractions) were conducted (see **Section 4.7**).

4.6 Total Metal Concentrations of Mineral Waste Solids

The total metal concentrations obtained in this study are comparable with results collected to date from the broader GRM area for rejects (URS 2007 and 2004; AGC 1992), coal roof and floor (URS 2007) and overburden (EGi 1995).

The results indicate limited metal enrichment in the samples tested. The GAI values for the mineral waste samples tested indicate, that apart from As and Sb (and to a lesser extent Cr, Ni, Co, Cu and V), there is no substantial metal enrichment relative to the mean upper continental crust abundances. The degree of As and Sb enrichment was generally not significant (GAI between 1 to 3), except for a number of samples, which showed As enrichment with GAI of 4. Of the enriched metals, arsenic and selenium can be mobilised under oxidising near neutral conditions.

Generally, samples with a GAI value of three or greater are considered as enrichment to a level that warrants further examination to assess their environmental significance (DERM 1995; DITR 2007a). The GAI itself does not assess the mobility or reactivity of metals, which can be determined through metal leachability tests.

There are no guidelines and/or regulatory criteria specifically related to total metal concentrations in mineral wastes. To provide some context, the total metal concentrations were compared to the NEPC (1999) HILs for land used for parklands and recreational open spaces. This is considered reasonable given that the expected final land use of the mine following closure (i.e. a return to livestock grazing and forestry).

Compared to the NEPC HIL-E criteria for soils, the total metal concentrations in all mineral waste samples tested were orders of magnitude less than the guideline values, where such guideline levels exist. Therefore, the materials represented by the coarse reject and tailings samples, composited overburden, and both composited coal roof and coal floor samples are not expected to present a substantial risk to the environment with respect to beneficial use.

4.7 Drainage Water Quality

The drainage water quality (e.g. runoff water from spoil piles or tailings seepage) was assessed by evaluating its risk to soil structure degradation and metal leachability.

The relationship between EC and SAR values can be used to predict soil structural stability in relation to irrigation water as shown in **Figure 4-3** (adapted from ANZECC and ARMCANZ 2000). The EC (1:5) and SAR values obtained for the mineral waste samples were superimposed on **Figure 4-3** to evaluate how the predicted drainage water quality will affect soil structure.

The predicted drainage water quality for overburden, coal roof and coal floor materials, and most coarse rejects falls to the left of the stable soil structure line (dashed line). This suggests that runoff water from spoil piles may cause soil structural problems (through clay aggregate breakdown by sodium) in receiving soils. Therefore, corrective management is required to reduce soil dispersion risk by preventing or minimising water flow over potentially dispersive materials of spoil dumps, or by reducing the SAR by application of lime (or gypsum) to spoil piles. The use of lime can also be beneficial to extend the lag period in the unlikely event of acid generation.

Tailings seepage is unlikely to cause soil structural problems.

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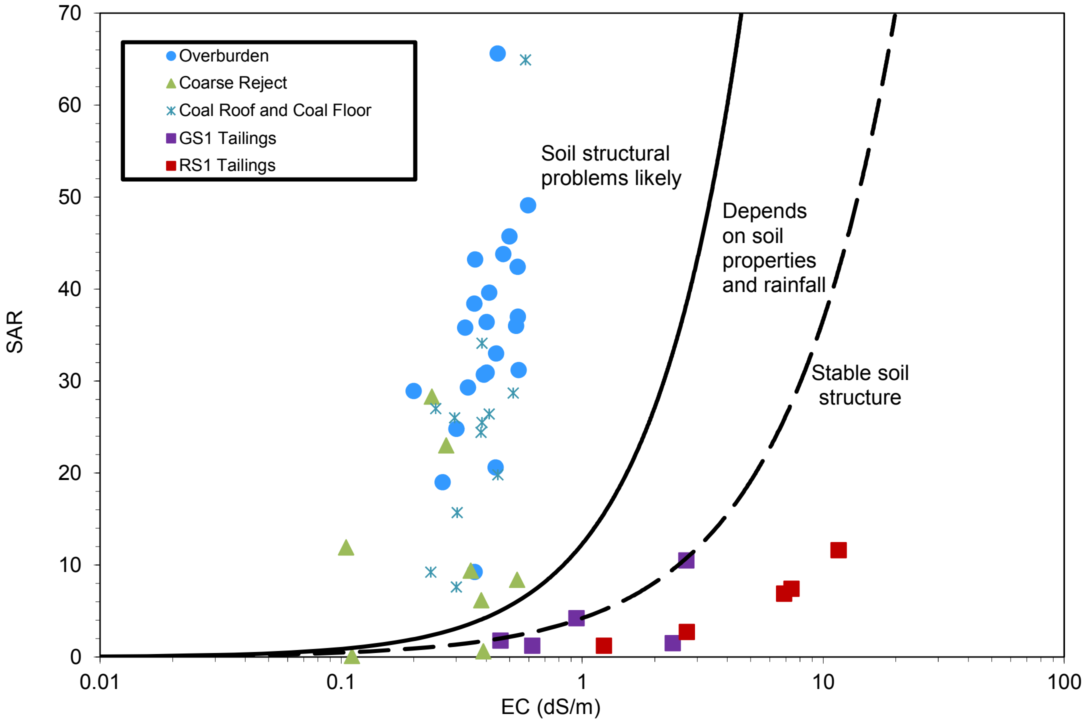
Figure 4-3 Relationship between EC (1:5) and SAR



The metal leachability results provide an indication of any possible weakly-bound forms of metals that are susceptible to release to solution upon initial contact with meteoric water (i.e. rainfall). The dissolved metal concentrations in the water extract (1:5) solutions for overburden, coal roof and coal floor materials, coarse reject and tailings samples are generally orders of magnitude below the Australian livestock drinking water guidelines (ANZECC and ARMCANZ 2000), where guidelines values exist. This finding is consistent with previous studies for overburden (URS 2007), reject samples (URS 2004 and 2007), and coal roof and coal floor samples (URS 2007).

Comparison with the Australian livestock drinking water guidelines is considered reasonable because the project is located in a sparsely populated rural area where surrounding areas have historically, and are currently, used for cattle grazing where mining activity is not currently occurring. The majority of the landscape not disturbed by mining activity has previously been cleared and maintained for grazing. Therefore, the principle use of surface and groundwater in the region is for stock watering.

Most tailings water sample extracts tested (90 per cent) exceed the Australian livestock drinking water guideline value for sulfate, and two GS1 tailings samples (deposited on May 2006 and November 2009) also exceed the guideline value for Ca by a factor of 2.5 on average.

Given the re-use of decant water from the tailings dams in the CHPP, and the semi-arid to arid climate of the region, where mean annual evaporation, based on open pan evaporation rates (BOM 2011a), exceeds the mean annual rainfall by approximately four times, migration of metal contaminants via seepage through the tailings will be limited during operations. This can be further enhanced by evaporative drying by cycling tailings deposition within both the RS1 and GS1 tailings dam. Hence, the potential risk for drainage, containing potential elevated metal (and sulfate) concentrations, to migrate off-site in groundwater is expected to be limited.

A general comparison between the metal leachability test conditions and mobilisation of metals from the surficial zone of the tailings dam by meteoric water is as follows. First, the solid to liquid ratio employed in the metal leachability testing was 1:5 (solid/water). If the density of the tailings solids is 1.8 t/m^3, then for an mean annual rainfall (based on rainfall data measured at Moranbah from 1972 to 2011) of 603.5 millimetres (BOM 2011b), the equivalent solid to liquid ratio experienced by the top 67 millimetres may be taken as 1:5 (solid/water). Therefore, the metal leachability results generally correspond to the efficient leaching of the top 67 millimetres of the RS1 and GS1 tailings dam profile by a year's worth of rainfall. This does not take into account evaporation effects on the effective rainfall.

This comparison, although approximate, places the metal leachability data into a broader perspective in terms of potential seepage and runoff water-quality for receiving environments. It represents a worst case scenario in that the metal leachability analysis was completed on continuously agitated pulverised sample suspensions.

It should be noted that solution pH is a primary factor determining the solubility and mobility of many trace metals in aquatic environments. Metal mobility is controlled by the solubility of hydrous oxides, and shows minimum values at pH ~7 to 10 (Stumm and Morgan 1996). In this study, the pH (1:5) of water extracts from all mineral waste samples tested ranged from 6.7 to 10.1, which was circum-neutral to very strongly alkaline. Further dilution effects from meteoric water and natural attenuation process are likely occur in the field, and thus it is expected that marginally elevated dissolved metal (and sulfate) in run-off and seepage will be further reduced in the field.

Therefore, runoff and seepage water quality arising from these mineral waste materials is predicted to contain low dissolved metal (and sulfate) concentrations. This combined with the low salinity and predominant NAF nature of the mineral waste samples, suggests the materials represented by the sample tested is unlikely to generate acid or mobilise metals to cause exceedance of the applied water quality guideline criteria.

4.8 Revegetation and Rehabilitation

The proposed mining strategy is to dispose all rejects and almost all overburden materials within the existing GRB mine complex waste storage facilities. Suitable overburden materials from mine access construction may be used for engineering and construction purposes. Generally, it is not acceptable mining practice to allow rejects to report to final surfaces. Typically rejects are buried or mixed well into the spoil material.

In terms of plant growth and erosion hazard, the geochemical characteristics that also need to be considered during revegetation and rehabilitation works include pH (1:5), EC (1:5), eCEC and ESP. It should be noted that the eCEC and ESP are primarily intended for the analysis of soils rather than sedimentary overburden and other mineral waste materials. However, it does provide some insight into the exchangeable cation chemistry and sodicity of the mineral waste materials tested.

The eCEC is the capacity of a soil material to hold and exchange cations. It is a major factor controlling the stability of soil structure, nutrient availability for plant growth, soil pH and the soil's buffering capacity to changes in soil chemistry. A low CEC implies that the soil has low resistance to changes in soil chemistry that are caused by land use.

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Sodicity is the concentration of exchangeable sodium adsorbed onto clay mineral surfaces as a proportion of the eCEC. When sodicity is high the clay structures that bind the fine aggregates and large particles (sand and silt) break down and disperse when it becomes wet or after applied mechanical work such as raindrop impact, irrigation or tillage. This increases the risk of erosion, compaction, surface crusting, low infiltration and hydraulic conductivity, and subsequently can effect plant growth.

The ESP is a direct measure of sodicity. A soil with an ESP value greater than six per cent is considered sodic and has low risk dispersion, whereas an ESP values greater than 12 indicate that a material has a higher risk of dispersion (Isbell, 2002). On this basis, approximately 96 per cent of all mineral waste samples tested are considered sodic with a high risk of dispersion (median ESP value of 30.8 per cent). Materials with a high risk of dispersion generally require management strategies to ensure that slopes are stabilised against erosion. The ESP for all coarse reject and tailings samples was less than 40 per cent, while the proportion of overburden (55 per cent), and coal roof and floor materials (25 per cent) was significantly less.

The majority (approximately 78.3 per cent) of overburden, coal roof and coal floor, coarse reject and tailings samples tested have pH values greater than 9.0, which is regarded as very high and likely to have direct effects on plant growth if not appropriately managed (DERM 1995a and 1995b). The optimum pH for native plants depends on the species, but a pH of 5.5 to 7.0 is considered desirable for many species (DERM 1995b). For pasture grass the optimum pH is 6.0 to 7.0.

The EC (1:5) value for most mineral waste samples (>95 per cent) falls within <150 to 900 µS/cm, which is classed as very low to medium salinity according to the Queensland guidelines for the assessment and management of acid drainage (DERM 1995a). High salinity levels in soils may reduce availability of water and essential nutrients to plants, which affects germination and growth or, in extreme cases, the elimination of crops and native vegetation (ANZECC and ARMCANZ 2000).

An assessment of the tolerance of pasture plants to salinity in runoff/seepage water, produced by the contact of meteoric water with mineral waste samples, is made by calculating the average root zone salinity (EC_{se}) from the EC (1:5) values and average root zone leaching fraction for four broad soil types (ANZECC and ARMCANZ 2000). The salt content of the soil water in the plant's root zone, referred to as the average root zone salinity (EC_{se}), is considered the key limitation to plant growth in response to salinity and sodicity levels in irrigation water (ANZECC and ARMCANZ 2000). The calculated EC_{se} ranged from one to 3264 µS/cm (mean 440 µS/cm) and generally did not exceed the average root zone salinity threshold for 13 common pasture species (such as *Cenchrus ciliaris var Gayndah*, *Agropyron elongatum* and *Chloris gayana*). The only exceptions were for three GS1 tailings samples (deposited in November 2010, November 2009 and May 2006) and one RS1 tailings samples (deposited November 2010).

The relatively low salinity and high alkaline pH, combined with the high ESP and predominance of sodium in the soil solution suggest the mineral waste samples tested can be classed as non-saline sodic materials (DERM 1995a). These mineral waste materials are predicted to have structural stability problems related to potential dispersion. Therefore, they would not be suitable for use as a final cover material without prior treatment or overlain with a stable topsoil layer. On this basis, all rejects materials from the RHM will need to be buried below plant root zones.

Treatment of the sodic overburden would be required if these are to be used as revegetation media. Ideally, sodic and dispersive materials should be identified, selectively handled and placed within the

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core of the overburden dump away from final surfaces, or returned to voids during mining. Alternatively, treatment of the sodic waste materials would be required if these were to be used as an additional source of revegetation or growth media. Materials with sodic/dispersion potential can be treated with gypsum ($CaSO_4{\cdot}2H_2O$) to provide a source of calcium, which can reduce the relative quantity of sodium and thus decrease the ESP.

Direct revegetation on tailings in a semi-arid climate is possible (DITR 2007b) provided suitable conditions exist, such as concentrations of plant-available heavy metals low enough to limit phytotoxicity and the use of native species that are ecologically adapted to the prevailing climate (Tordorf *et al.* 2000 and references therein). Alkaline tailings from the Kidston Gold Mine (located 260 kilometres south-west of Cairns, Queensland) have been proven to support vegetation growth directly with the support of drip irrigation over the first few months and initial fertilisation (DITR 2007b). Similarly, direct vegetation on Pb/Zn tailings has been successful at Broken Hill, New South Wales, by the use of irrigation with sewage sludge (Tordorf *et al.* 2000 and references therein).

Conclusions

URS has completed a geochemical characterisation program for mineral waste from the project.

A total of 46 overburden, 19 coal roof and coal floor, 8 coarse rejects and 10 tailings samples have been tested for their AMD forming characteristics. The results from this study are consistent with previous investigations and indicate that:

- The mineral waste materials (except tailings) are likely to have negligible sulfide-sulfur concentrations (<0.1 per cent).
- The overburden, and coal roof and floor materials are expected to have negligible risk of acid generation and a very high factor of safety in terms of its potential to generate acid.
- The Goonyella and Riverside tailings materials are generally expected to have a high risk of acid generation and a low factor of safety in terms of its potential to generate acid.
- The coarse reject materials are expected to have a moderate to high risk with respect to acid generation and low to moderate factor of safety with respect to potential acid generation.
- The majority (86 per cent) of all mineral waste material tested were NAF or AC, with another six per cent classified as PAF, two per cent PAF-LC and six per cent UC. The geochemical classification did not appear to be dependent of lithology (i.e. rock type) or sample depth.
- Generally, all overburden, coarse reject and coal roof and coal floor samples are predominantly NAF, while tailings samples are typically PAF.
- The ANC may overestimate the effective buffering available particularly for coal roof and floor materials, coarse rejects and tailings samples.
- The total metal concentrations in the mineral waste materials are generally not enriched relative to the mean upper continental crust abundances, and are within the NEPC (1999) HILs for land used for parklands and recreational open spaces.
- The relatively low salinity and alkaline pH of the mineral waste materials, combined with the high ESP and predominance of sodium in the soil solution, suggest they are non-saline sodic materials with high risk of dispersion.
- The runoff and seepage water quality resulting from the contact between the mineral waste materials and meteoric water is expected to contain dissolved metal and sulfate concentrations that are well below the Australian livestock drinking water guidelines (ANZECC and ARMCANZ 2000).
- The runoff water from spoil piles may cause soil structural problems (through clay aggregate breakdown by sodium) in receiving soils if not properly managed. Conversely, tailings seepage is unlikely to cause soil structure degradation.
- The risk of the mineral waste materials to cause significant downstream water quality impacts is low, and is unlikely to present any environmental issues associated with revegetation and rehabilitation in terms of adverse effects on plant growth. However, the high risk of dispersion will require strategies to manage potential erosion hazards.

Recommendations

The ongoing management of mineral waste within the GRB mine complex waste management system (overburden, coarse reject and tailings materials) will consider the geochemistry of any additional materials with respect to their potential risk to cause environmental harm, and their suitability for successful rehabilitation.

The mineral waste management strategy for the project will focus on:

- Evaluating the geochemical characteristics of actual reject materials collected from the Red Hill CHPP, and in-fill drilling core samples ahead of mining to confirm the NAF nature or delineate any PAF materials prior to mining.
- Strategic placement of mineral waste materials to minimise run-off and erosion.

Furthermore, the following waste disposal methodologies or activities are recommended to help further assess and develop management strategies for mineral waste materials for the project:

- Ongoing sampling and geochemical testing of overburden, coal roof and coal floor (potential reject) materials, and GMS coal samples collected from in-fill drilling core samples ahead of mining, at least on an annual basis, to confirm the NAF nature or delineate any PAF materials prior to mining.
- The bulk overburden materials, generated during the construction of drifts for access and services, and main drives for coal longwall access and coal transport, are expected to be NAF and from an AMD perspective, no selective handling is required away from coal units.
- Where the overburden materials have properties suitable for engineering purposes, they can be used as bulk fill, road sub-base, construction material for laydown areas, and/or foundations and levees, provided suitable surface covering material is applied.
- Excavated spoil (waste rock material) with properties unsuitable for engineering and construction purposes will be placed in designated mineral waste disposal areas at the GRB mine complex according to the existing approved overburden management practices. A small amount of overburden typically located near coal seams may be PAF-LC. Any overburden associated with coal units, such as coal ply partings < 30 centimetres in width and some coal roof and floor materials, will report with coal to the Red Hill CHPP and will therefore report as coarse reject.
- All reject materials (i.e. dense medium, coarse and fine rejects, and dewatered tailings) will be loaded into trucks and dumped onto the in-pit spoil dumps. Mixing and compaction will occur as appropriate to the properties of the materials to achieve a sustainable final landform. If marked amounts of PAF rejects are encountered, lime dosing of compacted coarse reject layers (one to two metres) will be used as a precautionary measure to extend the lag period in the unlikely event of acid generation.
- All reject materials will be mixed via alternating disposal of the reject and spoil material into the in-pit spoil dumps at the GRB mine complex.
- Pre-strip weathered spoil materials will be used to cap the reject disposal and dewatered tailings areas. A minimum thickness of two metres of inert cover material will be used, with final thickness to be determined based on the material characteristics. Coarse reject placement will be sequenced such that capping of the rejects will be completed progressively as the working face progresses down the dip. Suitable growth media will be placed onto the re-profiled slopes.
- Given that some coarse reject samples have been classified as PAF-LC in this study, potentially contaminated water from ROM coal and product coal stockpiles will be contained to avoid interaction with clean waters as a precautionary measure.
- Geochemical test results indicate that some rejects may be PAF. BMA will consider lime amendment of PAF rejects materials (dewatered) if they generate leachate pH values less than 5.0.

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- Spoil dumps may be re-shaped, and will be covered with a suitable growth media and revegetated with pasture species for a post-mining land use of grazing, or a combination of native grasses supplemented with introduced pasture species in areas where continuous pasture cover is necessary for erosion control.
- No reject material will be placed below the pre-mining groundwater table and all dumps will be designed and constructed to be free draining so as to minimise the potential for geotechnical instability.

BMA should undertake ongoing operational geochemical characterisation of mineral waste materials in planned disturbance areas of the proposed project ahead of mining to confirm the expected geochemical characteristics of these materials.

Characterisation of reject materials (coarse rejects and dewatered tailings) from the project will also be undertaken to verify their expected geochemical nature. These data will be used to re-evaluate and update the management and disposal strategies for reject materials.

BMA should conduct an ongoing geochemical assessment program that is commensurate with the current AMD risk of the mineral wastes:

- Actual coarse rejects and tailings (dewatered) generated from the project will be assessed on an annual basis for the following geochemical parameters:
  - pH (1:5) and EC (1:5);
  - NAPP (including ANC, Total S and CRS);
  - NAG;
  - total Al, As, Cd, Cr, Cu, Co, Pb, Mo, Ni, Se, Sb, U and Zn;
  - dissolved Al, As, Cd, Cr, Cu, Co, Pb, Mo, Ni, Se, Sb, U, V and Zn in 1:5 (solid to liquid) extracts; and
  - CEC, sodium absorption ratio (SAR) and ESP.
- Monitoring of potential drainage/seepage water quality from spoil dumps for pH, EC, sulfate, and dissolved Al, Cr, Cu, Fe, Mo, Ni, Se, U, V and Zn.
- Overburden, potential reject (i.e. coal roof and coal floor materials) and GMS coal samples collected from in-fill drill core samples will be assessed on an annual basis for the following geochemical parameters:
  - pH (1:5) and EC (1:5);
  - NAPP (including ANC, Total S and CRS);
  - NAG;
  - total Al, As, Cd, Cr, Cu, Co, Pb, Mo, Ni, Se, Sb, U and Zn;
  - dissolved Al, As, Cd, Cr, Cu, Co, Pb, Mo, Ni, Se, Sb, U and Zn in 1:5 (solid to liquid) extracts; and
  - CEC, SAR and ESP.
- BMA will conduct laboratory scale kinetic leach column tests during the mining phase of the project to improve predictions on seepage quality and release rates of environmentally important metals.

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Limitations

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Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.

A

Appendix A Overburden, and Coal Roof and Floor Samples Tested

URS

ALS Laboratory Sample ID	Core Hole ID	Client Sample Name	Sample Interval (m)		Intercept (m)	Sample Type	Lithology	URS Composite Sample Number	ALS Laboratory ID for Composite Samples
			From	To					
EB1109393-001	43723	43723_209.5m-210m_OB	209.50	210.00	0.50	Overburden	Siltstone	GRM01	EB1111587-066
EB1109393-002	43723	43723_213.12m-213.98m_OB	213.12	213.98	0.86	Overburden	Siltstone		
EB1109393-012	43733	43733_121.1m-121.4m_OB	121.10	121.40	0.30	Overburden	Siltstone		
EB1109393-028	43750	43750_264.51m-265m_OB	264.51	265.00	0.49	Overburden	Siltstone		
EB1109393-043	43765	43765_228m-228.5m_OB	228.00	228.50	0.50	Overburden	Siltstone		
EB1109393-053	43893	43893_182m-182.5m_OB	182.00	182.50	0.50	Overburden	Siltstone		
EB1109393-011	43733	43733_74m-74.5m_OB	74.00	74.50	0.50	Overburden	Claystone	GRM02	EB1111587-067
EB1109393-013	43733	43733_124.35m-124.71m_OB	124.35	124.71	0.36	Overburden	Claystone		
EB1109393-014	43733	43733_127.02m-127.5m_OB	127.02	127.50	0.48	Overburden	Carbonaceous Claystone	GRM03	EB1111587-068
EB1109393-029	43750	43750_273m-273.5m_OB	273.00	273.50	0.50	Overburden	Sandstone	GRM04	EB1111587-069
EB1109393-052	43893	43893_177.5m-178m_OB	177.50	178.00	0.50	Overburden	Sandstone		
EB1109393-004	43723	43723_260.57m-261.14m_IB	260.57	261.14	0.57	Interburden	Siltstone	GRM05	EB1111587-070
EB1109393-031	43750	43750_284.5m-285m_IB	284.50	285.00	0.50	Interburden	Siltstone		
EB1109393-018	43733	43733_214.5m-215_IB	214.50	215.00	0.50	Interburden	Siltstone	GRM06	EB1111587-071
EB1109393-019	43733	43733_219.5m-220.04m_IB	219.50	220.04	0.54	Interburden	Siltstone		
EB1109393-034	43750	43750_366.5m-366.95m_IB	366.50	366.95	0.45	Interburden	Siltstone		
EB1109393-045	43765	43765_322.5m-323m_IB	322.50	323.00	0.50	Interburden	Siltstone		
EB1109393-022	43733	43733_239.12m-239.5m_IB	239.12	239.50	0.38	Interburden	Siltstone	GRM07	EB1111587-072
EB1109393-038	43750	43750_400m-400.5m_IB	400.00	400.50	0.50	Interburden	Siltstone		
EB1109393-048	43765	43765_385m-385.5m_IB	385.00	385.50	0.50	Interburden	Siltstone		
EB1109393-061	43893	43893_322.8m-323.3m_IB	322.80	323.30	0.50	Interburden	Siltstone		
EB1109393-008	43723	43723_377m-377.5m_IB	377.00	377.50	0.50	Interburden	Siltstone	GRM08	EB1111587-073
EB1109393-056	43893	43893_194m-194.5m_IB	194.00	194.50	0.50	Interburden	Sandstone	GRM09	EB1111587-074
EB1109393-017	43733	43733_135m-135.38m_IB	135.00	135.38	0.38	Interburden	Sandstone		
EB1109393-032	43750	43750_361m-361.5m_IB	361.00	361.50	0.50	Interburden	Sandstone	GRM10	EB1111587-075
EB1109393-024	43733	43733_245.5m-246m_IB	245.50	246.00	0.50	Interburden	Sandstone	GRM11	EB1111587-076
EB1109393-037	43750	43750_383m-383.5m_IB	383.00	383.50	0.50	Interburden	Sandstone		
EB1109393-041	43750	43750_414.14m-414.47m_IB	414.14	414.47	0.33	Interburden	Sandstone		
EB1109393-059	43893	43893_312m-312.5m_IB	312.00	312.50	0.50	Interburden	Sandstone	GRM12	EB1111587-077
EB1109393-006	43723	43723_372m-372.5m_IB	372.00	372.50	0.50	Interburden	Sandstone	GRM13	EB1111587-078
EB1109393-009	43723	43723_384m-384.5m_IB	384.00	384.50	0.50	Interburden	Sandstone		
EB1109393-046	43765	43765_324.6m-325.1m_IB	324.60	325.10	0.50	Interburden	Claystone	GRM14	EB1111587-079
EB1109393-021	43733	43733_235m-235.43m_IB	235.00	235.43	0.43	Interburden	Claystone	GRM15	EB1111587-080
EB1109393-040	43750	43750_408m-408.43m_IB	408.00	408.43	0.43	Interburden	Claystone		
EB1109393-007	43723	43723_375m-375.48m_IB	375.00	375.48	0.48	Interburden	Claystone	GRM16	EB1111587-081
EB1109393-023	43733	43733_241.5m-241.98m_IB	241.50	241.98	0.48	Interburden	Carbonaceous Claystone	GRM17	EB1111587-082
EB1109393-025	43733	43733_256m-256.36m_IB	256.00	256.36	0.36	Interburden	Carbonaceous Claystone		
EB1109393-039	43750	43750_404m-404.5m_IB	404.00	404.50	0.50	Interburden	Carbonaceous Claystone		
EB1109393-047	43765	43765_337.6m-338.1m_IB	337.60	338.10	0.50	Interburden	Carbonaceous Claystone		
EB1109393-049	43765	43765_389.5m-390m_IB	389.50	390.00	0.50	Interburden	Carbonaceous Siltstone		
EB1109393-044	43765	43765_241.5m-242m_IB	241.50	242.00	0.50	Interburden	Sandstone/siltstone	GRM18.	EB1111587-083
EB1109393-033	43750	43750_364.9m-365.24m_IB	364.90	365.24	0.34	Interburden	Conglomerate	GRM19	EB1111587-084
EB1109393-026	43733	43733_267.2m-267.75m_IB	267.20	267.75	0.55	Interburden	Siltstone/claystone/sandstone	GRM20	EB1111587-085
EB1109393-050	43765	43765_390.8m-391.36m_IB	390.80	391.36	0.56	Interburden	Sandstone/siltstone		
EB1109393-060	43893	43893_315.8m-316.3m_IB	315.80	316.30	0.50	Interburden	Shale	GRM21	EB1111587-086
EB1109393-062	43893	43893_324.46m-324.88m_IB	324.46	324.88	0.42	Interburden	Mudstone	GRM22	EB1111587-087
EB1109393-015	43733	43733_128.79m-129.29m_Roof	128.79	129.29	0.50	Roof	Carbonaceous Claystone	GRM23	EB1111587-088
EB1109393-003	43723	43723_217.92m-218.3m_Roof	217.92	218.30	0.38	Roof	Siltstone	GRM24	EB1111587-089
EB1109393-020	43733	43733_222.83m-223.38m_Roof	222.83	223.38	0.55	Roof	Siltstone	GRM25	EB1111587-090
EB1109393-035	43750	43750_368.69m-369.08m_Roof	368.69	369.08	0.39	Roof	Siltstone		
EB1109393-057	43893	43893_299.46m-299.94m_Roof	299.46	299.94	0.48	Roof	Shale/Siltstone		
EB1109393-042	43750	43750_417m-417.34m_Roof	417.00	417.34	0.34	Roof	Sandstone/Siltstone	GRM26	EB1111587-091
EB1109393-051	43765	43765_392.3m-392.63m_Roof	392.30	392.63	0.33	Roof	Siltstone/Claystone		
EB1109393-064	43893	43893_357.09m-357.59m_Roof	357.09	357.59	0.50	Roof	Siltstone		
EB1109393-054	43893	43893_186.96m-187.37m_Roof	186.96	187.37	0.41	Roof	Shale	GRM27	EB1111587-092
EB1109393-055	43893	43893_192.12m-192.62m_Floor	192.12	192.62	0.50	Floor	Siltstone	GRM28	EB1111587-093
EB1109393-010	43723	43723_400.2m-400.7m_Floor	400.20	400.70	0.50	Floor	Siltstone	GRM29	EB1111587-094
EB1109393-065	43893	43893_363.61m-364.11m_Floor	363.61	364.11	0.50	Floor	Siltstone		
EB1109393-027	43733	43733_279.66m-280m_Floor	279.66	280.00	0.34	Floor	Siltstone		
EB1109393-058	43893	43893_307.57m-308.07m_Floor	307.57	308.07	0.50	Floor	Shale/Sandstone	GRM30	EB1111587-095
EB1109393-036	43750	43750_378.5m-379m_Floor	378.50	379.00	0.50	Floor	Sandstone	GRM31	EB1111587-096
EB1109393-005	43723	43723_264.65m-265.15m_Floor	264.65	265.15	0.50	Floor	Claystone	GRM32	EB1111587-097
EB1109393-030	43750	43750_282.2m-282.5m_Floor	282.20	282.50	0.30	Floor	Claystone		
EB1109393-016	43733	43733_133.5m-134m_Floor	133.50	134.00	0.50	Floor	Siltstone	GRM33	EB1111587-098
EB1109393-063	43893	43893_336m-336.38m_Floor	336.00	336.38	0.38	Floor	Carbonaceous Mudstone/Siltstone	GRM34	EB1111587-099

B

Appendix B ALS Laboratory Reports—Overburden, and Coal Roof and Floor

ALS Minerals
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Finalized Date: 30-JUN-2011
Account: URSAUS

CERTIFICATE BR11108740

Project: GRIM_EIS
P.O. No.: BN/060/11
This report is for 34 Pulp samples submitted to our lab in Brisbane, QLD, Australia on 16-JUN-2011.

The following have access to data associated with this certificate:

LAWRIE DUCK	TONY JONG	

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
LEV-01	Waste Disposal Levy
LOG-22	Sample login - Rcd w/o BarCode
ASH-01	Ashing of carbons/soils

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
ME-MS42	Up to 34 elements by ICP-MS	ICP-MS
C-IR07	Total Carbon (Leco)	LECO
ME-MS61	48 element four acid ICP-MS	

To: **URS AUSTRALIA PTY LTD**
ATTN: LAWRIE DUCK
LEVEL 14
240 QUEEN STREET
BRISBANE QLD 4000

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

Signature:

Shaun Kenny, Brisbane Laboratory Manager

ALS Minerals

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www.alsglobal.com

Finalized Date: 30-JUN-2011
Account: URSAUS

Project: GRIM_EIS

CERTIFICATE OF ANALYSIS BR11108740

Sample Description	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
Method / Analyte	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga
Units	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm
LOR	0.01	0.01	0.2	10	0.05	0.01	0.01	0.02	0.01	0.1	1	0.05	0.2	0.01	0.05
COMP GRM01	0.14	7.76	9.9	440	1.79	0.47	0.68	0.15	65.8	19.7	57	8.99	64.1	3.96	20.3
COMP GRM02	0.12	8.80	12.3	370	1.96	0.51	0.63	0.14	71.9	13.7	58	10.75	57.9	4.31	21.8
COMP GRM03	0.12	8.52	4.6	340	1.80	0.52	6.02	0.09	59.7	13.4	45	11.60	47.3	3.69	22.1
COMP GRM04	0.09	8.18	15.4	410	1.46	0.28	2.03	0.13	59.2	12.3	53	6.40	41.5	4.33	18.15
COMP GRM05	0.06	7.89	9.9	320	1.34	0.26	5.46	0.08	45.3	12.3	53	6.45	58.1	3.32	19.70
COMP GRM06	0.10	7.48	9.4	470	1.56	0.36	1.32	0.11	53.2	20.4	178	7.36	42.9	3.32	19.75
COMP GRM07	0.09	7.08	10.6	490	1.72	0.50	0.62	0.13	47.6	12.0	54	7.46	39.1	4.03	19.25
COMP GRM08	0.12	8.27	4.5	440	1.83	0.48	0.73	0.16	73.3	8.3	51	9.09	43.8	3.13	20.4
COMP GRM09	0.05	8.22	19.2	340	1.20	0.22	3.62	0.11	45.4	14.9	68	4.77	41.9	2.13	20.3
COMP GRM10	0.05	5.65	2.7	280	1.07	0.09	5.75	0.04	34.7	20.5	38	3.03	14.0	11.55	13.05
COMP GRM11	0.07	7.94	8.8	330	1.34	0.27	3.05	0.10	53.0	7.9	56	4.84	28.5	4.37	17.70
COMP GRM12	0.07	7.43	7.0	280	1.34	0.18	1.38	0.08	50.8	14.3	78	4.78	19.9	6.79	17.95
COMP GRM13	0.07	7.40	7.2	490	1.36	0.25	1.16	0.10	51.5	13.0	57	5.07	27.1	2.59	16.85
COMP GRM14	0.08	7.56	6.9	590	2.07	0.53	1.17	0.16	58.1	14.7	103	7.37	46.6	4.58	21.4
COMP GRM15	0.13	7.95	6.8	450	2.08	0.59	0.59	0.16	46.4	14.5	60	10.85	46.8	4.26	22.8
COMP GRM16	0.14	6.98	3.1	450	1.98	0.51	0.21	0.16	37.3	22.3	48	10.20	47.5	1.64	21.9
COMP GRM17	0.09	8.08	8.0	480	2.09	0.51	0.37	0.12	53.4	10.9	43	12.20	52.6	3.95	23.3
COMP GRM18	0.04	8.09	6.8	310	1.08	0.12	4.35	0.08	41.4	13.8	66	2.15	31.2	3.38	19.15
COMP GRM19	0.09	7.70	8.6	390	1.65	0.40	1.97	0.11	51.8	25.0	53	6.27	33.8	5.46	18.70
COMP GRM20	0.11	7.50	44.6	350	1.56	0.45	1.86	0.14	49.0	17.5	65	5.38	48.9	2.03	20.5
COMP GRM21	0.09	6.24	2.6	420	2.26	0.42	0.30	0.12	31.8	9.8	52	9.36	33.4	5.88	20.1
COMP GRM22	0.07	6.63	4.0	470	2.03	0.41	0.27	0.14	23.0	10.7	24	8.45	95.1	2.73	22.6
COMP GRM23	0.10	6.88	5.1	350	2.19	0.52	0.39	0.11	42.8	13.1	53	12.05	45.7	5.71	22.5
COMP GRM24	0.06	6.38	4.2	410	1.95	0.47	0.45	0.09	43.4	10.7	44	9.64	51.0	4.32	21.0
COMP GRM25	0.09	7.58	9.7	470	1.85	0.36	1.10	0.11	45.6	12.2	131	8.58	47.1	2.31	22.9
COMP GRM26	0.11	7.32	3.6	480	2.10	0.75	0.23	0.18	42.9	10.1	45	9.31	54.3	1.71	23.0
COMP GRM27	0.09	8.34	28.6	430	2.17	0.49	0.34	0.12	60.2	15.5	45	13.45	51.6	4.18	23.6
COMP GRM28	0.06	8.57	2.9	590	2.09	0.50	0.10	0.17	22.2	1.9	47	9.39	79.1	0.98	26.1
COMP GRM29	0.09	7.37	3.6	470	2.34	0.49	0.10	0.14	40.0	4.1	45	9.62	29.9	0.89	22.6
COMP GRM30	0.06	8.43	5.0	400	2.14	0.27	0.09	0.13	26.7	6.1	46	7.56	33.9	0.65	25.3
COMP GRM31	0.06	7.31	6.8	290	1.38	0.17	2.56	0.11	32.5	14.5	96	2.94	22.5	1.73	20.9
COMP GRM32	0.10	9.19	3.7	460	1.88	0.46	0.29	0.15	62.0	17.1	60	10.05	51.8	2.41	22.9
COMP GRM33	0.09	8.91	39.4	340	1.88	0.33	0.46	0.16	55.4	11.7	58	6.55	62.9	1.21	24.5
COMP GRM34	0.10	6.53	26.7	360	2.41	0.44	0.52	0.11	49.2	13.6	52	11.00	27.4	7.84	19.05

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

***** See Appendix Page for comments regarding this certificate *****

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Finalized Date: 30-JUN-2011
Account: URSAUS

Project: GRIM_EIS

CERTIFICATE OF ANALYSIS BR11108740

Sample Description	Method Analyte Units LOR	ME-MS61 Ge ppm 0.05	ME-MS61 Hf ppm 0.1	ME-MS61 In ppm 0.005	ME-MS61 K % 0.01	ME-MS61 La ppm 0.5	ME-MS61 Li ppm 0.2	ME-MS61 Mg % 0.01	ME-MS61 Mn ppm 5	ME-MS61 Mo ppm 0.05	ME-MS61 Na % 0.01	ME-MS61 Nb ppm 0.1	ME-MS61 Ni ppm 0.2	ME-MS61 P ppm 10	ME-MS61 Pb ppm 0.5	ME-MS61 Rb ppm 0.1
COMP GRM01		0.20	4.2	0.073	2.05	31.5	28.2	1.00	468	1.35	0.70	9.9	43.6	900	21.6	112.0
COMP GRM02		0.22	4.5	0.080	2.10	34.3	33.8	1.02	668	0.86	0.68	10.8	38.9	1040	20.1	120.0
COMP GRM03		0.23	3.9	0.075	2.23	28.3	30.5	0.94	1000	0.78	0.51	10.2	39.3	960	18.8	134.0
COMP GRM04		0.21	3.6	0.053	1.70	29.0	26.2	1.17	898	1.07	0.93	8.5	35.3	930	15.9	89.2
COMP GRM05		0.13	3.2	0.059	1.60	20.3	23.3	0.87	1315	1.21	0.90	8.0	30.5	1140	12.2	63.6
COMP GRM06		0.20	3.7	0.059	2.06	24.5	17.0	1.13	559	0.99	0.75	9.1	164.0	810	15.5	92.3
COMP GRM07		0.19	4.4	0.062	1.82	21.0	20.2	0.73	769	1.33	1.04	10.7	38.3	780	20.0	89.3
COMP GRM08		0.17	4.4	0.070	2.14	34.7	23.6	0.76	564	0.84	0.91	11.1	26.0	760	21.1	134.5
COMP GRM09		0.17	3.6	0.052	1.80	19.7	13.9	1.04	674	0.78	1.71	7.9	28.4	960	12.8	57.0
COMP GRM10		0.15	1.7	0.035	1.49	18.4	8.7	2.35	2160	0.54	0.54	5.4	25.8	950	7.7	64.2
COMP GRM11		0.20	4.2	0.052	1.34	25.4	25.3	1.42	855	1.06	0.97	10.5	30.5	760	14.7	54.0
COMP GRM12		0.25	3.4	0.049	1.19	25.3	20.6	1.02	1220	0.70	1.22	8.2	37.6	730	12.3	67.5
COMP GRM13		0.19	3.5	0.050	1.69	24.8	24.8	0.68	438	1.18	1.15	9.3	35.7	700	15.1	89.6
COMP GRM14		0.21	4.1	0.068	1.88	27.2	22.8	0.88	801	1.02	0.42	10.0	70.9	820	16.0	82.7
COMP GRM15		0.20	4.3	0.086	2.28	20.7	23.7	0.78	1160	1.10	0.56	10.6	46.1	730	20.8	116.0
COMP GRM16		0.16	4.5	0.078	2.56	15.8	23.9	0.54	172	1.29	0.88	12.4	54.4	640	28.9	121.5
COMP GRM17		0.15	3.4	0.081	2.15	24.5	21.3	0.67	1075	1.01	0.70	9.7	31.6	570	19.8	134.5
COMP GRM18		0.19	3.3	0.050	1.17	19.5	19.8	1.46	1110	0.84	1.95	6.8	23.7	1100	10.5	44.0
COMP GRM19		0.20	3.6	0.056	2.00	25.1	17.3	1.08	987	2.15	0.55	9.3	48.6	900	15.7	84.7
COMP GRM20		0.20	4.9	0.072	1.48	22.2	35.3	0.78	442	2.32	0.88	11.7	66.6	780	18.0	55.5
COMP GRM21		0.33	3.5	0.067	2.02	13.1	18.8	0.79	1320	0.55	0.91	8.8	34.5	550	17.1	90.3
COMP GRM22		0.12	3.3	0.079	2.12	9.8	18.6	0.52	678	1.79	0.85	8.3	27.1	770	15.6	82.1
COMP GRM23		0.23	3.9	0.075	2.36	19.4	30.6	0.83	1440	0.79	0.51	9.8	38.1	1000	20.1	122.5
COMP GRM24		0.20	3.5	0.057	2.27	20.2	29.9	0.91	369	1.32	0.58	8.4	34.9	1720	16.9	107.5
COMP GRM25		0.19	3.8	0.063	2.31	21.1	20.1	0.86	429	1.12	0.67	10.4	110.5	680	16.0	98.7
COMP GRM26		0.19	5.0	0.083	2.05	17.8	25.9	0.45	435	1.34	0.68	12.2	31.7	680	25.1	114.5
COMP GRM27		0.25	3.9	0.067	2.32	29.4	31.6	1.07	150	2.08	0.67	9.0	40.1	1310	19.3	161.0
COMP GRM28		0.16	5.1	0.080	3.74	11.5	9.2	0.50	23	0.88	0.57	11.6	9.1	160	20.3	139.5
COMP GRM29		0.19	4.6	0.077	2.43	17.8	34.8	0.29	56	0.59	0.52	13.3	13.1	160	24.7	137.5
COMP GRM30		0.14	5.0	0.065	1.67	13.1	50.9	0.28	43	1.54	0.83	12.9	17.5	150	15.6	97.1
COMP GRM31		0.16	4.5	0.073	1.04	14.9	55.8	0.91	188	1.50	1.02	12.8	26.8	630	14.5	25.9
COMP GRM32		0.20	4.5	0.073	2.39	30.7	25.6	0.85	168	1.84	0.93	11.5	45.3	850	17.9	133.5
COMP GRM33		0.19	4.5	0.083	1.47	26.0	40.0	0.46	76	1.90	0.71	11.7	35.5	1150	14.5	76.5
COMP GRM34		0.24	3.7	0.066	2.03	22.5	17.6	0.93	1600	0.88	0.75	8.9	44.5	640	17.4	121.0

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

***** See Appendix Page for comments regarding this certificate *****

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Finalized Date: 30-JUN-2011
Account: URSAUS

Project: GRIM_EIS

CERTIFICATE OF ANALYSIS BR11108740

Sample Description	Method Analyte Units LOR	ME-MS61 Re ppm 0.002	ME-MS61 S % 0.01	ME-MS61 Sb ppm 0.05	ME-MS61 Sc ppm 0.1	ME-MS61 Se ppm 1	ME-MS61 Sn ppm 0.2	ME-MS61 Sr ppm 0.2	ME-MS61 Ta ppm 0.05	ME-MS61 Te ppm 0.05	ME-MS61 Th ppm 0.2	ME-MS61 Ti % 0.005	ME-MS61 Tl ppm 0.02	ME-MS61 U ppm 0.1	ME-MS61 V ppm 1	ME-MS61 W ppm 0.1
COMP GRM01		<0.002	0.06	0.76	15.5	1	3.0	346	0.80	0.11	10.9	0.438	0.71	3.4	112	2.2
COMP GRM02		<0.002	0.05	0.65	18.1	2	3.1	346	0.82	0.14	11.9	0.444	0.70	3.4	123	2.3
COMP GRM03		<0.002	0.04	0.65	15.0	2	3.2	431	0.70	0.11	12.0	0.368	0.75	2.8	97	1.9
COMP GRM04		<0.002	0.06	0.68	16.3	2	2.3	401	0.62	0.08	10.0	0.413	0.56	2.8	111	1.6
COMP GRM05		<0.002	0.07	0.43	18.7	2	1.8	408	0.59	0.09	6.3	0.475	0.51	1.6	131	1.4
COMP GRM06		<0.002	0.04	0.54	15.3	1	2.4	466	0.65	0.09	8.0	0.451	0.65	2.6	113	1.6
COMP GRM07		<0.002	0.05	0.59	13.2	2	2.7	357	0.76	0.10	9.3	0.436	0.68	3.3	104	2.0
COMP GRM08		<0.002	0.07	0.69	16.9	2	2.9	236	0.81	0.11	12.7	0.422	0.73	3.4	101	2.2
COMP GRM09		<0.002	0.07	0.49	19.8	1	1.8	495	0.52	0.07	6.3	0.499	0.58	2.0	148	1.4
COMP GRM10		<0.002	0.02	0.27	10.9	1	1.1	479	0.38	<0.05	5.0	0.308	0.34	1.1	120	0.7
COMP GRM11		<0.002	0.02	0.46	15.0	2	2.3	361	0.70	0.08	9.0	0.435	0.44	2.6	98	1.7
COMP GRM12		<0.002	0.06	0.50	23.9	1	2.1	254	0.58	0.06	8.7	0.443	0.41	2.3	127	1.4
COMP GRM13		<0.002	0.06	0.84	14.0	1	2.3	247	0.64	0.06	9.3	0.415	0.56	2.6	95	1.8
COMP GRM14		<0.002	0.03	0.44	16.6	2	2.7	925	0.68	0.12	8.3	0.463	0.63	2.8	119	1.9
COMP GRM15		<0.002	0.05	0.70	17.5	2	3.0	296	0.77	0.19	8.9	0.448	0.84	3.0	122	2.0
COMP GRM16		0.002	0.03	0.70	12.6	2	3.4	231	0.88	0.10	7.2	0.472	0.81	3.2	120	2.1
COMP GRM17		<0.002	0.08	0.48	16.8	2	2.9	291	0.76	0.13	11.0	0.404	0.74	2.5	115	1.9
COMP GRM18		<0.002	0.03	0.24	19.9	1	1.5	425	0.45	<0.05	5.7	0.498	0.34	1.6	159	1.1
COMP GRM19		0.002	0.07	0.91	17.0	2	2.3	384	0.63	0.13	8.4	0.464	0.64	2.6	126	1.6
COMP GRM20		<0.002	0.05	1.18	15.0	2	2.8	306	0.81	0.14	8.7	0.495	0.67	2.9	114	2.2
COMP GRM21		<0.002	0.02	0.32	16.2	1	2.6	215	0.67	0.10	6.2	0.382	0.76	2.6	113	1.6
COMP GRM22		0.002	0.07	0.59	12.9	2	2.4	257	0.60	0.13	4.7	0.461	0.70	1.9	144	1.7
COMP GRM23		<0.002	0.03	0.83	14.6	2	3.3	285	0.71	0.13	8.2	0.374	0.80	2.7	123	2.0
COMP GRM24		<0.002	0.03	0.54	11.7	2	2.7	275	0.69	0.10	7.9	0.368	0.81	2.8	92	1.9
COMP GRM25		<0.002	0.03	0.63	14.6	2	2.7	366	0.68	0.10	7.0	0.488	0.64	2.5	116	1.9
COMP GRM26		<0.002	0.03	0.45	12.9	2	3.2	460	0.88	0.19	9.2	0.439	0.85	3.6	106	1.9
COMP GRM27		<0.002	0.43	1.28	15.8	2	2.9	345	0.67	0.11	11.8	0.361	2.07	2.9	100	1.9
COMP GRM28		<0.002	0.04	0.32	15.5	1	2.8	395	0.83	0.15	6.7	0.624	1.21	3.6	135	2.3
COMP GRM29		<0.002	0.03	0.57	13.1	2	3.7	179.0	0.95	0.09	9.9	0.453	0.82	3.6	89	2.6
COMP GRM30		<0.002	0.02	0.68	16.0	2	3.0	209	0.85	0.08	7.8	0.633	0.62	2.8	133	2.0
COMP GRM31		<0.002	0.03	0.87	16.1	2	2.5	300	0.83	0.05	5.8	0.990	0.51	2.1	183	2.2
COMP GRM32		0.003	0.05	0.68	18.6	2	2.9	420	0.78	0.14	11.1	0.516	0.77	3.2	123	2.4
COMP GRM33		<0.002	0.12	0.57	18.8	2	2.3	335	0.76	0.11	6.8	0.666	0.56	2.5	155	2.0
COMP GRM34		<0.002	0.16	1.02	19.7	2	2.7	203	0.64	0.10	8.9	0.318	0.85	2.6	106	1.7

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

***** See Appendix Page for comments regarding this certificate *****

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Finalized Date: 30-JUN-2011
Account: URSAUS

Project: GRIM_EIS

CERTIFICATE OF ANALYSIS BR11108740

Sample Description	Method / Analyte / Units / LOR	ME-MS61 Y ppm 0.1	ME-MS61 Zn ppm 2	ME-MS61 Zr ppm 0.5	ME-MS42 Hg ppm 0.005	C-IR07 C % 0.01
COMP GRM01		24.0	86	141.0	0.050	1.62
COMP GRM02		30.5	90	157.0	0.044	2.26
COMP GRM03		27.2	81	137.5	0.039	2.86
COMP GRM04		25.4	77	135.0	0.043	2.99
COMP GRM05		22.2	72	116.5	0.053	5.92
COMP GRM06		19.8	80	128.5	0.040	2.37
COMP GRM07		20.6	76	153.0	0.051	2.14
COMP GRM08		31.0	86	152.0	0.044	1.59
COMP GRM09		21.7	82	142.5	0.084	1.97
COMP GRM10		17.7	61	65.8	0.021	5.44
COMP GRM11		24.7	75	158.5	0.052	2.96
COMP GRM12		25.1	70	133.0	0.043	2.98
COMP GRM13		22.1	79	126.5	0.049	2.76
COMP GRM14		23.3	93	145.5	0.064	2.98
COMP GRM15		25.3	104	158.0	0.053	3.09
COMP GRM16		18.2	102	159.0	0.042	1.11
COMP GRM17		22.0	82	117.5	0.056	7.14
COMP GRM18		21.1	84	126.0	0.033	2.75
COMP GRM19		23.6	80	135.0	0.057	2.74
COMP GRM20		20.2	85	167.5	0.079	2.12
COMP GRM21		18.3	68	126.5	0.035	2.67
COMP GRM22		14.8	103	114.5	0.042	6.34
COMP GRM23		21.7	88	139.5	0.064	1.91
COMP GRM24		20.6	69	114.5	0.060	1.10
COMP GRM25		19.1	96	142.0	0.084	1.98
COMP GRM26		18.7	91	175.5	0.072	2.10
COMP GRM27		26.7	73	139.5	0.216	2.52
COMP GRM28		8.0	84	166.0	0.060	0.89
COMP GRM29		16.1	80	165.0	0.058	0.94
COMP GRM30		12.2	64	174.5	0.063	1.47
COMP GRM31		12.8	96	156.5	0.090	1.74
COMP GRM32		26.6	94	159.0	0.045	1.48
COMP GRM33		21.7	114	137.0	0.097	3.36
COMP GRM34		30.6	80	141.5	0.093	3.36

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

***** See Appendix Page for comments regarding this certificate *****

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Finalized Date: 30-JUN-2011
Account: URSAUS

Project: GRIM_EIS

CERTIFICATE OF ANALYSIS BR11108740

Method	CERTIFICATE COMMENTS
ME-MS61	REE's may not be totally soluble in this method.

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QC CERTIFICATE BR11108740

Project: GRIM_EIS
P.O. No.: BN/060/11
This report is for 34 Pulp samples submitted to our lab in Brisbane, QLD, Australia on 16-JUN-2011.

The following have access to data associated with this certificate:

LAWRIE DUCK	TONY JONG	

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
LEV-01	Waste Disposal Levy
LOG-22	Sample login - Rcd w/o BarCode
ASH-01	Ashing of carbons/soils

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
ME-MS42	Up to 34 elements by ICP-MS	ICP-MS
C-IR07	Total Carbon (Leco)	LECO
ME-MS61	48 element four acid ICP-MS	

To: URS AUSTRALIA PTY LTD
ATTN: LAWRIE DUCK
LEVEL 14
240 QUEEN STREET
BRISBANE QLD 4000

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

Signature:

Shaun Kenny, Brisbane Laboratory Manager

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Project: GRIM_EIS

Finalized Date: 30-JUN-2011
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QC CERTIFICATE OF ANALYSIS BR11108740

Sample Description / Method / Analyte / Units / LOR	ME-MS61 Ag ppm 0.01	ME-MS61 Al % 0.01	ME-MS61 As ppm 0.2	ME-MS61 Ba ppm 10	ME-MS61 Be ppm 0.05	ME-MS61 Bi ppm 0.01	ME-MS61 Ca % 0.01	ME-MS61 Cd ppm 0.02	ME-MS61 Ce ppm 0.01	ME-MS61 Co ppm 0.1	ME-MS61 Cr ppm 1	ME-MS61 Cs ppm 0.05	ME-MS61 Cu ppm 0.2	ME-MS61 Fe % 0.01	ME-MS61 Ga ppm 0.05
STANDARDS															
GBM908-10															
Target Range - Lower Bound															
Upper Bound															
GBM908-10	2.85	6.87	63.0	1020	1.51	1.34	3.52	1.80	115.5	26.1	133	4.06	3510	5.24	21.9
Target Range - Lower Bound	2.69	6.40	49.3	930	1.19	1.09	3.33	1.52	99.0	21.5	118	3.37	3270	5.21	18.65
Upper Bound	3.31	7.84	60.7	1280	1.57	1.35	4.10	1.90	121.0	26.5	146	4.23	3990	6.39	22.9
GEOMS-03															
Target Range - Lower Bound															
Upper Bound															
MRGeo08															
Target Range - Lower Bound															
Upper Bound															
MRGeo08	4.57	6.71	36.4	1030	3.08	0.75	2.48	2.42	60.2	19.6	88	11.15	637	3.78	20.6
Target Range - Lower Bound	4.16	7.00	29.7	920	2.80	0.63	2.35	2.01	72.9	18.4	82	11.00	568	3.61	17.50
Upper Bound	5.10	8.57	36.7	1270	3.54	0.79	2.90	2.50	89.1	22.8	102	13.60	694	4.43	21.5
OGGeo08															
Target Range - Lower Bound															
Upper Bound															
BLANKS															
BLANK															
BLANK															
Target Range - Lower Bound															
Upper Bound															
BLANK	<0.01	<0.01	<0.2	<10	<0.05	0.01	<0.01	<0.02	0.01	<0.1	<1	<0.05	0.3	<0.01	<0.05
Target Range - Lower Bound	<0.01	<0.01	<0.2	<10	<0.05	<0.01	<0.01	<0.02	<0.01	<0.1	<1	<0.05	<0.2	<0.01	<0.05
Upper Bound	0.02	0.02	0.4	20	0.10	0.02	0.02	0.04	0.02	0.2	2	0.10	0.4	0.02	0.10

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

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Project: GRIM_EIS

QC CERTIFICATE OF ANALYSIS BR11108740

Sample Description	Method / Analyte / Units / LOR	ME-MS61 Ge ppm 0.05	ME-MS61 Hf ppm 0.1	ME-MS61 In ppm 0.005	ME-MS61 K % 0.01	ME-MS61 La ppm 0.5	ME-MS61 Li ppm 0.2	ME-MS61 Mg % 0.01	ME-MS61 Mn ppm 5	ME-MS61 Mo ppm 0.05	ME-MS61 Na % 0.01	ME-MS61 Nb ppm 0.1	ME-MS61 Ni ppm 0.2	ME-MS61 P ppm 10	ME-MS61 Pb ppm 0.5	ME-MS61 Rb ppm 0.1
STANDARDS																
GBM908-10																
Target Range - Lower Bound																
Upper Bound																
GBM908-10		0.32	3.8	0.073	2.01	60.5	11.7	1.66	765	61.7	1.99	11.5	2040	940	1930	185.0
Target Range - Lower Bound		0.21	3.2	0.065	1.86	49.0	5.5	1.59	704	60.3	2.02	9.3	2030	870	1860	153.0
Upper Bound		0.37	4.1	0.090	2.29	61.0	7.2	1.97	871	73.8	2.50	11.6	2480	1090	2270	187.0
GEOMS-03																
Target Range - Lower Bound																
Upper Bound																
MRGeo08																
Target Range - Lower Bound																
Upper Bound																
MRGeo08		0.22	3.1	0.170	3.01	29.7	36.6	1.19	550	16.00	1.86	22.6	677	1020	1040	155.0
Target Range - Lower Bound		0.09	2.8	0.161	2.79	36.3	30.4	1.24	506	13.65	1.76	19.3	617	910	965	187.0
Upper Bound		0.23	3.6	0.207	3.43	45.5	37.6	1.54	630	16.75	2.18	23.8	755	1140	1180	229
OGGeo08																
Target Range - Lower Bound																
Upper Bound																
BLANKS																
BLANK																
BLANK																
Target Range - Lower Bound																
Upper Bound																
BLANK		<0.05	<0.1	<0.005	<0.01	<0.5	<0.2	<0.01	<5	<0.05	<0.01	<0.1	0.2	<10	<0.5	<0.1
Target Range - Lower Bound		<0.05	<0.1	<0.005	<0.01	<0.5	<0.2	<0.01	<5	<0.05	<0.01	<0.1	<0.2	<10	<0.5	<0.1
Upper Bound		0.10	0.2	0.010	0.02	1.0	0.4	0.02	10	0.10	0.02	0.2	0.4	20	1.0	0.2

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

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QC CERTIFICATE OF ANALYSIS BR11108740

Sample Description / Method / Analyte / Units / LOR	ME-MS61 Re ppm 0.002	ME-MS61 S % 0.01	ME-MS61 Sb ppm 0.05	ME-MS61 Sc ppm 0.1	ME-MS61 Se ppm 1	ME-MS61 Sn ppm 0.2	ME-MS61 Sr ppm 0.2	ME-MS61 Ta ppm 0.05	ME-MS61 Te ppm 0.05	ME-MS61 Th ppm 0.2	ME-MS61 Ti % 0.005	ME-MS61 Tl ppm 0.02	ME-MS61 U ppm 0.1	ME-MS61 V ppm 1	ME-MS61 W ppm 0.1
STANDARDS															
GBM908-10															
Target Range - Lower Bound															
Upper Bound															
GBM908-10	0.002	0.37	1.71	20.4	2	3.2	280	0.80	0.05	19.0	0.636	1.32	2.5	131	3.8
Target Range - Lower Bound	<0.002	0.33	1.30	17.0	<1	2.6	258	0.69	<0.05	16.9	0.591	0.16	2.0	123	2.7
Upper Bound	0.004	0.43	1.88	21.0	2	3.6	316	0.96	0.10	21.1	0.733	0.26	2.6	153	3.9
GEOMS-03															
Target Range - Lower Bound															
Upper Bound															
MRGeo08															
Target Range - Lower Bound															
Upper Bound															
MRGeo08	0.008	0.31	4.44	11.5	2	4.2	295	1.54	0.06	16.1	0.490	1.17	5.6	108	4.8
Target Range - Lower Bound	0.008	0.27	4.08	11.0	<1	3.5	272	1.48	<0.05	19.2	0.454	0.87	5.6	99	4.3
Upper Bound	0.014	0.35	5.64	13.6	2	4.7	332	1.92	0.10	23.9	0.566	1.23	7.0	123	6.1
OGGeo08															
Target Range - Lower Bound															
Upper Bound															
BLANKS															
BLANK															
BLANK															
Target Range - Lower Bound															
Upper Bound															
BLANK	<0.002	<0.01	<0.05	<0.1	<1	0.3	<0.2	<0.05	<0.05	<0.2	<0.005	<0.02	<0.1	<1	<0.1
Target Range - Lower Bound	<0.002	<0.01	<0.05	<0.1	<1	<0.2	<0.2	<0.05	<0.05	<0.2	<0.005	<0.02	<0.1	<1	<0.1
Upper Bound	0.004	0.02	0.10	0.2	5	0.4	0.4	0.10	0.10	0.4	0.010	0.04	0.2	2	0.2

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

***** See Appendix Page for comments regarding this certificate *****

ALS Minerals

Australian Laboratory Services Pty. Ltd.
32 Shand Street
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www.alsglobal.com

Finalized Date: 30-JUN-2011
Account: URSAUS

Project: GRIM_EIS

QC CERTIFICATE OF ANALYSIS BR11108740

Sample Description	Method / Analyte / Units / LOR	ME-MS61 Y ppm 0.1	ME-MS61 Zn ppm 2	ME-MS61 Zr ppm 0.5	ME-MS42 Hg ppm 0.005	C-IR07 C % 0.01
STANDARDS						
GBM908-10					0.019	
Target Range - Lower Bound					0.009	
Upper Bound					0.025	
GBM908-10		43.3	1020	145.5		
Target Range - Lower Bound		36.2	939	109.0		
Upper Bound		44.5	1155	146.5		
GEOMS-03					0.643	
Target Range - Lower Bound					0.582	
Upper Bound					0.799	
MRGeo08					0.062	
Target Range - Lower Bound					0.055	
Upper Bound					0.086	
MRGeo08		25.5	789	111.5		
Target Range - Lower Bound		24.3	712	92.2		
Upper Bound		29.9	874	126.0		
OGGeo08					0.469	
Target Range - Lower Bound					<0.005	
Upper Bound					0.010	
BLANKS						
BLANK					<0.005	
BLANK					<0.005	
Target Range - Lower Bound					<0.005	
Upper Bound					0.010	
BLANK		<0.1	<2	<0.5		
Target Range - Lower Bound		<0.1	<2	<0.5		
Upper Bound		0.2	4	1.0		

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

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Finalized Date: 30-JUN-2011
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Project: GRIM_EIS

QC CERTIFICATE OF ANALYSIS BR11108740

Sample Description	Method / Analyte / Units / LOR	ME-MS61 Ag ppm 0.01	ME-MS61 Al % 0.01	ME-MS61 As ppm 0.2	ME-MS61 Ba ppm 10	ME-MS61 Be ppm 0.05	ME-MS61 Bi ppm 0.01	ME-MS61 Ca % 0.01	ME-MS61 Cd ppm 0.02	ME-MS61 Ce ppm 0.01	ME-MS61 Co ppm 0.1	ME-MS61 Cr ppm 1	ME-MS61 Cs ppm 0.05	ME-MS61 Cu ppm 0.2	ME-MS61 Fe % 0.01	ME-MS61 Ga ppm 0.05
DUPLICATES																
COMP GRM05																
DUP																
Target Range - Lower Bound																
Upper Bound																
COMP GRM10																
DUP																
Target Range - Lower Bound																
Upper Bound																
COMP GRM12		0.07	7.43	7.0	280	1.34	0.18	1.38	0.08	50.8	14.3	78	4.78	19.9	6.79	17.95
DUP		0.05	6.40	6.4	270	1.32	0.19	1.29	0.07	38.7	13.6	80	3.86	22.3	6.53	17.05
Target Range - Lower Bound		0.05	6.56	6.2	240	1.21	0.17	1.26	0.05	42.5	13.2	74	4.05	19.8	6.32	16.60
Upper Bound		0.07	7.27	7.2	310	1.45	0.20	1.41	0.10	47.0	14.7	84	4.59	22.4	7.00	18.45
COMP GRM20																
DUP																
Target Range - Lower Bound																
Upper Bound																
COMP GRM25																
DUP																
Target Range - Lower Bound																
Upper Bound																
COMP GRM30																
DUP																
Target Range - Lower Bound																
Upper Bound																
COMP GRM34		0.10	6.53	26.7	360	2.41	0.44	0.52	0.11	49.2	13.6	52	11.00	27.4	7.84	19.05
DUP		0.11	5.98	27.8	350	2.37	0.43	0.50	0.12	37.4	13.9	48	9.95	29.1	7.60	19.50
Target Range - Lower Bound		0.09	5.93	25.7	320	2.22	0.40	0.47	0.09	41.1	13.0	47	9.90	26.6	7.32	18.25
Upper Bound		0.12	6.58	28.8	390	2.56	0.47	0.55	0.14	45.5	14.5	54	11.05	29.9	8.12	20.3

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

***** See Appendix Page for comments regarding this certificate *****

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Finalized Date: 30-JUN-2011
Account: URSAUS

Project: GRIM_EIS

QC CERTIFICATE OF ANALYSIS BR11108740

Sample Description / Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
Analyte	Ge	Hf	In	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Rb
Units	ppm	ppm	ppm	%	ppm	ppm	%	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
LOR	0.05	0.1	0.005	0.01	0.5	0.2	0.01	5	0.05	0.01	0.1	0.2	10	0.5	0.1
DUPLICATES															
COMP GRM05															
DUP															
Target Range - Lower Bound															
Upper Bound															
COMP GRM10															
DUP															
Target Range - Lower Bound															
Upper Bound															
COMP GRM12	0.25	3.4	0.049	1.19	25.3	20.6	1.02	1220	0.70	1.22	8.2	37.6	730	12.3	67.5
DUP	0.23	3.4	0.045	1.12	18.0	21.5	0.95	1180	0.65	1.19	7.9	36.7	710	12.0	48.1
Target Range - Lower Bound	0.18	3.1	0.040	1.09	20.1	19.8	0.93	1135	0.59	1.13	7.5	35.1	670	11.0	54.8
Upper Bound	0.30	3.7	0.054	1.22	23.2	22.3	1.04	1265	0.76	1.28	8.6	39.2	770	13.3	60.8
COMP GRM20															
DUP															
Target Range - Lower Bound															
Upper Bound															
COMP GRM25															
DUP															
Target Range - Lower Bound															
Upper Bound															
COMP GRM30															
DUP															
Target Range - Lower Bound															
Upper Bound															
COMP GRM34	0.24	3.7	0.066	2.03	22.5	17.6	0.93	1600	0.88	0.75	8.9	44.5	640	17.4	121.0
DUP	0.26	3.4	0.062	1.99	16.3	17.7	0.89	1560	0.81	0.74	9.0	46.8	620	16.8	97.1
Target Range - Lower Bound	0.19	3.3	0.056	1.90	17.9	16.6	0.85	1495	0.75	0.70	8.4	43.2	590	15.7	103.5
Upper Bound	0.31	3.8	0.072	2.12	20.9	18.7	0.97	1665	0.94	0.79	9.5	48.1	670	18.5	114.5

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

***** See Appendix Page for comments regarding this certificate *****

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ALS Minerals

Finalized Date: 30-JUN-2011
Account: URSAUS

Project: GRIM_EIS

QC CERTIFICATE OF ANALYSIS BR11108740

Sample Description	Method / Analyte / Units / LOR	ME-MS61 Re ppm 0.002	ME-MS61 S % 0.01	ME-MS61 Sb ppm 0.05	ME-MS61 Sc ppm 0.1	ME-MS61 Se ppm 1	ME-MS61 Sn ppm 0.2	ME-MS61 Sr ppm 0.2	ME-MS61 Ta ppm 0.05	ME-MS61 Te ppm 0.05	ME-MS61 Th ppm 0.2	ME-MS61 Ti % 0.005	ME-MS61 Tl ppm 0.02	ME-MS61 U ppm 0.1	ME-MS61 V ppm 1	ME-MS61 W ppm 0.1
							DUPLICATES									
COMP GRM05																
DUP																
Target Range - Lower Bound																
Upper Bound																
COMP GRM10																
DUP																
Target Range - Lower Bound																
Upper Bound																
COMP GRM12		<0.002	0.06	0.50	23.9	1	2.1	254	0.58	0.06	8.7	0.443	0.41	2.3	127	1.4
DUP		<0.002	0.06	0.49	19.6	1	1.6	235	0.56	<0.05	6.5	0.428	0.45	2.1	123	1.3
Target Range - Lower Bound		<0.002	0.05	0.41	20.6	<1	1.6	232	0.49	<0.05	7.0	0.409	0.38	2.0	118	1.1
Upper Bound		0.004	0.07	0.58	22.9	2	2.1	257	0.65	0.10	8.2	0.462	0.48	2.4	132	1.6
COMP GRM20																
DUP																
Target Range - Lower Bound																
Upper Bound																
COMP GRM25																
DUP																
Target Range - Lower Bound																
Upper Bound																
COMP GRM30																
DUP																
Target Range - Lower Bound																
Upper Bound																
COMP GRM34		<0.002	0.16	1.02	19.7	2	2.7	203	0.64	0.10	8.9	0.318	0.85	2.6	106	1.7
DUP		<0.002	0.16	1.05	19.0	2	2.8	192.0	0.64	0.09	7.2	0.310	0.81	2.4	104	1.6
Target Range - Lower Bound		<0.002	0.14	0.91	18.3	<1	2.4	187.5	0.56	<0.05	7.4	0.283	0.75	2.3	99	1.4
Upper Bound		0.004	0.18	1.16	20.4	3	3.1	208	0.72	0.10	8.7	0.335	0.91	2.7	111	1.9

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

***** See Appendix Page for comments regarding this certificate *****

ALS Minerals
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Finalized Date: 30-JUN-2011
Account: URSAUS

Project: GRIM_EIS

QC CERTIFICATE OF ANALYSIS BR11108740

Sample Description	Method / Analyte / Units / LOR	ME-MS61 Y ppm 0.1	ME-MS61 Zn ppm 2	ME-MS61 Zr ppm 0.5	ME-MS42 Hg ppm 0.005	C-IR07 C % 0.01
DUPLICATES						
COMP GRM05					0.053	
DUP					0.046	
Target Range - Lower Bound					0.041	
Upper Bound					0.058	
COMP GRM10						5.44
DUP						5.48
Target Range - Lower Bound						5.31
Upper Bound						5.61
COMP GRM12		25.1	70	133.0		
DUP		19.4	69	124.5		
Target Range - Lower Bound		21.0	64	122.0		
Upper Bound		23.5	75	135.5		
COMP GRM20						2.12
DUP						2.16
Target Range - Lower Bound						2.08
Upper Bound						2.20
COMP GRM25					0.084	
DUP					0.084	
Target Range - Lower Bound					0.073	
Upper Bound					0.095	
COMP GRM30						1.47
DUP						1.42
Target Range - Lower Bound						1.40
Upper Bound						1.49
COMP GRM34		30.6	80	141.5	0.093	
DUP		25.6	78	142.0	0.103	
Target Range - Lower Bound		26.6	73	134.0	0.086	
Upper Bound		29.6	85	149.5	0.110	

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61.

***** See Appendix Page for comments regarding this certificate *****

ALS Minerals

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Finalized Date: 30-JUN-2011
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Project: GRIM_EIS

QC CERTIFICATE OF ANALYSIS BR11108740

Method	CERTIFICATE COMMENTS
ME-MS61	REE's may not be totally soluble in this method.

Environmental Division
Brisbane
BW Work Order
EB1109393
Telephone : +61-7-3243 7222
17.5.11

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD 4053 c/o Bryn Stephens

FROM: Steven Wilson, BMA Coal
c/o URS Australia: Level 16, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED: Turn-around-time = Standard

Project Name: GRM_EIS
Project No: 42626689
Project Manager: Kim Bidle
Agreement No.: EN/001/10
Quote No.: BN/060/11

Sampler Name: Mike Jacobson
Sampler Contact: 0437920346

Released by:
Date: **Time:**

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

Container Identification

Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB
Preservative Code	none	none	none	none	none	none	none
Analytes	Sample Preparation - refer attached Sample Split & Preparation Spreadsheet	pH and EC (1:5)	NAPP	Chromium Reducible Sulfur (CRS)			

Laboratory ID	Core Hole ID	Sample Date	Depth from (m)	Depth to (m)	Sample ID	Matrix	Type	Type Code	Lithology	No of bags	Sample Preparation	pH and EC (1:5)	NAPP	CRS	PsB	PsB	PsB	NOTES
1	43723		209.50	210.00	43723_209.5m-210m_OB	solid	Overburden	OB	Siltstone	1	X	X	X	X				
2	43723		213.12	213.98	43723_213.12m-213.98m_OB	solid	Overburden	OB	Siltstone	1	X	X	X	X				* - See Remarks to Lab
3	43723		217.92	218.30	43723_217.92m-218.3m_Roof	solid	Coal roof	Roof	Siltstone	1	X	X	X	X				
4	43723		260.57	261.14	43723_260.57m-261.14m_IB	solid	Interburden	IB	Siltstone	1	X	X	X	X				
5	43723		264.65	265.15	43723_264.65m-265.15m_Floor	solid	Coal floor	Floor	Claystone	1	X	X	X	X				
6	43723		372.00	372.50	43723_372m-372.5m_IB	solid	Interburden	IB	Sandstone	1	X	X	X	X				* - See Remarks to Lab
7	43723		375.00	375.48	43723_375m-375.48m_IB	solid	Interburden	IB	Claystone	1	X	X	X	X				
8	43723		377.00	377.50	43723_377m-377.5m_IB	solid	Interburden	IB	Siltstone	1	X	X	X	X				
9	43723		384.00	384.50	43723_384m-384.5m_IB	solid	Interburden	IB	Sandstone	1	X	X	X	X				
10	43723		400.20	400.70	43723_400.2m-400.7m_Floor	solid	Coal floor	Floor	Siltstone	1	X	X	X	X				
11	43733		74.00	74.50	43733_74m-74.5m_OB	solid	Overburden	OB	Claystone	1	X	X	X	X				* - See Remarks to Lab
12	43733		121.10	121.40	43733_121.1m-121.4m_OB	solid	Overburden	OB	Siltstone	1	X	X	X	X				
13	43733		124.35	124.71	43733_124.35m-124.71m_OB	solid	Overburden	OB	Claystone	1	X	X	X	X				
14	43733		127.02	127.50	43733_127.02m-127.5m_OB	solid	Overburden	OB	Carbonaceous Claystone	1	X	X	X	X				
15	43733		128.79	129.29	43733_128.79m-129.29m_Roof	solid	Coal roof	Roof	Carbonaceous Claystone	1	X	X	X	X				
16	43733		133.50	134.00	43733_133.5m-134m_Floor	solid	Coal floor	Floor	Siltstone	1	X	X	X	X				
17	43733		135.00	135.38	43733_135m-135.38m_IB	solid	Interburden	IB	Sandstone	1	X	X	X	X				
18	43733		214.50	215.00	43733_214.5m-215m_IB	solid	Interburden	IB	Siltstone	1	X	X	X	X				
19	43733		219.50	220.04	43733_219.5m-220.04m_IB	solid	Interburden	IB	Siltstone	1	X	X	X	X				* - See Remarks to Lab
20	43733		222.83	223.38	43733_222.83m-223.38m_Roof	solid	Coal roof	Roof	Siltstone	1	X	X	X	X				
21	43733		235.00	235.43	43733_235m-235.43m_IB	solid	Interburden	IB	Claystone	1	X	X	X	X				
22	43733		239.12	239.50	43733_239.12m-239.5m_IB	solid	Interburden	IB	Siltstone	1	X	X	X	X				
23	43733		241.50	241.98	43733_241.5m-241.98m_IB	solid	Interburden	IB	Carbonaceous Claystone	1	X	X	X	X				
24	43733		245.50	246.00	43733_245.5m-246m_IB	solid	Interburden	IB	Sandstone	1	X	X	X	X				* - See Remarks to Lab
25	43733		256.00	256.36	43733_256m-256.36m_IB	solid	Interburden	IB	Carbonaceous Claystone	1	X	X	X	X				
26	43733		267.20	267.75	43733_267.2m-267.75m_IB	solid	Interburden	IB	Siltstone/claystone/sandstone	1	X	X	X	X				
27	43733		279.66	280.00	43733_279.66m-280m_Floor	solid	Coal floor	Floor	Siltstone	1	X	X	X	X				
28	43750		264.51	265.00	43750_264.51m-265m_OB	solid	Overburden	OB	Siltstone	1	X	X	X	X				* - See Remarks to Lab
29	43750		273.00	273.50	43750_273m-273.5m_OB	solid	Overburden	OB	Sandstone	1	X	X	X	X				* - See Remarks to Lab
30	43750		282.20	282.50	43750_282.2m-282.5m_Floor	solid	Coal floor	Floor	Claystone	1	X	X	X	X				

[redacted]

FROM: Steven Wilson, BMA Coal
c/o URS Australia: Level 16, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED: Turn-around-time = Standard

Project Name: GRM_EIS
Project No: 42626689
Project Manager: Kim Bidle
Agreement No.: EN/001/10
Quote No.: BN/060/11

Sampler Name: Mike Jacobson
Sampler Contact: 0437929346

Released by:
Date: **Time:**

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

Container Identification							
Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB
Preservative Code	none	none	none	none	none	none	none
Analytes	Sample Preparation - refer attached Sample Split & Preparation Spreadsheet	pH and EC (1:5)	NAPP	Chromium Reducible Sulfur (CRS)			

Laboratory ID	Core Hole ID	Sample Date	Depth from (m)	Depth to (m)	Sample ID	Matrix	Type	Type Code	Lithology	No of bags	Sample Preparation	pH and EC (1:5)	NAPP	CRS				NOTES
31	43750		284.50	285.00	43750_284.5m-285m_IB	solid	Interburden	IB	Siltstone	1	X	X	X	X				* - See Remarks to Lab
32	43750		361.00	361.50 *	43750_361m-361.5m_IB	solid	Interburden	IB	Sandstone	1	X	X	X	X				* - See Remarks to Lab
33	43750		364.90	365.24	43750_364.9m-365.24m_IB	solid	Interburden	IB	Conglomerate	1	X	X	X	X				
34	43750		366.50	366.95	43750_366.5m-366.95m_IB	solid	Interburden	IB	Siltstone	1	X	X	X	X				
35	43750		368.69	369.08	43750_368.69m-369.08m_Roof	solid	Coal roof	Roof	Siltstone	1	X	X	X	X				
36	43750		378.50	379.00	43750_378.5m-379m_Floor	solid	Coal floor	Floor	Sandstone	1	X	X	X	X				
37	43750		383.00	383.50	43750_383m-383.5m_IB	solid	Interburden	IB	Sandstone	1	X	X	X	X				* - See Remarks to Lab
38	43750		400.00	400.50	43750_400m-400.5m_IB	solid	Interburden	IB	Siltstone	1	X	X	X	X				* - See Remarks to Lab
39	43750		404.00	404.50	43750_404m-404.5m_IB	solid	Interburden	IB	Carbonaceous Claystone	1	X	X	X	X				

ALS: 26 Shand St, Stafford QLD 4053 Ph: 3243 7222

THIS SECTION FOR LAB USE ONLY

NO N/A

NO N/A

FROM: Steven Wilson, BMA Coal

c/o URS Australia: Level 16, 240 Queen Street Brisbane QLD 4000

Contact: Tony Jong or Lawrie Duck

Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED: Turn-around-time = Standard

Project Name:	GRM_EIS
Project No:	42626689
Project Manager:	Kim Bidle
Agreement No.:	EN/001/10
Quote No.:	BN/060/11

Sampler Name: Mike Jacobsen

Sampler Contact: 0437929346

Released by:

Date: Time:

Received for Laboratory by:

Date: Time:

Container Type, Preservative and Analysis

	Container Identification						
Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB
Preservative Code	none	none	none	none	none	none	none
Analytes	Sample Preparation - refer attached Sample Split & Preparation Spreadsheet	pH and EC (1:5)	NAPP	Chromium Reducible Sulfur (CRS)			

Laboratory ID	Core Hole ID	Sample Date	Depth from (m)	Depth to (m)	Sample ID	Matrix	Type	Type Code	Lithology	No of bags	Sample Preparation	pH and EC (1:5)	NAPP	CRS	PsB	PsB	PsB	NOTES
40	43750		408.00	408.43	43750_408m-408.43m_IB	solid	Interburden	IB	Claystone	1	X	X	X	X				
41	43750		414.14	414.47	43750_414.14m-414.47m_IB	solid	Interburden	IB	Sandstone	1	X	X	X	X				
42	43750		417.00	417.34	43750_417m-417.34m_Roof	solid	Coal roof	Roof	Sandstone/silstone	1	X	X	X	X				
43	43765		228.00	228.50	43765_228m-228.5m_OB	solid	Overburden	OB	Siltstone	1	X	X	X	X				
44	43765		241.50	242.00	43765_241.5m-242m_IB	solid	Interburden	IB	Sandstone/siltstone	1	X	X	X	X				
45	43765		322.50	323.00	43765_322.5m-323m_IB	solid	Interburden	IB	Siltstone	1	X	X	X	X				* - See Remarks to Lab
46	43765		324.60	325.10	43765_324.6m-325.1m_IB	solid	Interburden	IB	Claystone	1	X	X	X	X				* - See Remarks to Lab
47	43765		337.60	338.10	43765_337.6m-338.1m_IB	solid	Interburden	IB	Carbonaceous Claystone	1	X	X	X	X				
48	43765		385.00	385.50	43765_385m-385.5m_IB	solid	Interburden	IB	Siltstone	1	X	X	X	X				
49	43765		389.50	390.00	43765_389.5m-390m_IB	solid	Interburden	IB	Carbonaceous Siltstone	1	X	X	X	X				
50	43765		390.80	391.36	43765_390.8m-391.36m_IB	solid	Interburden	IB	Sandstone/siltstone	1	X	X	X	X				
51	43765		392.30	392.63	43765_392.3m-392.63m_Roof	solid	Coal roof	Roof	siltstone/claystone	1	X	X	X	X				
52	43893		177.50	178.00	43893_177.5m-178m_OB	solid	Overburden	OB	Sandstone	1	X	X	X	X				* - See Remarks to Lab
53	43893		182.00	182.50	43893_182m-182.5m_OB	solid	Overburden	OB	Siltstone	1	X	X	X	X				* - See Remarks to Lab
54	43893		186.96	187.37	43893_186.96m-187.37m_Roof	solid	Coal roof	Roof	Shale	1	X	X	X	X				
55	43893		192.12	192.62	43893_192.12m-192.62m_Floor	solid	Coal floor	Floor	Siltstone	1	X	X	X	X				
56	43893		194.00	194.50	43893_194m-194.5m_IB	solid	Interburden	IB	Sandstone	1	X	X	X	X				
57	43893		299.46	299.94	43893_299.46m-299.94m_Roof	solid	Coal roof	Roof	Shale/Siltstone	1	X	X	X	X				
58	43893		307.57	308.07	43893_307.57m-308.07m_Floor	solid	Coal floor	Floor	Shale/Sandstone	1	X	X	X	X				
59	43893		312.00	312.50	43893_312m-312.5m_IB	solid	Interburden	IB	Sandstone	1	X	X	X	X				* - See Remarks to Lab
60	43893		315.80	316.30	43893_315.8m-316.3m_IB	solid	Interburden	IB	Shale	1	X	X	X	X				* - See Remarks to Lab
61	43893		322.80	323.30	43893_322.8m-323.3m_IB	solid	Interburden	IB	Siltstone	1	X	X	X	X				* - See Remarks to Lab
62	43893		324.46	324.88	43893_324.46m-324.88m_IB	solid	Interburden	IB	Mudstone	1	X	X	X	X				
63	43893		336.00	336.38	43893_336m-336.38m_Floor	solid	Coal floor	Floor	Carbonaceous Mudstone/Siltstone	1	X	X	X	X				
64	43893		357.09	357.59	43893_357.09m-357.59m_Roof	solid	Coal roof	Roof	Siltstone	1	X	X	X	X				
65	43893		363.61	364.11	43893_363.61m-364.11m_Floor	solid	Coal floor	Floor	Siltstone	1	X	X	X	X				
									TOTAL number of bags	65	65	65	65	65	0	0	0	

TOTAL number of each analyte: 65, 65, 65, 65, 0, 0, 0

Remarks to Lab: **Sample preparation as per attached Sample Split & Preparation Spreadsheet;** **Please cut/separate 15cm length (if sample is competent) prior to 2mm crushing and send to URS Brisbane** * -

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

Email Results to: tony_jong@urscorp.com lawrie_duck@urscorp.com

NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES. GLOVES SHOULD BE WORN WHILST HANDLING SAMPLES

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] YES NO N/A

[illegible] YES NO N/A

FROM: Steven Wilson, BMA Coal

c/o URS Australia: Level 16, 240 Queen Street Brisbane QLD 4000

Contact: Tony Jong or Lawrie Duck

Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED: Turn-around-time = Standard

Project Name:	GRM_EIS
Project No:	42626689
Project Manager:	Kim Bidle
Agreement No.:	EN/001/10
Quote No.:	BN/060/11

Sampler Name: Mike Jacobson

Sampler Contact: 0437929346

Released by:

Date: **Time:**

Received for Laboratory by:

Date: **Time:**

Container Type, Preservative and Analysis

Container Identification

Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB
Preservative Code	none	none	none	none	none	none	none
Analytes	Sample Preparation - refer attached Sample Split & Preparation Spreadsheet	pH and EC (1:5)	NAPP	Chromium Reducible Sulfur (CRS)			

NOTES

Laboratory ID	Core Hole ID	Sample Date	Depth from (m)	Depth to (m)	Sample ID	Matrix	Type	Type Code	Lithology	No of bags

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order	: **EB1109393**	Page	: 1 of 15
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Customer Services
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 11-MAY-2011
Sampler	: Mike Jacobson	Issue Date	: 30-MAY-2011
Site	: ----		
		No. of samples received	: 65
Quote number	: BN/060/11	No. of samples analysed	: 65

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.

WORLD RECOGNISED ACCREDITATION

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
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Inorganics
Myles.Clark	Acid Sulfate Soils Supervisor	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.**

Analytical Results

Sub-Matrix: **SOLID**

			Client sample ID	43723_209.5m-210m_OB	43723_213.12m-213.98m_OB	43723_217.92m-218.3m_Roof	43723_260.57m-261.14m_IB	43723_264.65m-265.15m_Floor
			Client sampling date / time	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00
Compound	*CAS Number*	*LOR*	*Unit*	EB1109393-001	EB1109393-002	EB1109393-003	EB1109393-004	EB1109393-005
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.8	9.5	9.6	9.9	9.6
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-12.3	-26.1	-26.0	-214	-38.6
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	569	661	397	649	382
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	14.4	28.4	27.1	216	40.1
^ ANC as CaCO3	----	0.1	% CaCO3	1.5	2.9	2.8	22.0	4.1
Fizz Rating	----	0	Fizz Unit	0	2	2	3	2
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.038	0.029	<0.005	0.039	0.017
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.07	0.07	0.03	0.06	0.05

Analytical Results

Sub-Matrix: SOLID			Client sample ID	43723_372m-372.5m_IB	43723_375m-375.48m_IB	43723_377m-377.5m_IB	43723_384m-384.5m_IB	43723_400.2m-400.7m_Floor
			Client sampling date / time	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00
Compound	CAS Number	LOR	Unit	EB1109393-006	EB1109393-007	EB1109393-008	EB1109393-009	EB1109393-010
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.8	9.6	9.7	9.7	9.7
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-42.4	-11.2	-37.6	-29.6	-6.8
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	523	363	467	493	340
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	44.4	12.3	39.5	30.9	7.6
^ ANC as CaCO3	----	0.1	% CaCO3	4.5	1.2	4.0	3.2	0.8
Fizz Rating	----	0	Fizz Unit	2	0	2	2	0
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.037	0.013	0.044	0.026	0.010
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.06	0.04	0.06	0.04	0.02

Analytical Results

Sub-Matrix: **SOLID**

Compound	CAS Number	LOR	Unit	43733_74m-74.5m_OB	43733_121.1m-121.4m_OB	4377_124.35m-124.71m_OB	43733_127.02m-127.5m_OB	43733_128.79m-129.29m_Roof
Client sampling date / time				11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00
				EB1109393-011	EB1109393-012	EB1109393-013	EB1109393-014	EB1109393-015
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.4	9.2	9.1	9.4	9.1
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-13.6	-31.1	-27.3	-163	-22.5
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	428	386	361	458	387
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	15.4	32.7	28.4	164	23.4
^ ANC as CaCO3	----	0.1	% CaCO3	1.6	3.3	2.9	16.7	2.4
Fizz Rating	----	0	Fizz Unit	0	2	2	3	2
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.015	0.009	0.019	0.008	0.011
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.06	0.05	0.04	0.03	0.03

Analytical Results

Sub-Matrix: **SOLID**			Client sample ID	43733_133.5m-134m_Floor	43733_135m-135.38m_IB	43733_214.5m-215_IB	43733_219.5m-220.04m_IB	43733_222.83m-223.38m_Roof
			Client sampling date / time	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1109393-016**	**EB1109393-017**	**EB1109393-018**	**EB1109393-019**	**EB1109393-020**
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**8.8**	**9.5**	**9.5**	**9.4**	**9.5**
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	**-12.1**	**-154**	**-37.5**	**-74.8**	**-39.4**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**481**	**432**	**390**	**453**	**421**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**16.1**	**158**	**38.3**	**75.9**	**40.1**
^ ANC as CaCO3	----	0.1	% CaCO3	**1.6**	**16.1**	**3.9**	**7.7**	**4.1**
Fizz Rating	----	0	Fizz Unit	**0**	**3**	**2**	**2**	**2**
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	**0.066**	**0.054**	**0.016**	**0.019**	**0.011**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.13**	**0.09**	**0.03**	**0.04**	**0.02**

Analytical Results

Sub-Matrix: SOLID			Client sample ID	43733_235m-235.43m_IB	43733_239.12m-239.5m_IB	43733_241.5m-241.98m_IB	43733_245.5m-246m_IB	43733_256m-256.36m_IB
			Client sampling date / time	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00
Compound	CAS Number	LOR	Unit	EB1109393-021	EB1109393-022	EB1109393-023	EB1109393-024	EB1109393-025
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.5	9.3	9.5	9.6	9.4
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-7.9	-29.4	-7.5	-56.2	-11.2
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	331	402	337	451	335
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	8.9	30.9	8.0	56.8	13.5
^ ANC as CaCO3	----	0.1	% CaCO3	0.9	3.2	0.8	5.8	1.4
Fizz Rating	----	0	Fizz Unit	0	2	0	2	0
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.014	0.029	0.023	0.007	0.010
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.03	0.05	0.02	0.02	0.07

Analytical Results

Sub-Matrix: **SOLID**

			Client sample ID	43733_267.2m-267.75m_IB	43733_279.66m-280m_Floor	43750_264.51m-265m_OB	43750_273m-273.5m_OB	43750_282.2m-282.5m_Floor
			Client sampling date / time	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00
Compound	*CAS Number*	*LOR*	*Unit*	EB1109393-026	EB1109393-027	EB1109393-028	EB1109393-029	EB1109393-030
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.4	9.5	9.9	9.7	9.5
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-25.6	-5.3	-27.4	-41.6	-8.2
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	402	333	572	579	311
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	26.5	7.2	29.0	43.2	9.8
^ ANC as CaCO3	----	0.1	% CaCO3	2.7	0.7	3.0	4.4	1.0
Fizz Rating	----	0	Fizz Unit	2	0	2	2	0
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.015	0.040	0.026	0.021	0.015
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.03	0.06	0.05	0.05	0.05

Analytical Results

Sub-Matrix: SOLID			Client sample ID	43750_284.5m-285m_IB	43750_361m-361.5m_IB	43750_364.9m-365.24m_IB	43750_366.5m-366.95m_IB	43750_368.69m-369.08m_Roof
			Client sampling date / time	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00
Compound	CAS Number	LOR	Unit	EB1109393-031	EB1109393-032	EB1109393-033	EB1109393-034	EB1109393-035
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.6	9.8	9.7	9.7	9.7
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-31.6	-182	-78.3	-86.5	-12.3
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	387	604	597	549	423
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	33.9	182	80.2	87.6	13.4
^ ANC as CaCO3	----	0.1	% CaCO3	3.4	18.6	8.2	8.9	1.4
Fizz Rating	----	0	Fizz Unit	2	3	2	2	0
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.016	<0.005	0.035	0.015	0.017
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.08	0.01	0.06	0.04	0.04

Analytical Results

Sub-Matrix: **SOLID**			Client sample ID	43750_378.5m-379m_ Floor	43750_383m-383.5m_ IB	43750_400m-400.5m_ IB	43750_404m-404.5m_ IB	43750_408m-408.43m _IB
			Client sampling date / time	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00
Compound	*CAS Number*	*LOR*	*Unit*	EB1109393-036	EB1109393-037	EB1109393-038	EB1109393-039	EB1109393-040
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.7	9.7	9.7	9.7	9.6
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-115	-160	-51.0	-17.0	-20.1
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	588	504	516	440	533
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	116	161	52.4	18.9	21.6
^ ANC as CaCO3	----	0.1	% CaCO3	11.8	16.4	5.3	1.9	2.2
Fizz Rating	----	0	Fizz Unit	2	3	2	0	2
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.013	0.007	0.023	0.006	0.015
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.05	0.06	0.05

Analytical Results

Sub-Matrix: SOLID			Client sample ID	43750_414.14m-414.47m_IB	43750_417m-417.34m_Roof	43765_228m-228.5m_OB	43765_241.5m-242m_IB	43765_322.5m-323m_IB
			Client sampling date / time	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00
Compound	CAS Number	LOR	Unit	EB1109393-041	EB1109393-042	EB1109393-043	EB1109393-044	EB1109393-045
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.7	9.9	9.4	9.8	9.6
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-162	-22.7	-74.6	-174	-26.6
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	499	363	471	529	414
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	162	23.4	75.9	175	27.8
^ ANC as CaCO3	----	0.1	% CaCO3	16.6	2.4	7.7	17.8	2.8
Fizz Rating	----	0	Fizz Unit	3	2	2	3	2
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.007	0.010	0.024	0.014	0.014
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.04	0.02	0.04

Analytical Results

Sub-Matrix: SOLID			Client sample ID	43765_324.6m-325.1m_IB	43765_337.6m-338.1m_IB	43765_385m-385.5m_IB	43765_389.5m-390m_IB	43765_390.8m-391.36m_IB
			Client sampling date / time	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00
Compound	CAS Number	LOR	Unit	EB1109393-046	EB1109393-047	EB1109393-048	EB1109393-049	EB1109393-050
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.8	9.8	9.5	9.8	9.6
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-49.8	-8.6	-26.9	-23.5	-34.3
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	416	286	302	321	432
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	50.6	9.8	27.8	24.7	35.8
^ ANC as CaCO3	----	0.1	% CaCO3	5.2	1.0	2.8	2.5	3.6
Fizz Rating	----	0	Fizz Unit	2	0	2	2	2
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	<0.005	0.031	0.024	0.015	0.034
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.03	0.04	0.03	0.04	0.05

Analytical Results

Sub-Matrix: SOLID			Client sample ID	43765_392.3m-392.63m_Roof	43893_177.5m-178m_OB	43893_182m-182.5m_OB	43893_186.96m-187.37m_Roof	43893_192.12m-192.62m_Floor
			Client sampling date / time	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00
Compound	CAS Number	LOR	Unit	EB1109393-051	EB1109393-052	EB1109393-053	EB1109393-054	EB1109393-055
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.6	10.0	9.8	8.1	9.9
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-10.6	-32.5	-31.4	2.7	-6.5
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	255	585	506	623	503
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	11.4	33.9	33.3	9.5	7.6
^ ANC as CaCO3	----	0.1	% CaCO3	1.2	3.4	3.4	1.0	0.8
Fizz Rating	----	0	Fizz Unit	0	2	2	0	0
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.013	0.024	0.043	0.341	0.023
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.03	0.05	0.06	0.40	0.04

Analytical Results

Sub-Matrix: SOLID			Client sample ID	43893_194m-194.5m_IB	43893_299.46m-299.94m_Roof	43893_307.57m-308.07m_Floor	43893_312m-312.5m_IB	43893_315.8m-316.3m_IB
			Client sampling date / time	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00
Compound	CAS Number	LOR	Unit	EB1109393-056	EB1109393-057	EB1109393-058	EB1109393-059	EB1109393-060
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	10.1	9.7	9.7	9.7	9.6
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-94.4	-4.1	-2.8	-67.8	-13.0
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	708	322	273	259	374
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	95.6	5.0	3.7	69.1	13.6
^ ANC as CaCO3	----	0.1	% CaCO3	9.8	0.5	0.4	7.0	1.4
Fizz Rating	----	0	Fizz Unit	2	0	0	2	0
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.024	0.007	0.021	0.039	0.014
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.04	0.03	0.03	0.04	0.02

Analytical Results

Sub-Matrix: **SOLID**			Client sample ID	43893_322.8m-323.3m_IB	43893_324.46m-324.88m_IB	43893_336m-336.38m_Floor	43893_357.09m-357.59m_Roof	43893_363.61m-364.11m_Floor
			Client sampling date / time	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00	11-MAY-2011 15:00
Compound	CAS Number	LOR	Unit	EB1109393-061	EB1109393-062	EB1109393-063	EB1109393-064	EB1109393-065
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.8	9.7	9.3	9.9	9.8
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-15.9	-9.3	-8.9	-10.4	-3.2
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	368	328	327	535	320
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	17.2	11.4	13.6	11.4	3.7
^ ANC as CaCO3	----	0.1	% CaCO3	1.8	1.2	1.4	1.2	0.4
Fizz Rating	----	0	Fizz Unit	0	0	0	0	0
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.033	0.030	0.135	0.014	0.007
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.04	0.07	0.15	0.03	0.02

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **EB1109393**	Page	: 1 of 7
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Customer Services
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Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 11-MAY-2011
Sampler	: Mike Jacobson	Issue Date	: 30-MAY-2011
Order number	: ----		
		No. of samples received	: 65
Quote number	: BN/060/11	No. of samples analysed	: 65

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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA
WORLD RECOGNISED ACCREDITATION

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
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Inorganics
Myles.Clark	Acid Sulfate Soils Supervisor	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.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
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
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA002 : pH (Soils) (QC Lot: 1792916)									
EB1109393-001	43723_209.5m-210m_OB	EA002: pH Value	----	0.1	pH Unit	9.8	9.8	0.0	0% - 20%
EB1109393-011	43733_74m-74.5m_OB	EA002: pH Value	----	0.1	pH Unit	9.4	9.4	0.0	0% - 20%
EA002 : pH (Soils) (QC Lot: 1792918)									
EB1109393-021	43733_235m-235.43m_IB	EA002: pH Value	----	0.1	pH Unit	9.5	9.4	0.0	0% - 20%
EB1109393-032	43750_361m-361.5m_IB	EA002: pH Value	----	0.1	pH Unit	9.8	9.8	0.0	0% - 20%
EA002 : pH (Soils) (QC Lot: 1792920)									
EB1109393-042	43750_417m-417.34m_Roof	EA002: pH Value	----	0.1	pH Unit	9.9	9.8	0.0	0% - 20%
EB1109393-052	43893_177.5m-178m_OB	EA002: pH Value	----	0.1	pH Unit	10.0	10.0	0.0	0% - 20%
EA002 : pH (Soils) (QC Lot: 1792924)									
EB1109393-062	43893_324.46m-324.88m_IB	EA002: pH Value	----	0.1	pH Unit	9.7	9.7	0.0	0% - 20%
EA002 : pH (Soils) (QC Lot: 1792930)									
EB1109393-028	43750_264.51m-265m_OB	EA002: pH Value	----	0.1	pH Unit	9.9	9.9	0.0	0% - 20%
EA010: Conductivity (QC Lot: 1792917)									
EB1109393-001	43723_209.5m-210m_OB	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	569	575	1.0	0% - 20%
EB1109393-011	43733_74m-74.5m_OB	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	428	423	1.2	0% - 20%
EA010: Conductivity (QC Lot: 1792919)									
EB1109393-021	43733_235m-235.43m_IB	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	331	332	0.3	0% - 20%
EB1109393-032	43750_361m-361.5m_IB	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	604	602	0.3	0% - 20%
EA010: Conductivity (QC Lot: 1792921)									
EB1109393-042	43750_417m-417.34m_Roof	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	363	360	0.8	0% - 20%
EB1109393-052	43893_177.5m-178m_OB	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	585	592	1.2	0% - 20%
EA010: Conductivity (QC Lot: 1792925)									
EB1109393-062	43893_324.46m-324.88m_IB	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	328	334	1.8	0% - 20%
EA010: Conductivity (QC Lot: 1792931)									
EB1109393-028	43750_264.51m-265m_OB	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	572	567	0.9	0% - 20%
EA013: Acid Neutralising Capacity (QC Lot: 1803076)									
EB1109393-001	43723_209.5m-210m_OB	EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	14.4	14.6	1.4	0% - 20%
EB1109393-012	43733_121.1m-121.4m_OB	EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	32.7	29.6	10.0	0% - 20%
EA013: Acid Neutralising Capacity (QC Lot: 1803078)									
EB1109393-021	43733_235m-235.43m_IB	EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	8.9	8.6	3.4	0% - 50%

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EA013: Acid Neutralising Capacity (QC Lot: 1803078) - continued									
EB1109393-032	43750_361m-361.5m_IB	EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	182	184	1.0	0% - 20%
EA013: Acid Neutralising Capacity (QC Lot: 1803080)									
EB1109393-041	43750_414.14m-414.47m_IB	EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	162	164	0.7	0% - 20%
EB1109393-052	43893_177.5m-178m_OB	EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	33.9	34.6	2.0	0% - 20%
EA013: Acid Neutralising Capacity (QC Lot: 1803082)									
EB1109393-061	43893_322.8m-323.3m_IB	EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	17.2	16.6	3.6	0% - 20%
EA026 : Chromium Reducible Sulfur (QC Lot: 1803077)									
EB1109393-001	43723_209.5m-210m_OB	EA026: Chromium Reducible Sulphur	----	0.005	%	0.038	0.037	0.0	No Limit
EB1109393-012	43733_121.1m-121.4m_OB	EA026: Chromium Reducible Sulphur	----	0.005	%	0.009	0.014	43.5	No Limit
EA026 : Chromium Reducible Sulfur (QC Lot: 1803079)									
EB1109393-021	43733_235m-235.43m_IB	EA026: Chromium Reducible Sulphur	----	0.005	%	0.014	0.012	15.4	No Limit
EB1109393-032	43750_361m-361.5m_IB	EA026: Chromium Reducible Sulphur	----	0.005	%	<0.005	<0.005	0.0	No Limit
EA026 : Chromium Reducible Sulfur (QC Lot: 1803081)									
EB1109393-041	43750_414.14m-414.47m_IB	EA026: Chromium Reducible Sulphur	----	0.005	%	0.007	0.006	0.0	No Limit
EB1109393-052	43893_177.5m-178m_OB	EA026: Chromium Reducible Sulphur	----	0.005	%	0.024	0.022	8.7	No Limit
EA026 : Chromium Reducible Sulfur (QC Lot: 1803083)									
EB1109393-061	43893_322.8m-323.3m_IB	EA026: Chromium Reducible Sulphur	----	0.005	%	0.033	0.034	0.0	No Limit
ED042T: Total Sulfur by LECO (QC Lot: 1803746)									
EB1109393-001	43723_209.5m-210m_OB	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.07	0.07	0.0	No Limit
EB1109393-010	43723_400.2m-400.7m_Floor	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.03	0.0	No Limit
ED042T: Total Sulfur by LECO (QC Lot: 1803747)									
EB1109393-021	43733_235m-235.43m_IB	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.03	0.03	0.0	No Limit
EB1109393-030	43750_282.2m-282.5m_Floor	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.05	0.05	0.0	No Limit
ED042T: Total Sulfur by LECO (QC Lot: 1803748)									
EB1109393-041	43750_414.14m-414.47m_IB	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.0	No Limit
EB1109393-050	43765_390.8m-391.36m_IB	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.05	0.05	0.0	No Limit
ED042T: Total Sulfur by LECO (QC Lot: 1803749)									
EB1109393-061	43893_322.8m-323.3m_IB	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.04	0.04	0.0	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002 : pH (Soils) (QCLot: 1792916)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	101	96	104
EA002 : pH (Soils) (QCLot: 1792918)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	101	96	104
EA002 : pH (Soils) (QCLot: 1792920)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	102	96	104
EA002 : pH (Soils) (QCLot: 1792924)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	100	96	104
EA002 : pH (Soils) (QCLot: 1792930)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	103	96	104
EA010: Conductivity (QCLot: 1792917)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	91.8	91	111
EA010: Conductivity (QCLot: 1792919)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	98.0	91	111
EA010: Conductivity (QCLot: 1792921)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	91.8	91	111
EA010: Conductivity (QCLot: 1792925)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	91.8	91	111
EA010: Conductivity (QCLot: 1792931)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	92.8	91	111
EA013: Acid Neutralising Capacity (QCLot: 1803076)								
EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	----	9.9 kg H2SO4/t	96.0	75	127
EA013: Acid Neutralising Capacity (QCLot: 1803078)								
EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	----	49 kg H2SO4/t	107	75	127
EA013: Acid Neutralising Capacity (QCLot: 1803080)								
EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	----	96.2 kg H2SO4/t	109	75	127
EA013: Acid Neutralising Capacity (QCLot: 1803082)								
EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	----	9.9 kg H2SO4/t	85.8	75	127
EA026 : Chromium Reducible Sulfur (QCLot: 1803077)								
EA026: Chromium Reducible Sulphur	----	0.005	%	<0.005	.28 %	82.3	80	120
EA026 : Chromium Reducible Sulfur (QCLot: 1803079)								
EA026: Chromium Reducible Sulphur	----	0.005	%	<0.005	.28 %	83.0	80	120
EA026 : Chromium Reducible Sulfur (QCLot: 1803081)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	High
EA026 : Chromium Reducible Sulfur (QCLot: 1803081) - continued								
EA026: Chromium Reducible Sulphur	----	0.005	%	<0.005	.28 %	83.0	80	120
EA026 : Chromium Reducible Sulfur (QCLot: 1803083)								
EA026: Chromium Reducible Sulphur	----	0.005	%	<0.005	.28 %	88.0	80	120
ED042T: Total Sulfur by LECO (QCLot: 1803746)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	100 %	101	70	130
ED042T: Total Sulfur by LECO (QCLot: 1803747)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	100 %	104	70	130
ED042T: Total Sulfur by LECO (QCLot: 1803748)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	100 %	93.1	70	130
ED042T: Total Sulfur by LECO (QCLot: 1803749)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	100 %	100	70	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) Results are required to be reported.**

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1109393**	Page	: 1 of 13
Client	: URS AUSTRALIA PTY LTD (QLD)	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Customer Services
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Telephone	: +61 32432111	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 11-MAY-2011
Sampler	: Mike Jacobson	Issue Date	: 30-MAY-2011
Order number	: ----		
		No. of samples received	: 65
Quote number	: BN/060/11	No. of samples analysed	: 65

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 Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non -volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation Date extracted	Due for extraction	Evaluation	Analysis Date analysed	Due for analysis	Evaluation
EA002 : pH (Soils)								
Pulp Bag								
43750_264.51m-265m_OB		**11-MAY-2011**	**25-MAY-2011**	18-MAY-2011	×	**28-MAY-2011**	25-MAY-2011	×
Snap Lock Bag								
43723_209.5m-210m_OB,	43723_213.12m-213.98m_OB,	**11-MAY-2011**	**25-MAY-2011**	18-MAY-2011	×	**27-MAY-2011**	25-MAY-2011	×
43723_217.92m-218.3m_Roof,	43723_260.57m-261.14m_IB,							
43723_264.65m-265.15m_Floor,	43723_372m-372.5m_IB,							
43723_375m-375.48m_IB,	43723_377m-377.5m_IB,							
43723_384m-384.5m_IB,	43723_400.2m-400.7m_Floor,							
43733_74m-74.5m_OB,	43733_121.1m-121.4m_OB,							
4377_124.35m-124.71m_OB,	43733_127.02m-127.5m_OB,							
43733_128.79m-129.29m_Roof,	43733_133.5m-134m_Floor,							
43733_135m-135.38m_IB,	43733_214.5m-215_IB,							
43733_219.5m-220.04m_IB,	43733_222.83m-223.38m_Roof,							
43733_235m-235.43m_IB,	43733_239.12m-239.5m_IB,							
43733_241.5m-241.98m_IB,	43733_245.5m-246m_IB,							
43733_256m-256.36m_IB,	43733_267.2m-267.75m_IB,							
43733_279.66m-280m_Floor,	43750_273m-273.5m_OB,							
43750_282.2m-282.5m_Floor,	43750_284.5m-285m_IB,							
43750_361m-361.5m_IB,	43750_364.9m-365.24m_IB,							
43750_366.5m-366.95m_IB,	43750_368.69m-369.08m_Roof,							
43750_378.5m-379m_Floor,	43750_383m-383.5m_IB,							
43750_400m-400.5m_IB,	43750_404m-404.5m_IB,							
43750_408m-408.43m_IB,	43750_414.14m-414.47m_IB							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA002 : pH (Soils) - Continued								
Snap Lock Bag								
43750_417m-417.34m_Roof,	43765_228m-228.5m_OB,	**11-MAY-2011**	**25-MAY-2011**	18-MAY-2011	×	**28-MAY-2011**	25-MAY-2011	×
43765_241.5m-242m_IB,	43765_322.5m-323m_IB,							
43765_324.6m-325.1m_IB,	43765_337.6m-338.1m_IB,							
43765_385m-385.5m_IB,	43765_389.5m-390m_IB,							
43765_390.8m-391.36m_IB,	43765_392.3m-392.63m_Roof,							
43893_177.5m-178m_OB,	43893_182m-182.5m_OB,							
43893_186.96m-187.37m_Roof,	43893_192.12m-192.62m_Floor,							
43893_194m-194.5m_IB,	43893_299.46m-299.94m_Roof,							
43893_307.57m-308.07m_Floor,	43893_312m-312.5m_IB,							
43893_315.8m-316.3m_IB,	43893_322.8m-323.3m_IB,							
43893_324.46m-324.88m_IB,	43893_336m-336.38m_Floor,							
43893_357.09m-357.59m_Roof,	43893_363.61m-364.11m_Floor							

Matrix: **SOIL**

Evaluation: ✘ = Holding time breach ; ✓ = Within holding time.

Method / *Container / Client Sample ID(s)*		*Sample Date*	*Extraction / Preparation* - *Date extracted*	*Due for extraction*	*Evaluation*	*Analysis* - *Date analysed*	*Due for analysis*	*Evaluation*
EA010: Conductivity								
Pulp Bag								
43750_264.51m-265m_OB		**11-MAY-2011**	**25-MAY-2011**	18-MAY-2011	✘	**28-MAY-2011**	22-JUN-2011	✓
Snap Lock Bag								
43723_209.5m-210m_OB,	43723_213.12m-213.98m_OB,	**11-MAY-2011**	**25-MAY-2011**	18-MAY-2011	✘	**27-MAY-2011**	22-JUN-2011	✓
43723_217.92m-218.3m_Roof,	43723_260.57m-261.14m_IB,							
43723_264.65m-265.15m_Floor,	43723_372m-372.5m_IB,							
43723_375m-375.48m_IB,	43723_377m-377.5m_IB,							
43723_384m-384.5m_IB,	43723_400.2m-400.7m_Floor,							
43733_74m-74.5m_OB,	43733_121.1m-121.4m_OB,							
4377_124.35m-124.71m_OB,	43733_127.02m-127.5m_OB,							
43733_128.79m-129.29m_Roof,	43733_133.5m-134m_Floor,							
43733_135m-135.38m_IB,	43733_214.5m-215_IB,							
43733_219.5m-220.04m_IB,	43733_222.83m-223.38m_Roof,							
43733_235m-235.43m_IB,	43733_239.12m-239.5m_IB,							
43733_241.5m-241.98m_IB,	43733_245.5m-246m_IB,							
43733_256m-256.36m_IB,	43733_267.2m-267.75m_IB,							
43733_279.66m-280m_Floor,	43750_273m-273.5m_OB,							
43750_282.2m-282.5m_Floor,	43750_284.5m-285m_IB,							
43750_361m-361.5m_IB,	43750_364.9m-365.24m_IB,							
43750_366.5m-366.95m_IB,	43750_368.69m-369.08m_Roof,							
43750_378.5m-379m_Floor,	43750_383m-383.5m_IB,							
43750_400m-400.5m_IB,	43750_404m-404.5m_IB,							
43750_408m-408.43m_IB,	43750_414.14m-414.47m_IB							
Snap Lock Bag								
43750_417m-417.34m_Roof,	43765_228m-228.5m_OB,	**11-MAY-2011**	**25-MAY-2011**	18-MAY-2011	✘	**28-MAY-2011**	22-JUN-2011	✓
43765_241.5m-242m_IB,	43765_322.5m-323m_IB,							
43765_324.6m-325.1m_IB,	43765_337.6m-338.1m_IB,							
43765_385m-385.5m_IB,	43765_389.5m-390m_IB,							
43765_390.8m-391.36m_IB,	43765_392.3m-392.63m_Roof,							
43893_177.5m-178m_OB,	43893_182m-182.5m_OB,							
43893_186.96m-187.37m_Roof,	43893_192.12m-192.62m_Floor,							
43893_194m-194.5m_IB,	43893_299.46m-299.94m_Roof,							
43893_307.57m-308.07m_Floor,	43893_312m-312.5m_IB,							
43893_315.8m-316.3m_IB,	43893_322.8m-323.3m_IB,							
43893_324.46m-324.88m_IB,	43893_336m-336.38m_Floor,							
43893_357.09m-357.59m_Roof,	43893_363.61m-364.11m_Floor							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	*Sample Date*	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		*Date extracted*	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EA013: Acid Neutralising Capacity							
Pulp Bag							
43723_209.5m-210m_OB, 43723_213.12m-213.98m_OB, 43723_217.92m-218.3m_Roof, 43723_260.57m-261.14m_IB, 43723_264.65m-265.15m_Floor, 43723_372m-372.5m_IB, 43723_375m-375.48m_IB, 43723_377m-377.5m_IB, 43723_384m-384.5m_IB, 43723_400.2m-400.7m_Floor, 43733_74m-74.5m_OB, 43733_121.1m-121.4m_OB, 4377_124.35m-124.71m_OB, 43733_127.02m-127.5m_OB, 43733_128.79m-129.29m_Roof, 43733_133.5m-134m_Floor, 43733_135m-135.38m_IB, 43733_214.5m-215_IB, 43733_219.5m-220.04m_IB, 43733_222.83m-223.38m_Roof, 43733_235m-235.43m_IB, 43733_239.12m-239.5m_IB, 43733_241.5m-241.98m_IB, 43733_245.5m-246m_IB, 43733_256m-256.36m_IB, 43733_267.2m-267.75m_IB, 43733_279.66m-280m_Floor, 43750_264.51m-265m_OB, 43750_273m-273.5m_OB, 43750_282.2m-282.5m_Floor, 43750_284.5m-285m_IB, 43750_361m-361.5m_IB, 43750_364.9m-365.24m_IB, 43750_366.5m-366.95m_IB, 43750_368.69m-369.08m_Roof, 43750_378.5m-379m_Floor, 43750_383m-383.5m_IB, 43750_400m-400.5m_IB, 43750_404m-404.5m_IB, 43750_408m-408.43m_IB, 43750_414.14m-414.47m_IB, 43750_417m-417.34m_Roof, 43765_228m-228.5m_OB, 43765_241.5m-242m_IB, 43765_322.5m-323m_IB, 43765_324.6m-325.1m_IB, 43765_337.6m-338.1m_IB, 43765_385m-385.5m_IB, 43765_389.5m-390m_IB, 43765_390.8m-391.36m_IB, 43765_392.3m-392.63m_Roof, 43893_177.5m-178m_OB, 43893_182m-182.5m_OB, 43893_186.96m-187.37m_Roof, 43893_192.12m-192.62m_Floor, 43893_194m-194.5m_IB, 43893_299.46m-299.94m_Roof, 43893_307.57m-308.07m_Floor, 43893_312m-312.5m_IB, 43893_315.8m-316.3m_IB, 43893_322.8m-323.3m_IB, 43893_324.46m-324.88m_IB, 43893_336m-336.38m_Floor, 43893_357.09m-357.59m_Roof, 43893_363.61m-364.11m_Floor	**11-MAY-2011**	**25-MAY-2011**	10-MAY-2012	✓	**27-MAY-2011**	21-NOV-2011	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA026 : Chromium Reducible Sulfur								
Pulp Bag								
43750_264.51m-265m_OB		**11-MAY-2011**	**25-MAY-2011**	10-MAY-2012	✓	**27-MAY-2011**	23-AUG-2011	✓
Snap Lock Bag								
43723_209.5m-210m_OB,	43723_213.12m-213.98m_OB,	**11-MAY-2011**	**25-MAY-2011**	12-MAY-2011	×	**27-MAY-2011**	23-AUG-2011	✓
43723_217.92m-218.3m_Roof,	43723_260.57m-261.14m_IB,							
43723_264.65m-265.15m_Floor,	43723_372m-372.5m_IB,							
43723_375m-375.48m_IB,	43723_377m-377.5m_IB,							
43723_384m-384.5m_IB,	43723_400.2m-400.7m_Floor,							
43733_74m-74.5m_OB,	43733_121.1m-121.4m_OB,							
4377_124.35m-124.71m_OB,	43733_127.02m-127.5m_OB,							
43733_128.79m-129.29m_Roof,	43733_133.5m-134m_Floor,							
43733_135m-135.38m_IB,	43733_214.5m-215_IB,							
43733_219.5m-220.04m_IB,	43733_222.83m-223.38m_Roof,							
43733_235m-235.43m_IB,	43733_239.12m-239.5m_IB,							
43733_241.5m-241.98m_IB,	43733_245.5m-246m_IB,							
43733_256m-256.36m_IB,	43733_267.2m-267.75m_IB,							
43733_279.66m-280m_Floor,	43750_273m-273.5m_OB,							
43750_282.2m-282.5m_Floor,	43750_284.5m-285m_IB,							
43750_361m-361.5m_IB,	43750_364.9m-365.24m_IB,							
43750_366.5m-366.95m_IB,	43750_368.69m-369.08m_Roof,							
43750_378.5m-379m_Floor,	43750_383m-383.5m_IB,							
43750_400m-400.5m_IB,	43750_404m-404.5m_IB,							
43750_408m-408.43m_IB,	43750_414.14m-414.47m_IB,							
43750_417m-417.34m_Roof,	43765_228m-228.5m_OB,							
43765_241.5m-242m_IB,	43765_322.5m-323m_IB,							
43765_324.6m-325.1m_IB,	43765_337.6m-338.1m_IB,							
43765_385m-385.5m_IB,	43765_389.5m-390m_IB,							
43765_390.8m-391.36m_IB,	43765_392.3m-392.63m_Roof,							
43893_177.5m-178m_OB,	43893_182m-182.5m_OB,							
43893_186.96m-187.37m_Roof,	43893_192.12m-192.62m_Floor,							
43893_194m-194.5m_IB,	43893_299.46m-299.94m_Roof,							
43893_307.57m-308.07m_Floor,	43893_312m-312.5m_IB,							
43893_315.8m-316.3m_IB,	43893_322.8m-323.3m_IB,							
43893_324.46m-324.88m_IB,	43893_336m-336.38m_Floor,							
43893_357.09m-357.59m_Roof,	43893_363.61m-364.11m_Floor							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED042T: Total Sulfur by LECO							
Pulp Bag							
43723_209.5m-210m_OB, 43723_213.12m-213.98m_OB, 43723_217.92m-218.3m_Roof, 43723_260.57m-261.14m_IB, 43723_264.65m-265.15m_Floor, 43723_372m-372.5m_IB, 43723_375m-375.48m_IB, 43723_377m-377.5m_IB, 43723_384m-384.5m_IB, 43723_400.2m-400.7m_Floor, 43733_74m-74.5m_OB, 43733_121.1m-121.4m_OB, 4377_124.35m-124.71m_OB, 43733_127.02m-127.5m_OB, 43733_128.79m-129.29m_Roof, 43733_133.5m-134m_Floor, 43733_135m-135.38m_IB, 43733_214.5m-215_IB, 43733_219.5m-220.04m_IB, 43733_222.83m-223.38m_Roof, 43733_235m-235.43m_IB, 43733_239.12m-239.5m_IB, 43733_241.5m-241.98m_IB, 43733_245.5m-246m_IB, 43733_256m-256.36m_IB, 43733_267.2m-267.75m_IB, 43733_279.66m-280m_Floor, 43750_264.51m-265m_OB, 43750_273m-273.5m_OB, 43750_282.2m-282.5m_Floor, 43750_284.5m-285m_IB, 43750_361m-361.5m_IB, 43750_364.9m-365.24m_IB, 43750_366.5m-366.95m_IB, 43750_368.69m-369.08m_Roof, 43750_378.5m-379m_Floor, 43750_383m-383.5m_IB, 43750_400m-400.5m_IB, 43750_404m-404.5m_IB, 43750_408m-408.43m_IB, 43750_414.14m-414.47m_IB, 43750_417m-417.34m_Roof, 43765_228m-228.5m_OB, 43765_241.5m-242m_IB, 43765_322.5m-323m_IB, 43765_324.6m-325.1m_IB, 43765_337.6m-338.1m_IB, 43765_385m-385.5m_IB, 43765_389.5m-390m_IB, 43765_390.8m-391.36m_IB, 43765_392.3m-392.63m_Roof, 43893_177.5m-178m_OB, 43893_182m-182.5m_OB, 43893_186.96m-187.37m_Roof, 43893_192.12m-192.62m_Floor, 43893_194m-194.5m_IB, 43893_299.46m-299.94m_Roof, 43893_307.57m-308.07m_Floor, 43893_312m-312.5m_IB, 43893_315.8m-316.3m_IB, 43893_322.8m-323.3m_IB, 43893_324.46m-324.88m_IB, 43893_336m-336.38m_Floor, 43893_357.09m-357.59m_Roof, 43893_363.61m-364.11m_Floor	**11-MAY-2011**	**25-MAY-2011**	07-NOV-2011	✓	**25-MAY-2011**	07-NOV-2011	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Acid Neutralising Capacity (ANC)	EA013	7	65	**10.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chromium Reducible Sulphur	EA026	7	65	**10.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	8	65	**12.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	8	65	**12.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfur - Total as S (LECO)	ED042T	7	65	**10.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Acid Neutralising Capacity (ANC)	EA013	4	65	**6.2**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chromium Reducible Sulphur	EA026	4	65	**6.2**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	5	65	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	5	65	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfur - Total as S (LECO)	ED042T	4	65	**6.2**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chromium Reducible Sulphur	EA026	4	65	**6.2**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	5	65	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfur - Total as S (LECO)	ED042T	4	65	**6.2**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
pH (1:5)	EA002	SOIL	(APHA 21st ed., 4500H+) pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 103)
Net Acid Production Potential	EA009	SOIL	Coastech Research (Canada)(Mod.). NAPP = Acid Production Potential (APP or MAP- Maximum Acid Potential) minus Neutralising Capacity (ANC). NAPP may be +ve, zero or -ve.
Electrical Conductivity (1:5)	EA010	SOIL	(APHA 21st ed., 2510) Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 104)
Acid Neutralising Capacity (ANC)	EA013	SOIL	USEPA 600/2-78-054, I. Miller (2000). A fizz test is done to semiquanititatively estimate the likely reactivity. The soil is then reacted with an known excess quanitity of an appropriate acid. Titration determines the acid remaining, and the ANC can be calculated from comparison with a blank titration.
Chromium Reducible Sulphur	EA026	SOIL	Sullivan et al (1998) The CRS method converts reduced inorganic sulfur to H2S by CrCl2 solution ; the evolved H2S is trapped in a zinc acetate solution as ZnS which is quantified by iodometric titration.
Sulfur - Total as S (LECO)	ED042T	SOIL	In-house. Dried and pulverised sample is combusted in a LECO furnace at 1350C in the presence of strong oxidants / catalysts. The evolved S (as SO2) is measured by infra-red detector

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **SOIL**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	**Days overdue**	Date analysed	Due for analysis	**Days overdue**
EA002 : pH (Soils)							
Pulp Bag							
43750_264.51m-265m_OB		25-MAY-2011	18-MAY-2011	**7**	28-MAY-2011	25-MAY-2011	**3**
Snap Lock Bag							
43723_209.5m-210m_OB,	43723_213.12m-213.98m_OB,	25-MAY-2011	18-MAY-2011	**7**	27-MAY-2011	25-MAY-2011	**2**
43723_217.92m-218.3m_Roof,	43723_260.57m-261.14m_IB,						
43723_264.65m-265.15m_Floor,	43723_372m-372.5m_IB,						
43723_375m-375.48m_IB,	43723_377m-377.5m_IB,						
43723_384m-384.5m_IB,	43723_400.2m-400.7m_Floor,						
43733_74m-74.5m_OB,	43733_121.1m-121.4m_OB,						
4377_124.35m-124.71m_OB,	43733_127.02m-127.5m_OB,						
43733_128.79m-129.29m_Roof,	43733_133.5m-134m_Floor,						
43733_135m-135.38m_IB,	43733_214.5m-215_IB,						
43733_219.5m-220.04m_IB,	43733_222.83m-223.38m_Roof,						
43733_235m-235.43m_IB,	43733_239.12m-239.5m_IB,						
43733_241.5m-241.98m_IB,	43733_245.5m-246m_IB,						
43733_256m-256.36m_IB,	43733_267.2m-267.75m_IB,						
43733_279.66m-280m_Floor,	43750_273m-273.5m_OB,						
43750_282.2m-282.5m_Floor,	43750_284.5m-285m_IB,						
43750_361m-361.5m_IB,	43750_364.9m-365.24m_IB,						
43750_366.5m-366.95m_IB,	43750_368.69m-369.08m_Roof,						
43750_378.5m-379m_Floor,	43750_383m-383.5m_IB,						
43750_400m-400.5m_IB,	43750_404m-404.5m_IB,						
43750_408m-408.43m_IB,	43750_414.14m-414.47m_IB						

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)	*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EA002 : pH (Soils) - Analysis Holding Time Compliance						
Snap Lock Bag 43750_417m-417.34m_Roof, 43765_228m-228.5m_OB, 43765_241.5m-242m_IB, 43765_322.5m-323m_IB, 43765_324.6m-325.1m_IB, 43765_337.6m-338.1m_IB, 43765_385m-385.5m_IB, 43765_389.5m-390m_IB, 43765_390.8m-391.36m_IB, 43765_392.3m-392.63m_Roof, 43893_177.5m-178m_OB, 43893_182m-182.5m_OB, 43893_186.96m-187.37m_Roof, 43893_192.12m-192.62m_Floor, 43893_194m-194.5m_IB, 43893_299.46m-299.94m_Roof, 43893_307.57m-308.07m_Floor, 43893_312m-312.5m_IB, 43893_315.8m-316.3m_IB, 43893_322.8m-323.3m_IB, 43893_324.46m-324.88m_IB, 43893_336m-336.38m_Floor, 43893_357.09m-357.59m_Roof, 43893_363.61m-364.11m_Floor	25-MAY-2011	18-MAY-2011	**7**	28-MAY-2011	25-MAY-2011	**3**
EA010: Conductivity						
Pulp Bag 43750_264.51m-265m_OB	25-MAY-2011	18-MAY-2011	**7**	----	----	----
Snap Lock Bag 43723_209.5m-210m_OB, 43723_213.12m-213.98m_OB, 43723_217.92m-218.3m_Roof, 43723_260.57m-261.14m_IB, 43723_264.65m-265.15m_Floor, 43723_372m-372.5m_IB, 43723_375m-375.48m_IB, 43723_377m-377.5m_IB, 43723_384m-384.5m_IB, 43723_400.2m-400.7m_Floor, 43733_74m-74.5m_OB, 43733_121.1m-121.4m_OB, 4377_124.35m-124.71m_OB, 43733_127.02m-127.5m_OB, 43733_128.79m-129.29m_Roof, 43733_133.5m-134m_Floor, 43733_135m-135.38m_IB, 43733_214.5m-215_IB, 43733_219.5m-220.04m_IB, 43733_222.83m-223.38m_Roof, 43733_235m-235.43m_IB, 43733_239.12m-239.5m_IB, 43733_241.5m-241.98m_IB, 43733_245.5m-246m_IB, 43733_256m-256.36m_IB, 43733_267.2m-267.75m_IB, 43733_279.66m-280m_Floor, 43750_273m-273.5m_OB, 43750_282.2m-282.5m_Floor, 43750_284.5m-285m_IB, 43750_361m-361.5m_IB, 43750_364.9m-365.24m_IB, 43750_366.5m-366.95m_IB, 43750_368.69m-369.08m_Roof, 43750_378.5m-379m_Floor, 43750_383m-383.5m_IB, 43750_400m-400.5m_IB, 43750_404m-404.5m_IB, 43750_408m-408.43m_IB, 43750_414.14m-414.47m_IB	25-MAY-2011	18-MAY-2011	**7**	----	----	----

Matrix: **SOIL**

Method / Container / Client Sample ID(s)		Extraction / Preparation: Date extracted	Due for extraction	Days overdue	Analysis: Date analysed	Due for analysis	Days overdue
EA010: Conductivity - Analysis Holding Time Compliance							
Snap Lock Bag							
43750_417m-417.34m_Roof, 43765_241.5m-242m_IB, 43765_324.6m-325.1m_IB, 43765_385m-385.5m_IB, 43765_390.8m-391.36m_IB, 43893_177.5m-178m_OB, 43893_186.96m-187.37m_Roof, 43893_194m-194.5m_IB, 43893_307.57m-308.07m_Floor, 43893_315.8m-316.3m_IB, 43893_324.46m-324.88m_IB, 43893_357.09m-357.59m_Roof,	43765_228m-228.5m_OB, 43765_322.5m-323m_IB, 43765_337.6m-338.1m_IB, 43765_389.5m-390m_IB, 43765_392.3m-392.63m_Roof, 43893_182m-182.5m_OB, 43893_192.12m-192.62m_Floor, 43893_299.46m-299.94m_Roof, 43893_312m-312.5m_IB, 43893_322.8m-323.3m_IB, 43893_336m-336.38m_Floor, 43893_363.61m-364.11m_Floor	25-MAY-2011	18-MAY-2011	**7**	----	----	----
EA026 : Chromium Reducible Sulfur							

Matrix: **SOIL**

Method		Extraction / Preparation			Analysis		
Container / Client Sample ID(s)		Date extracted	Due for extraction	**Days overdue**	Date analysed	Due for analysis	**Days overdue**
EA026 : Chromium Reducible Sulfur - Analysis Holding Time Compliance							
Snap Lock Bag							
43723_209.5m-210m_OB,	43723_213.12m-213.98m_OB,	25-MAY-2011	12-MAY-2011	**13**	----	----	----
43723_217.92m-218.3m_Roof,	43723_260.57m-261.14m_IB,						
43723_264.65m-265.15m_Floor,	43723_372m-372.5m_IB,						
43723_375m-375.48m_IB,	43723_377m-377.5m_IB,						
43723_384m-384.5m_IB,	43723_400.2m-400.7m_Floor,						
43733_74m-74.5m_OB,	43733_121.1m-121.4m_OB,						
4377_124.35m-124.71m_OB,	43733_127.02m-127.5m_OB,						
43733_128.79m-129.29m_Roof,	43733_133.5m-134m_Floor,						
43733_135m-135.38m_IB,	43733_214.5m-215_IB,						
43733_219.5m-220.04m_IB,	43733_222.83m-223.38m_Roof,						
43733_235m-235.43m_IB,	43733_239.12m-239.5m_IB,						
43733_241.5m-241.98m_IB,	43733_245.5m-246m_IB,						
43733_256m-256.36m_IB,	43733_267.2m-267.75m_IB,						
43733_279.66m-280m_Floor,	43750_273m-273.5m_OB,						
43750_282.2m-282.5m_Floor,	43750_284.5m-285m_IB,						
43750_361m-361.5m_IB,	43750_364.9m-365.24m_IB,						
43750_366.5m-366.95m_IB,	43750_368.69m-369.08m_Roof,						
43750_378.5m-379m_Floor,	43750_383m-383.5m_IB,						
43750_400m-400.5m_IB,	43750_404m-404.5m_IB,						
43750_408m-408.43m_IB,	43750_414.14m-414.47m_IB,						
43750_417m-417.34m_Roof,	43765_228m-228.5m_OB,						
43765_241.5m-242m_IB,	43765_322.5m-323m_IB,						
43765_324.6m-325.1m_IB,	43765_337.6m-338.1m_IB,						
43765_385m-385.5m_IB,	43765_389.5m-390m_IB,						
43765_390.8m-391.36m_IB,	43765_392.3m-392.63m_Roof,						
43893_177.5m-178m_OB,	43893_182m-182.5m_OB,						
43893_186.96m-187.37m_Roof,	43893_192.12m-192.62m_Floor,						
43893_194m-194.5m_IB,	43893_299.46m-299.94m_Roof,						
43893_307.57m-308.07m_Floor,	43893_312m-312.5m_IB,						
43893_315.8m-316.3m_IB,	43893_322.8m-323.3m_IB,						
43893_324.46m-324.88m_IB,	43893_336m-336.38m_Floor,						
43893_357.09m-357.59m_Roof,	43893_363.61m-364.11m_Floor						

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order : **EB1109393**

Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Customer Services
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: Brisbane.Enviro.Services@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7222
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	Page	: 1 of 4
Order number	: ----		
C-O-C number	: ----	Quote number	: EB2011URSQLD0327 (BN/060/11)
Site	: ----		
Sampler	: Mike Jacobson	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 11-MAY-2011	Issue Date	: 17-MAY-2011 13:11
Client Requested Due Date	: 30-MAY-2011	Scheduled Reporting Date	: **30-MAY-2011**

Delivery Details

Mode of Delivery	: Carrier	Temperature	: AMBIENT
No. of coolers/boxes	: 1 PALLET (2X DRUMS)	No. of samples received	: 65
Security Seal	: Intact.	No. of samples analysed	: 65

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Requested Deliverables
- Samples received in appropriately pretreated and preserved containers.
- Turnaround time has been extended due to additional preparation requirements (Jaw Crushing, Splitting etc).
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

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

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

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.

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - ASS1 NAPP	SOIL - EA002 pH (1:5)	SOIL - EA010 (solids): Electrical Conductivity (1:5) Electrical Conductivity (1:5)	SOIL - EA026 Chromium Reducible Sulphur
EB1109393-001	11-MAY-2011 15:00	43723_209.5m-210m_OB	✓	✓	✓	✓
EB1109393-002	11-MAY-2011 15:00	43723_213.12m-213.98.	✓	✓	✓	✓
EB1109393-003	11-MAY-2011 15:00	43723_217.92m-218.3m.	✓	✓	✓	✓
EB1109393-004	11-MAY-2011 15:00	43723_260.57m-261.14.	✓	✓	✓	✓
EB1109393-005	11-MAY-2011 15:00	43723_264.65m-265.15.	✓	✓	✓	✓
EB1109393-006	11-MAY-2011 15:00	43723_372m-372.5m_IB	✓	✓	✓	✓
EB1109393-007	11-MAY-2011 15:00	43723_375m-375.48m_IB	✓	✓	✓	✓
EB1109393-008	11-MAY-2011 15:00	43723_377m-377.5m_IB	✓	✓	✓	✓
EB1109393-009	11-MAY-2011 15:00	43723_384m-384.5m_IB	✓	✓	✓	✓
EB1109393-010	11-MAY-2011 15:00	43723_400.2m-400.7m_.	✓	✓	✓	✓
EB1109393-011	11-MAY-2011 15:00	43733_74m-74.5m_OB	✓	✓	✓	✓
EB1109393-012	11-MAY-2011 15:00	43733_121.1m-121.4m_.	✓	✓	✓	✓
EB1109393-013	11-MAY-2011 15:00	4377_124.35m-124.71m.	✓	✓	✓	✓
EB1109393-014	11-MAY-2011 15:00	43733_127.02m-127.5m.	✓	✓	✓	✓
EB1109393-015	11-MAY-2011 15:00	43733_128.79m-129.29.	✓	✓	✓	✓
EB1109393-016	11-MAY-2011 15:00	43733_133.5m-134m_FI.	✓	✓	✓	✓
EB1109393-017	11-MAY-2011 15:00	43733_135m-135.38m_IB	✓	✓	✓	✓
EB1109393-018	11-MAY-2011 15:00	43733_214.5m-215_IB	✓	✓	✓	✓
EB1109393-019	11-MAY-2011 15:00	43733_219.5m-220.04m.	✓	✓	✓	✓
EB1109393-020	11-MAY-2011 15:00	43733_222.83m-223.38.	✓	✓	✓	✓
EB1109393-021	11-MAY-2011 15:00	43733_235m-235.43m_IB	✓	✓	✓	✓
EB1109393-022	11-MAY-2011 15:00	43733_239.12m-239.5m.	✓	✓	✓	✓
EB1109393-023	11-MAY-2011 15:00	43733_241.5m-241.98m.	✓	✓	✓	✓
EB1109393-024	11-MAY-2011 15:00	43733_245.5m-246m_IB	✓	✓	✓	✓
EB1109393-025	11-MAY-2011 15:00	43733_256m-256.36m_IB	✓	✓	✓	✓
EB1109393-026	11-MAY-2011 15:00	43733_267.2m-267.75m.	✓	✓	✓	✓
EB1109393-027	11-MAY-2011 15:00	43733_279.66m-280m_F	✓	✓	✓	✓
EB1109393-028	11-MAY-2011 15:00	43750_264.51m-265m_O	✓	✓	✓	✓
EB1109393-029	11-MAY-2011 15:00	43750_273m-273.5m_OB	✓	✓	✓	✓
EB1109393-030	11-MAY-2011 15:00	43750_282.2m-282.5m_.	✓	✓	✓	✓
EB1109393-031	11-MAY-2011 15:00	43750_284.5m-285m_IB	✓	✓	✓	✓
EB1109393-032	11-MAY-2011 15:00	43750_361m-361.5m_IB	✓	✓	✓	✓
EB1109393-033	11-MAY-2011 15:00	43750_364.9m-365.24m.	✓	✓	✓	✓
EB1109393-034	11-MAY-2011 15:00	43750_366.5m-366.95m.	✓	✓	✓	✓
EB1109393-035	11-MAY-2011 15:00	43750_368.69m-369.08.	✓	✓	✓	✓

			SOIL - ASS1 NAPP	SOIL - EA002 pH (1:5)	SOIL - EA010 (solids): Electrical Conductivity (1:5) Electrical Conductivity (1:5)	SOIL - EA026 Chromium Reducible Sulphur
EB1109393-036	11-MAY-2011 15:00	43750_378.5m-379m_Fl.	✓	✓	✓	✓
EB1109393-037	11-MAY-2011 15:00	43750_383m-383.5m_IB	✓	✓	✓	✓
EB1109393-038	11-MAY-2011 15:00	43750_400m-400.5m_IB	✓	✓	✓	✓
EB1109393-039	11-MAY-2011 15:00	43750_404m-404.5m_IB	✓	✓	✓	✓
EB1109393-040	11-MAY-2011 15:00	43750_408m-408.43m_IB	✓	✓	✓	✓
EB1109393-041	11-MAY-2011 15:00	43750_414.14m-414.47.	✓	✓	✓	✓
EB1109393-042	11-MAY-2011 15:00	43750_417m-417.34m_R	✓	✓	✓	✓
EB1109393-043	11-MAY-2011 15:00	43765_228m-228.5m_OB	✓	✓	✓	✓
EB1109393-044	11-MAY-2011 15:00	43765_241.5m-242m_IB	✓	✓	✓	✓
EB1109393-045	11-MAY-2011 15:00	43765_322.5m-323m_IB	✓	✓	✓	✓
EB1109393-046	11-MAY-2011 15:00	43765_324.6m-325.1m_.	✓	✓	✓	✓
EB1109393-047	11-MAY-2011 15:00	43765_337.6m-338.1m_.	✓	✓	✓	✓
EB1109393-048	11-MAY-2011 15:00	43765_385m-385.5m_IB	✓	✓	✓	✓
EB1109393-049	11-MAY-2011 15:00	43765_389.5m-390m_IB	✓	✓	✓	✓
EB1109393-050	11-MAY-2011 15:00	43765_390.8m-391.36m.	✓	✓	✓	✓
EB1109393-051	11-MAY-2011 15:00	43765_392.3m-392.63m.	✓	✓	✓	✓
EB1109393-052	11-MAY-2011 15:00	43893_177.5m-178m_OB	✓	✓	✓	✓
EB1109393-053	11-MAY-2011 15:00	43893_182m-182.5m_OB	✓	✓	✓	✓
EB1109393-054	11-MAY-2011 15:00	43893_186.96m-187.37.	✓	✓	✓	✓
EB1109393-055	11-MAY-2011 15:00	43893_192.12m-192.62.	✓	✓	✓	✓
EB1109393-056	11-MAY-2011 15:00	43893_194m-194.5m_IB	✓	✓	✓	✓
EB1109393-057	11-MAY-2011 15:00	43893_299.46m-299.94.	✓	✓	✓	✓
EB1109393-058	11-MAY-2011 15:00	43893_307.57m-308.07.	✓	✓	✓	✓
EB1109393-059	11-MAY-2011 15:00	43893_312m-312.5m_IB	✓	✓	✓	✓
EB1109393-060	11-MAY-2011 15:00	43893_315.8m-316.3m_.	✓	✓	✓	✓
EB1109393-061	11-MAY-2011 15:00	43893_322.8m-323.3m_.	✓	✓	✓	✓
EB1109393-062	11-MAY-2011 15:00	43893_324.46m-324.88.	✓	✓	✓	✓
EB1109393-063	11-MAY-2011 15:00	43893_336m-336.38m_F	✓	✓	✓	✓
EB1109393-064	11-MAY-2011 15:00	43893_357.09m-357.59.	✓	✓	✓	✓
EB1109393-065	11-MAY-2011 15:00	43893_363.61m-364.11.	✓	✓	✓	✓

Requested Deliverables

DR TONY JONG		
- *AU Certificate of Analysis - NATA (COA)	Email	tony_jong@urscorp.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	tony_jong@urscorp.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	tony_jong@urscorp.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	tony_jong@urscorp.com
- Chain of Custody (CoC) (COC)	Email	tony_jong@urscorp.com
- EDI Format - MRED (MRED)	Email	tony_jong@urscorp.com
MR LAWRIE DUCK		
- *AU Certificate of Analysis - NATA (COA)	Email	lawrie_duck@urscorp.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	lawrie_duck@urscorp.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	lawrie_duck@urscorp.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	lawrie_duck@urscorp.com
- Chain of Custody (CoC) (COC)	Email	lawrie_duck@urscorp.com
- EDI Format - MRED (MRED)	Email	lawrie_duck@urscorp.com
RESULTS ADDRESS		
- *AU Certificate of Analysis - NATA (COA)	Email	brisbane@urscorp.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	brisbane@urscorp.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	brisbane@urscorp.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	brisbane@urscorp.com
- Chain of Custody (CoC) (COC)	Email	brisbane@urscorp.com
- EDI Format - MRED (MRED)	Email	brisbane@urscorp.com
THE ACCOUNTS BRISBANE		
- A4 - AU Tax Invoice (INV)	Email	brisbane_accounts@urscorp.com

ALS Environmental

Acid Buffering Characteristic Curve (ABCC) REPORT

Batch: **EB1111587**

CONTACT:	TONY JONG	LABORATORY:	Brisbane
CLIENT:	URS AUSTRALIA PTY LTD (QLD)	DATE SAMPLED:	11/05/2011
ADDRESS:	GPO BOX 302	DATE RECEIVED:	14/06/2011
	BRISBANE, QLD, AUSTRALIA 4001	DATE COMPLETED:	20/07/2011
		SAMPLE TYPE:	Soil
		No. of SAMPLES:	18

COMMENTS

EA046 : NATA accreditation does not cover performance of this service.
ANC and ABCCs were repeated and verified
EB1111587 - 014 run at 0.1M HCL 0.5mLs incements to achieve a more usable result

ISSUING LABORATORY: ALS BRISBANE

Address:	32 Shand Street	Telephone:	07 3243 7222
	STAFFORD QLD 4053	Facsimile:	07 3243 7218
	AUSTRALIA	E-mail:	Myles.Clark@alsenviro.com

Signatory

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43723_260.57m_261.14m_IB
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				4 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.5**
Increments:	**mL**	**1**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**216**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	10.14				
1	1	12.25	7.09				
2	2	24.5	6.73				
3	3	36.75	6.53				
4	4	49	6.33				
5	5	61.25	6.11				
6	6	73.5	5.88				
7	7	85.75	5.56				
8	8	98	5.08				
9	9	110.25	4.55				
10	10	122.5	3.81				
11	11	134.75	3.05				
12	12	147	3.00				
13	13	159.25	2.61				
14	14	171.5	2.29				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43723_260.57m_261.14m_IB
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				4 Check EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.5**
Increments:	**mL**	**1**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**216**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	10.42				
1	1	12.25	7.95				
2	2	24.5	6.32				
3	3	36.75	6.32				
4	4	49	6.25				
5	5	61.25	6.10				
6	6	73.5	5.79				
7	7	85.75	5.57				
8	8	98	5.26				
9	9	110.25	4.49				
10	10	122.5	3.76				
11	11	134.75	3.33				
12	12	147	3.06				
13	13	159.25	2.53				
14	14	171.5	2.49				
15	15	183.75	2.41				
16	16	196	2.35				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43723_264.65m-265.15m_Floor
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				5 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**10.1**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.09	36	7.2	17.64	2.57
1	0.2	0.49	7.50	37	7.4	18.13	2.55
2	0.4	0.98	6.64	38	7.6	18.62	2.53
3	0.6	1.47	6.21	39	7.8	19.11	2.51
4	0.8	1.96	5.84	40	8	19.6	2.49
5	1	2.45	5.50	41	8.2	20.09	2.47
6	1.2	2.94	5.22	42	8.4	20.58	2.46
7	1.4	3.43	4.97				
8	1.6	3.92	4.73				
9	1.8	4.41	4.49				
10	2	4.9	4.26				
11	2.2	5.39	4.06				
12	2.4	5.88	3.89				
13	2.6	6.37	3.74				
14	2.8	6.86	3.61				
15	3	7.35	3.49				
16	3.2	7.84	3.40				
17	3.4	8.33	3.31				
18	3.6	8.82	3.24				
19	3.8	9.31	3.18				
20	4	9.8	3.12				
21	4.2	10.29	3.07				
22	4.4	10.78	3.01				
23	4.6	11.27	2.97				
24	4.8	11.76	2.92				
25	5	12.25	2.89				
26	5.2	12.74	2.85				
27	5.4	13.23	2.81				
28	5.6	13.72	2.78				
29	5.8	14.21	2.75				
30	6	14.7	2.72				
31	6.2	15.19	2.70				
32	6.4	15.68	2.67				
33	6.6	16.17	2.64				
34	6.8	16.66	2.62				
35	7	17.15	2.60				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43723_400.2m-400.7m_Floor
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				10 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.1**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**7.6**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.57	36	3.6	8.82	2.64
1	0.1	0.245	8.23	37	3.7	9.065	2.62
2	0.2	0.49	7.28	38	3.8	9.31	2.60
3	0.3	0.735	6.89	39	3.9	9.555	2.59
4	0.4	0.98	6.56	40	4	9.8	2.57
5	0.5	1.225	6.21	41	4.1	10.045	2.56
6	0.6	1.47	5.81	42	4.2	10.29	2.54
7	0.7	1.715	5.39	43	4.3	10.535	2.53
8	0.8	1.96	4.99	44	4.4	10.78	2.52
9	0.9	2.205	4.60	45	4.5	11.025	2.51
10	1	2.45	4.25	46	4.6	11.27	2.49
11	1.1	2.695	3.98	47	4.7	11.515	2.48
12	1.2	2.94	3.78	48	4.8	11.76	2.47
13	1.3	3.185	3.63				
14	1.4	3.43	3.52				
15	1.5	3.675	3.42				
16	1.6	3.92	3.33				
17	1.7	4.165	3.26				
18	1.8	4.41	3.20				
19	1.9	4.655	3.14				
20	2	4.9	3.09				
21	2.1	5.145	3.04				
22	2.2	5.39	3.00				
23	2.3	5.635	2.96				
24	2.4	5.88	2.93				
25	2.5	6.125	2.90				
26	2.6	6.37	2.87				
27	2.7	6.615	2.84				
28	2.8	6.86	2.81				
29	2.9	7.105	2.78				
30	3	7.35	2.76				
31	3.1	7.595	2.74				
32	3.2	7.84	2.71				
33	3.3	8.085	2.69				
34	3.4	8.33	2.67				
35	3.5	8.575	2.65				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43733_127.02m-127.5m_OB
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				14 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**142**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.23	36	18	44.1	3.53
1	0.5	1.225	8.48	37	18.5	45.325	3.32
2	1	2.45	8.09	38	19	46.55	3.34
3	1.5	3.675	7.93	39	19.5	47.775	3.28
4	2	4.9	7.79	40	20	49	3.12
5	2.5	6.125	7.70	41	20.5	50.225	3.06
6	3	7.35	7.66	42	21	51.45	2.93
7	3.5	8.575	7.61	43	21.5	52.675	2.92
8	4	9.8	7.57	44	22	53.9	2.88
9	4.5	11.025	7.51	45	22.5	55.125	2.85
10	5	12.25	7.48	46	23	56.35	2.82
11	5.5	13.475	7.46	47	23.5	57.575	2.80
12	6	14.7	7.42	48	24	58.8	2.78
13	6.5	15.925	7.38	49	24.5	60.025	2.75
14	7	17.15	7.31	50	25	61.25	2.72
15	7.5	18.375	7.27	51	25.5	62.475	2.70
16	8	19.6	7.37	52	26	63.7	2.68
17	8.5	20.825	7.24	53	26.5	64.925	2.68
18	9	22.05	7.08	54	27	66.15	2.67
19	9.5	23.275	6.79	55	27.5	67.375	2.68
20	10	24.5	6.81	56	28	68.6	2.70
21	10.5	25.725	6.67	57	28.5	69.825	2.69
22	11	26.95	6.32	58	29	71.05	2.68
23	11.5	28.175	5.98	59	29.5	72.275	2.68
24	12	29.4	5.53	60	30	73.5	2.70
25	12.5	30.625	5.01	61	30.5	74.725	2.69
26	13	31.85	4.60	62	31	75.95	2.67
27	13.5	33.075	4.28	63	31.5	77.175	2.65
28	14	34.3	4.01	64	32	78.4	2.63
29	14.5	35.525	3.83	65	32.5	79.625	2.61
30	15	36.75	3.83	66	33	80.85	2.58
31	15.5	37.975	3.65	67	33.5	82.075	2.56
32	16	39.2	3.70	68	34	83.3	2.55
33	16.5	40.425	3.77	69	34.5	84.525	2.53
34	17	41.65	3.64	70	35	85.75	2.51
35	17.5	42.875	3.62	71	35.5	86.975	2.48

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43733_222.83m-223.38m_Roof
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				20 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**40.1**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.75	36	18	44.1	5.87
1	0.5	1.225	7.54	37	18.5	45.325	5.85
2	1	2.45	6.87	38	19	46.55	5.84
3	1.5	3.675	6.65	39	19.5	47.775	5.82
4	2	4.9	6.53	40	20	49	5.80
5	2.5	6.125	6.45	41	20.5	50.225	5.79
6	3	7.35	6.39	42	21	51.45	5.77
7	3.5	8.575	6.35	43	21.5	52.675	5.76
8	4	9.8	6.31	44	22	53.9	5.74
9	4.5	11.025	6.27	45	22.5	55.125	5.72
10	5	12.25	6.24	46	23	56.35	5.71
11	5.5	13.475	6.22	47	23.5	57.575	5.69
12	6	14.7	6.19	48	24	58.8	5.67
13	6.5	15.925	6.18	49	24.5	60.025	5.65
14	7	17.15	6.16	50	25	61.25	5.63
15	7.5	18.375	6.14	51	25.5	62.475	5.61
16	8	19.6	6.12	52	26	63.7	5.59
17	8.5	20.825	6.11	53	26.5	64.925	5.57
18	9	22.05	6.09	54	27	66.15	5.55
19	9.5	23.275	6.08	55	27.5	67.375	5.53
20	10	24.5	6.07	56	28	68.6	5.51
21	10.5	25.725	6.05	57	28.5	69.825	5.49
22	11	26.95	6.04	58	29	71.05	5.46
23	11.5	28.175	6.04	59	29.5	72.275	5.43
24	12	29.4	6.02	60	30	73.5	5.42
25	12.5	30.625	6.01	61	30.5	74.725	5.39
26	13	31.85	6.00	62	31	75.95	5.35
27	13.5	33.075	5.99	63	31.5	77.175	5.32
28	14	34.3	5.98	64	32	78.4	5.29
29	14.5	35.525	5.97	65	32.5	79.625	5.26
30	15	36.75	5.95	66	33	80.85	5.22
31	15.5	37.975	5.94	67	33.5	82.075	5.17
32	16	39.2	5.93	68	34	83.3	5.13
33	16.5	40.425	5.92	69	34.5	84.525	5.08
34	17	41.65	5.90	70	35	85.75	5.03
35	17.5	42.875	5.88	71	35.5	86.975	4.97

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

Method	Analyte	Units	LOR	
	Sub Matrix			Soil
	Client Sample Identification 1			43733_222.83m-223.38m_Roof
	Client Sample Identification 2			
	Sample Date			11/05/2011
				20 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**40.1**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
72	36	88.2	4.91				
73	36.5	89.425	4.84				
74	37	90.65	4.77				
75	37.5	91.875	4.69				
76	38	93.1	4.61				
77	38.5	94.325	4.51				
78	39	95.55	4.39				
79	39.5	96.775	4.24				
80	40	98	4.05				
81	40.5	99.225	3.83				
82	41	100.45	3.60				
83	41.5	101.675	3.39				
84	42	102.9	3.21				
85	42.5	104.125	3.06				
86	43	105.35	2.94				
87	43.5	106.575	2.85				
88	44	107.8	2.77				
89	44.5	109.025	2.71				
90	45	110.25	2.65				
91	45.5	111.475	2.60				
92	46	112.7	2.55				
93	46.5	113.925	2.51				
94	47	115.15	2.47				
95	47.5	116.375	2.44				
96	48	117.6	2.41				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43750_273m-273.5m_OB
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				29 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**43.2**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.73				
1	0.5	1.225	7.42				
2	1	2.45	6.80				
3	1.5	3.675	6.54				
4	2	4.9	6.36				
5	2.5	6.125	6.21				
6	3	7.35	6.07				
7	3.5	8.575	5.94				
8	4	9.8	5.78				
9	4.5	11.025	5.56				
10	5	12.25	5.27				
11	5.5	13.475	4.95				
12	6	14.7	4.59				
13	6.5	15.925	4.11				
14	7	17.15	3.68				
15	7.5	18.375	3.40				
16	8	19.6	3.21				
17	8.5	20.825	3.08				
18	9	22.05	2.98			`	
19	9.5	23.275	2.90				
20	10	24.5	2.83				
21	10.5	25.725	2.77				
22	11	26.95	2.72				
23	11.5	28.175	2.67				
24	12	29.4	2.63				
25	12.5	30.625	2.59				
26	13	31.85	2.56				
27	13.5	33.075	2.52				
28	14	34.3	2.49				
29	14.5	35.525	2.46				
30	15	36.75	2.44				
31	15.5	37.975	2.41				
32	16	39.2	2.39				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43750_361m-361.5m_IB
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				32 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.5**
Increments:	**mL**	**0.4**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**182**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	10.03	36	14.4	176.4	2.53
1	0.4	4.9	6.45	37	14.8	181.3	2.46
2	0.8	9.8	6.17	38	15.2	186.2	2.41
3	1.2	14.7	6.04	39	15.6	191.1	2.36
4	1.6	19.6	5.95				
5	2	24.5	5.88				
6	2.4	29.4	5.82				
7	2.8	34.3	5.77				
8	3.2	39.2	5.72				
9	3.6	44.1	5.67				
10	4	49	5.62				
11	4.4	53.9	5.57				
12	4.8	58.8	5.53				
13	5.2	63.7	5.47				
14	5.6	68.6	5.42				
15	6	73.5	5.36				
16	6.4	78.4	5.30				
17	6.8	83.3	5.22				
18	7.2	88.2	5.14				
19	7.6	93.1	5.06				
20	8	98	4.97				
21	8.4	102.9	4.85				
22	8.8	107.8	4.69				
23	9.2	112.7	4.52				
24	9.6	117.6	4.31				
25	10	122.5	4.05				
26	10.4	127.4	3.79				
27	10.8	132.3	3.52				
28	11.2	137.2	3.32				
29	11.6	142.1	3.18				
30	12	147	3.06				
31	12.4	151.9	2.95				
32	12.8	156.8	2.84				
33	13.2	161.7	2.75				
34	13.6	166.6	2.66				
35	14	171.5	2.60				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43750_364.9m-365.24m_IB
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	33 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.5**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**80.2**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.52				
1	0.2	2.45	6.31				
2	0.4	4.9	5.58				
3	0.6	7.35	5.25				
4	0.8	9.8	4.97				
5	1	12.25	4.67				
6	1.2	14.7	4.26				
7	1.4	17.15	3.70				
8	1.6	19.6	3.18				
9	1.8	22.05	2.91				
10	2	24.5	2.72				
11	2.2	26.95	2.58				
12	2.4	29.4	2.48				
13	2.6	31.85	2.39				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43750_378.5m-379m_Floor
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				36 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.5**
Increments:	**mL**	**0.4**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**116**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.87				
1	0.4	4.9	6.30				
2	0.8	9.8	6.03				
3	1.2	14.7	5.87				
4	1.6	19.6	5.74				
5	2	24.5	5.55				
6	2.4	29.4	5.25				
7	2.8	34.3	4.65				
8	3.2	39.2	3.39				
9	3.6	44.1	2.79				
10	4	49	2.54				
11	4.4	53.9	2.37				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43750_404m-404.5m_IB
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				39 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**18.9**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.55	36	7.2	17.64	2.73
1	0.2	0.49	7.94	37	7.4	18.13	2.71
2	0.4	0.98	7.10	38	7.6	18.62	2.69
3	0.6	1.47	6.75	39	7.8	19.11	2.66
4	0.8	1.96	6.39	40	8	19.6	2.64
5	1	2.45	6.00	41	8.2	20.09	2.62
6	1.2	2.94	5.57	42	8.4	20.58	2.60
7	1.4	3.43	5.27	43	8.6	21.07	2.58
8	1.6	3.92	5.01	44	8.8	21.56	2.56
9	1.8	4.41	4.81	45	9	22.05	2.55
10	2	4.9	4.62	46	9.2	22.54	2.53
11	2.2	5.39	4.41	47	9.4	23.03	2.51
12	2.4	5.88	4.24	48	9.6	23.52	2.49
13	2.6	6.37	4.08	49	9.8	24.01	2.48
14	2.8	6.86	3.93	50	10	24.5	2.46
15	3	7.35	3.83				
16	3.2	7.84	3.72				
17	3.4	8.33	3.63				
18	3.6	8.82	3.56				
19	3.8	9.31	3.48				
20	4	9.8	3.42				
21	4.2	10.29	3.34				
22	4.4	10.78	3.30				
23	4.6	11.27	3.25				
24	4.8	11.76	3.20				
25	5	12.25	3.16				
26	5.2	12.74	3.11				
27	5.4	13.23	3.07				
28	5.6	13.72	3.03				
29	5.8	14.21	2.99				
30	6	14.7	2.95				
31	6.2	15.19	2.91				
32	6.4	15.68	2.87				
33	6.6	16.17	2.83				
34	6.8	16.66	2.80				
35	7	17.15	2.76				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

Method	Analyte	Units	LOR	
	Sub Matrix			Soil
	Client Sample Identification 1			43750_408m-408.43_IB
	Client Sample Identification 2			
	Sample Date			11/05/2011
				40 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**21.6**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.77				
1	0.5	1.225	6.90				
2	1	2.45	6.07				
3	1.5	3.675	5.32				
4	2	4.9	5.00				
5	2.5	6.125	4.84				
6	3	7.35	4.79				
7	3.5	8.575	4.63				
8	4	9.8	4.26				
9	4.5	11.025	3.88				
10	5	12.25	3.57				
11	5.5	13.475	3.35				
12	6	14.7	3.19				
13	6.5	15.925	3.06				
14	7	17.15	2.96				
15	7.5	18.375	2.84				
16	8	19.6	2.75				
17	8.5	20.825	2.68				
18	9	22.05	2.62				
19	9.5	23.275	2.57				
20	10	24.5	2.52				
21	10.5	25.725	2.48				
22	11	26.95	2.45				
23	11.5	28.175	2.41				
24	12	29.4	2.38				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43750_408m-408.43_IB
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				40 Check EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**21.6**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.65				
1	0.5	1.225	7.03				
2	1	2.45	6.04				
3	1.5	3.675	5.37				
4	2	4.9	5.00				
5	2.5	6.125	4.70				
6	3	7.35	4.34				
7	3.5	8.575	3.92				
8	4	9.8	3.60				
9	4.5	11.025	3.39				
10	5	12.25	3.25				
11	5.5	13.475	3.13				
12	6	14.7	3.03				
13	6.5	15.925	2.95				
14	7	17.15	2.88				
15	7.5	18.375	2.82				
16	8	19.6	2.77				
17	8.5	20.825	2.72				
18	9	22.05	2.68				
19	9.5	23.275	2.64				
20	10	24.5	2.60				
21	10.5	25.725	2.57				
22	11	26.95	2.54				
23	11.5	28.175	2.51				
24	12	29.4	2.48				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43750_417m-417.34m_Roof
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				42 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**23.4**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.54				
1	0.5	1.225	6.70				
2	1	2.45	5.62				
3	1.5	3.675	5.05				
4	2	4.9	4.69				
5	2.5	6.125	4.24				
6	3	7.35	3.70				
7	3.5	8.575	3.34				
8	4	9.8	3.10				
9	4.5	11.025	2.94				
10	5	12.25	2.82				
11	5.5	13.475	2.72				
12	6	14.7	2.65				
13	6.5	15.925	2.58				
14	7	17.15	2.52				
15	7.5	18.375	2.47				
16	8	19.6	2.43				
17	8.5	20.825	2.39				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43765_228m-228.5m_OB
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				43 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.5**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**75.9**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.63				
1	0.2	2.45	6.58				
2	0.4	4.9	6.18				
3	0.6	7.35	5.97				
4	0.8	9.8	5.80				
5	1	12.25	5.58				
6	1.2	14.7	5.21				
7	1.4	17.15	4.68				
8	1.6	19.6	3.86				
9	1.8	22.05	3.24				
10	2	24.5	2.94				
11	2.2	26.95	2.75				
12	2.4	29.4	2.62				
13	2.6	31.85	2.52				
14	2.8	34.3	2.44				
15	3	36.75	2.37				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43765_389.5m-390m_IB
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				49 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**24.7**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.45				
1	0.5	1.225	8.67				
2	1	2.45	7.88				
3	1.5	3.675	6.31				
4	2	4.9	5.59				
5	2.5	6.125	4.87				
6	3	7.35	4.34				
7	3.5	8.575	3.80				
8	4	9.8	3.33				
9	4.5	11.025	3.08				
10	5	12.25	2.92				
11	5.5	13.475	2.80				
12	6	14.7	2.72				
13	6.5	15.925	2.64				
14	7	17.15	2.57				
15	7.5	18.375	2.52				
16	8	19.6	2.47				
17	8.5	20.825	2.42				
18	9	22.05	2.38				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43765_390.8m-391.36m_IB
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				50 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**35.8**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.68	36	18	44.1	2.52
1	0.5	1.225	7.35	37	18.5	45.325	2.50
2	1	2.45	6.90	38	19	46.55	2.48
3	1.5	3.675	6.71	39	19.5	47.775	2.46
4	2	4.9	6.58	40	20	49	2.45
5	2.5	6.125	6.48				
6	3	7.35	6.38				
7	3.5	8.575	6.28				
8	4	9.8	6.18				
9	4.5	11.025	6.06				
10	5	12.25	5.90				
11	5.5	13.475	5.61				
12	6	14.7	5.19				
13	6.5	15.925	4.72				
14	7	17.15	4.19				
15	7.5	18.375	3.77				
16	8	19.6	3.47				
17	8.5	20.825	3.27				
18	9	22.05	3.13				
19	9.5	23.275	3.04				
20	10	24.5	3.01				
21	10.5	25.725	2.94				
22	11	26.95	2.88				
23	11.5	28.175	2.82				
24	12	29.4	2.77				
25	12.5	30.625	2.72				
26	13	31.85	2.68				
27	13.5	33.075	2.65				
28	14	34.3	2.62				
29	14.5	35.525	2.59				
30	15	36.75	2.57				
31	15.5	37.975	2.57				
32	16	39.2	2.57				
33	16.5	40.425	2.55				
34	17	41.65	2.55				
35	17.5	42.875	2.53				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43893_315.8m-316.3m_IB
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				60 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**13.6**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.57	36	7.2	17.64	2.55
1	0.2	0.49	8.01	37	7.4	18.13	2.53
2	0.4	0.98	7.12	38	7.6	18.62	2.51
3	0.6	1.47	6.63	39	7.8	19.11	2.50
4	0.8	1.96	6.18	40	8	19.6	2.48
5	1	2.45	5.71	41	8.2	20.09	2.46
6	1.2	2.94	5.28				
7	1.4	3.43	4.93				
8	1.6	3.92	4.62				
9	1.8	4.41	4.37				
10	2	4.9	4.14				
11	2.2	5.39	3.95				
12	2.4	5.88	3.79				
13	2.6	6.37	3.65				
14	2.8	6.86	3.53				
15	3	7.35	3.43				
16	3.2	7.84	3.34				
17	3.4	8.33	3.26				
18	3.6	8.82	3.19				
19	3.8	9.31	3.13				
20	4	9.8	3.07				
21	4.2	10.29	3.02				
22	4.4	10.78	2.97				
23	4.6	11.27	2.93				
24	4.8	11.76	2.88				
25	5	12.25	2.85				
26	5.2	12.74	2.81				
27	5.4	13.23	2.78				
28	5.6	13.72	2.75				
29	5.8	14.21	2.72				
30	6	14.7	2.69				
31	6.2	15.19	2.66				
32	6.4	15.68	2.64				
33	6.6	16.17	2.62				
34	6.8	16.66	2.60				
35	7	17.15	2.57				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43893_324.46m-324.88m_IB
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				62 EB1111587

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**11.4**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.28				
1	0.2	0.49	7.25				
2	0.4	0.98	6.52				
3	0.6	1.47	5.92				
4	0.8	1.96	5.40				
5	1	2.45	5.00				
6	1.2	2.94	4.53				
7	1.4	3.43	4.16				
8	1.6	3.92	3.89				
9	1.8	4.41	3.69				
10	2	4.9	3.53				
11	2.2	5.39	3.39				
12	2.4	5.88	3.29				
13	2.6	6.37	3.20				
14	2.8	6.86	3.12				
15	3	7.35	3.05				
16	3.2	7.84	2.99				
17	3.4	8.33	2.94				
18	3.6	8.82	2.89				
19	3.8	9.31	2.84				
20	4	9.8	2.80				
21	4.2	10.29	2.76				
22	4.4	10.78	2.73				
23	4.6	11.27	2.70				
24	4.8	11.76	2.67				
25	5	12.25	2.64				
26	5.2	12.74	2.61				
27	5.4	13.23	2.58				
28	5.6	13.72	2.56				
29	5.8	14.21	2.54				
30	6	14.7	2.52				
31	6.2	15.19	2.50				
32	6.4	15.68	2.48				
33	6.6	16.17	2.46				
34	6.8	16.66	2.44				

Work Order :	EB1111587	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			43893_336m-336.38m_Floor
	Client Sample Identification 2			
	Sample Date			11/05/2011
Method	Analyte	Units	LOR	
				63 EB1111587

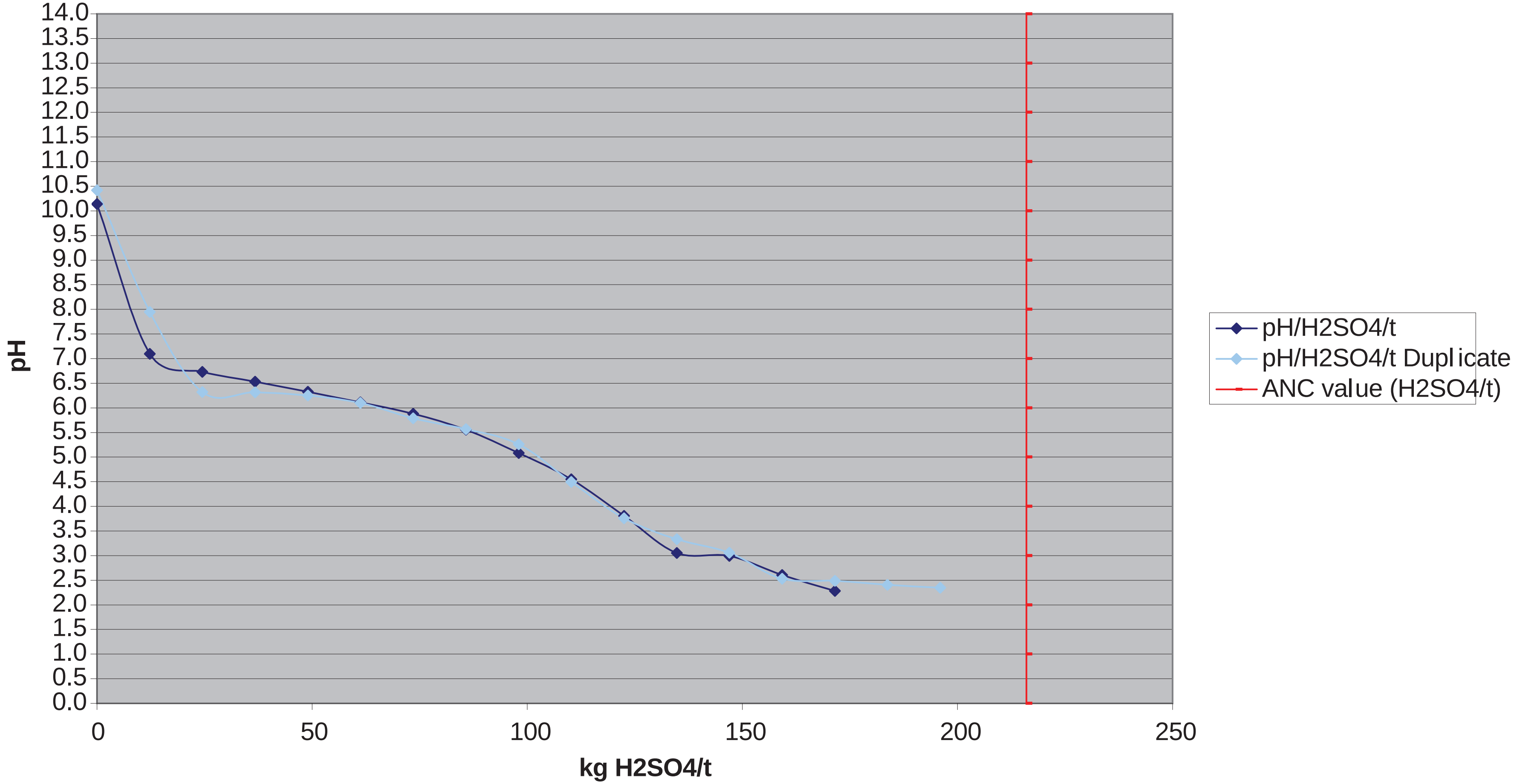
EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**13.6**

EA046 -B - Curve information

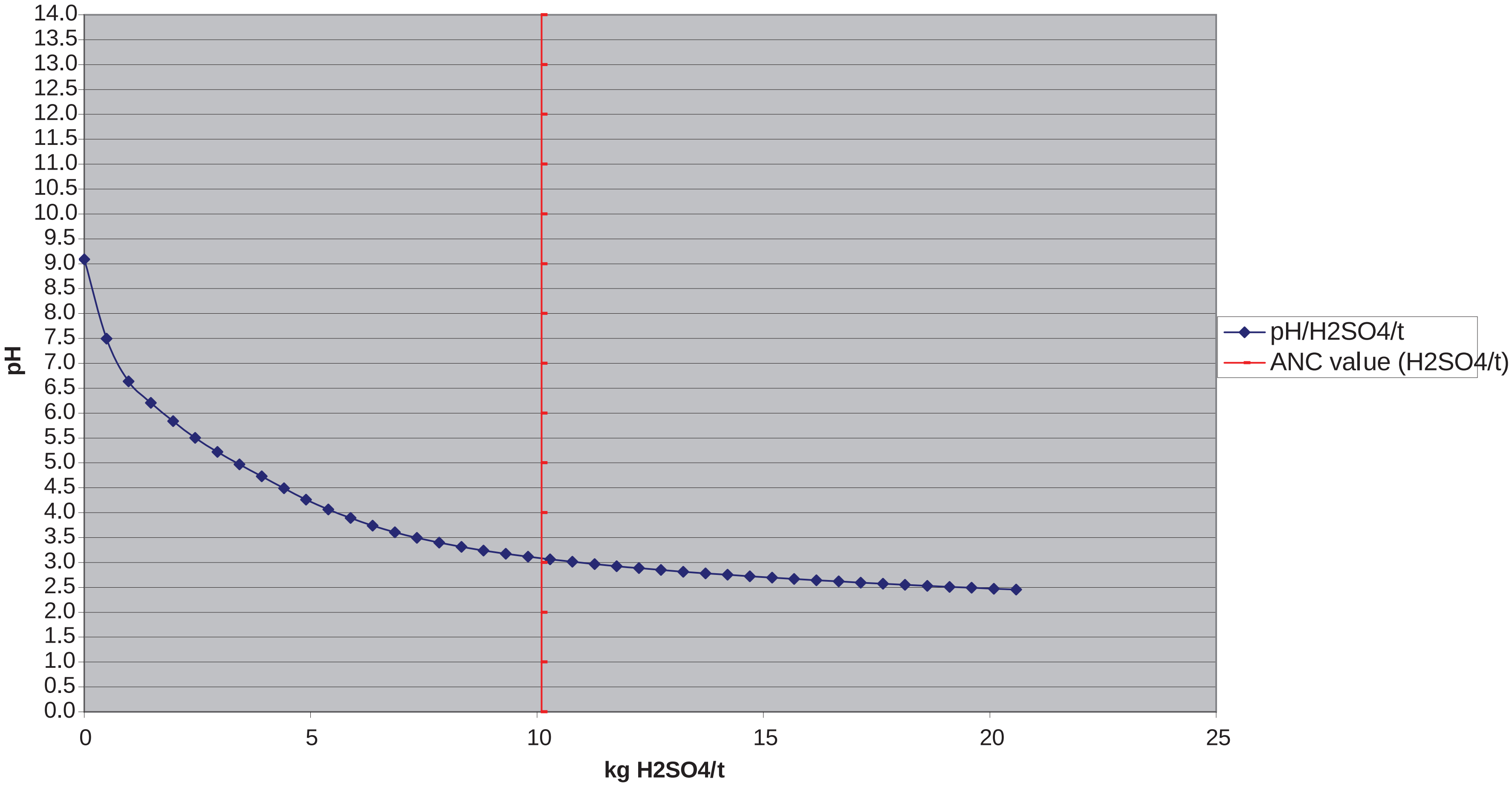
Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	9.30				
1	0.2	0.49	7.16				
2	0.4	0.98	6.36				
3	0.6	1.47	5.70				
4	0.8	1.96	4.98				
5	1	2.45	4.42				
6	1.2	2.94	4.02				
7	1.4	3.43	3.76				
8	1.6	3.92	3.56				
9	1.8	4.41	3.41				
10	2	4.9	3.30				
11	2.2	5.39	3.20				
12	2.4	5.88	3.12				
13	2.6	6.37	3.05				
14	2.8	6.86	2.99				
15	3	7.35	2.94				
16	3.2	7.84	2.89				
17	3.4	8.33	2.85				
18	3.6	8.82	2.81				
19	3.8	9.31	2.78				
20	4	9.8	2.74				
21	4.2	10.29	2.72				
22	4.4	10.78	2.69				
23	4.6	11.27	2.66				
24	4.8	11.76	2.64				
25	5	12.25	2.62				
26	5.2	12.74	2.60				
27	5.4	13.23	2.58				
28	5.6	13.72	2.56				
29	5.8	14.21	2.54				
30	6	14.7	2.52				
31	6.2	15.19	2.50				
32	6.4	15.68	2.49				
33	6.6	16.17	2.47				
34	6.8	16.66	2.46				

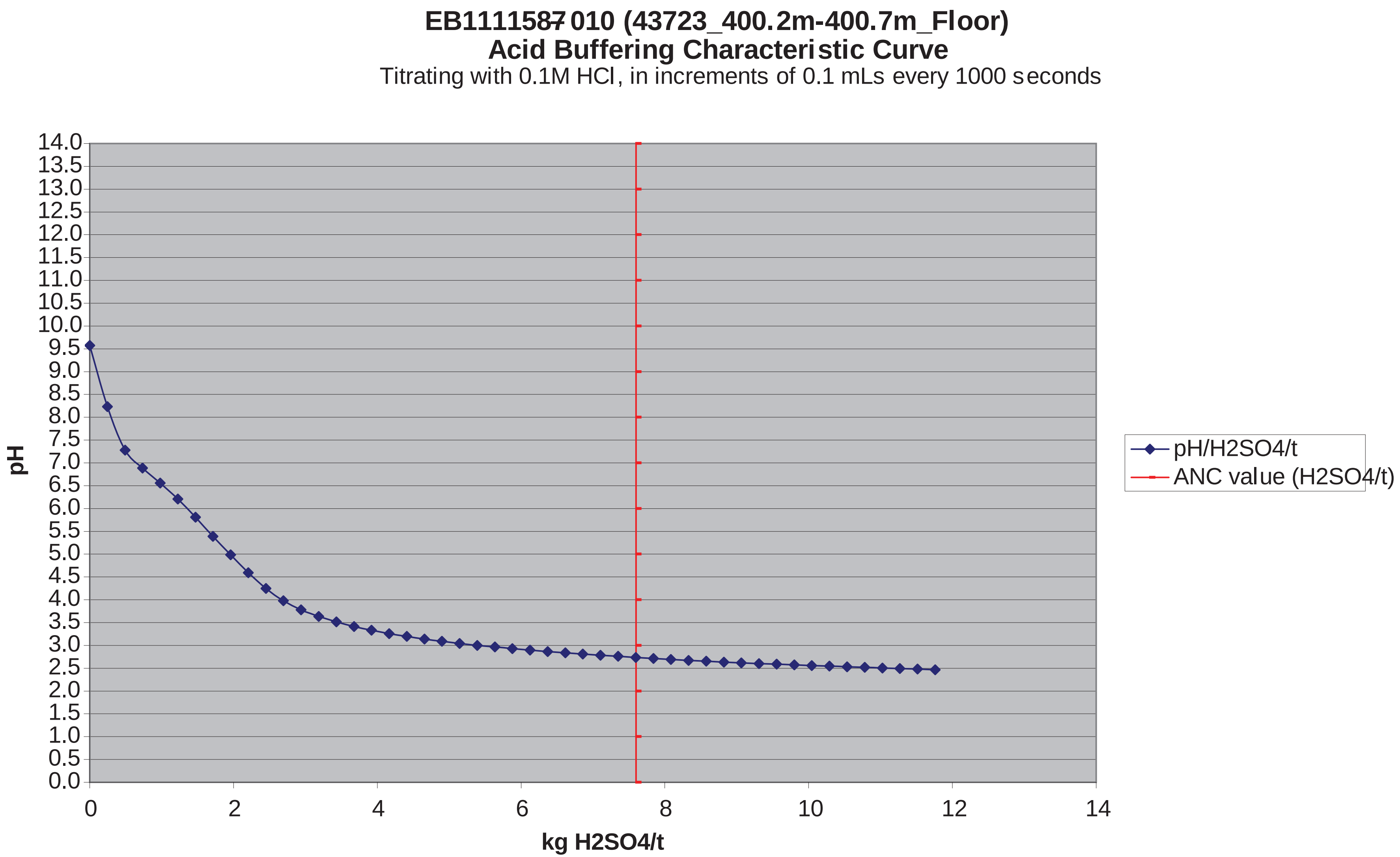
EB1111587 004 (43723_260.57m_261.14m_IB)
Acid Buffering Characteristic Curve
Titrating with 0.5M HCl, in increments of 1.0 mLs every 1000 seconds



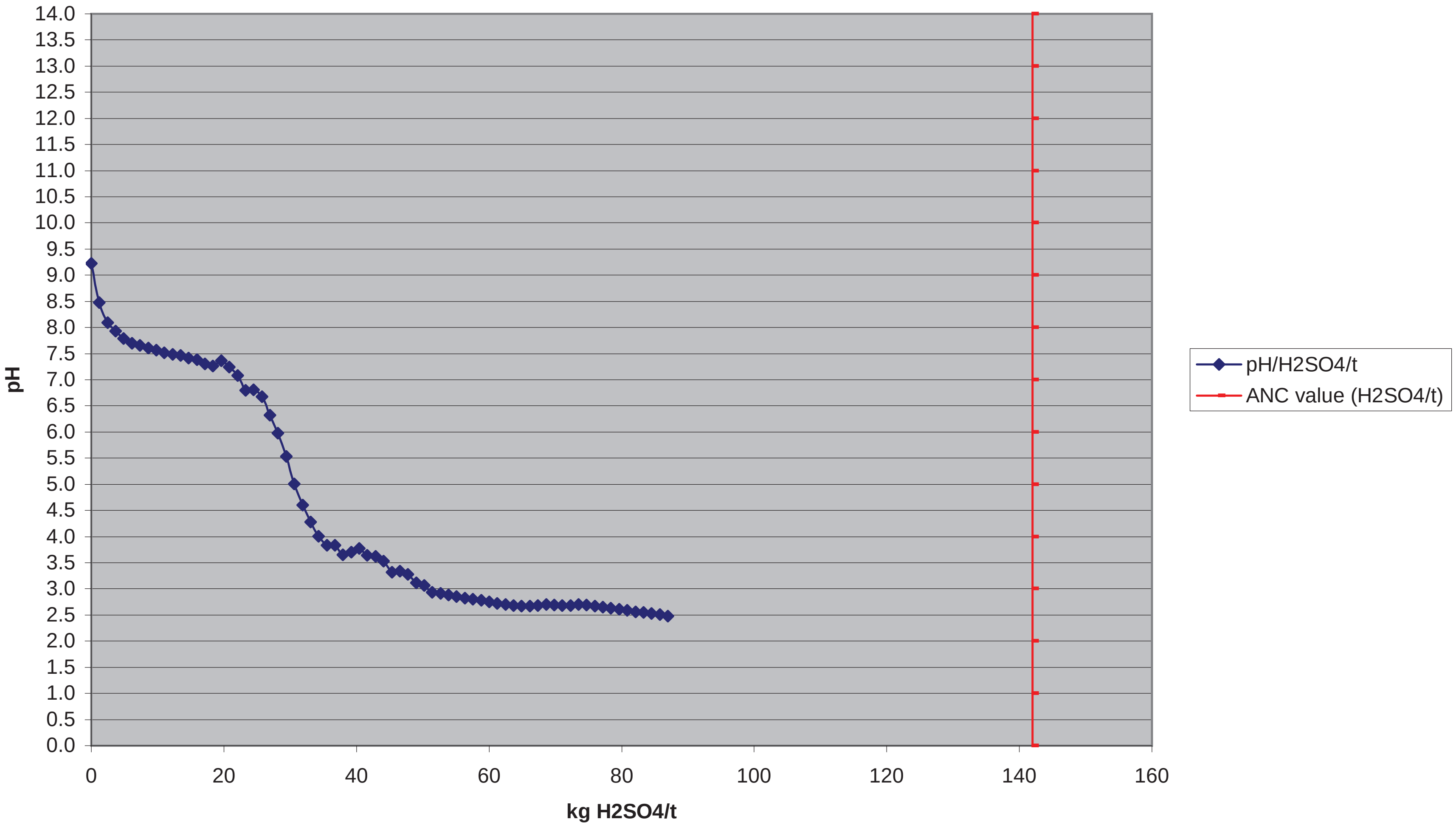
EB1111587 005 (43723_264.65m-265.15m_Floor)
Acid Buffering Characteristic Curve

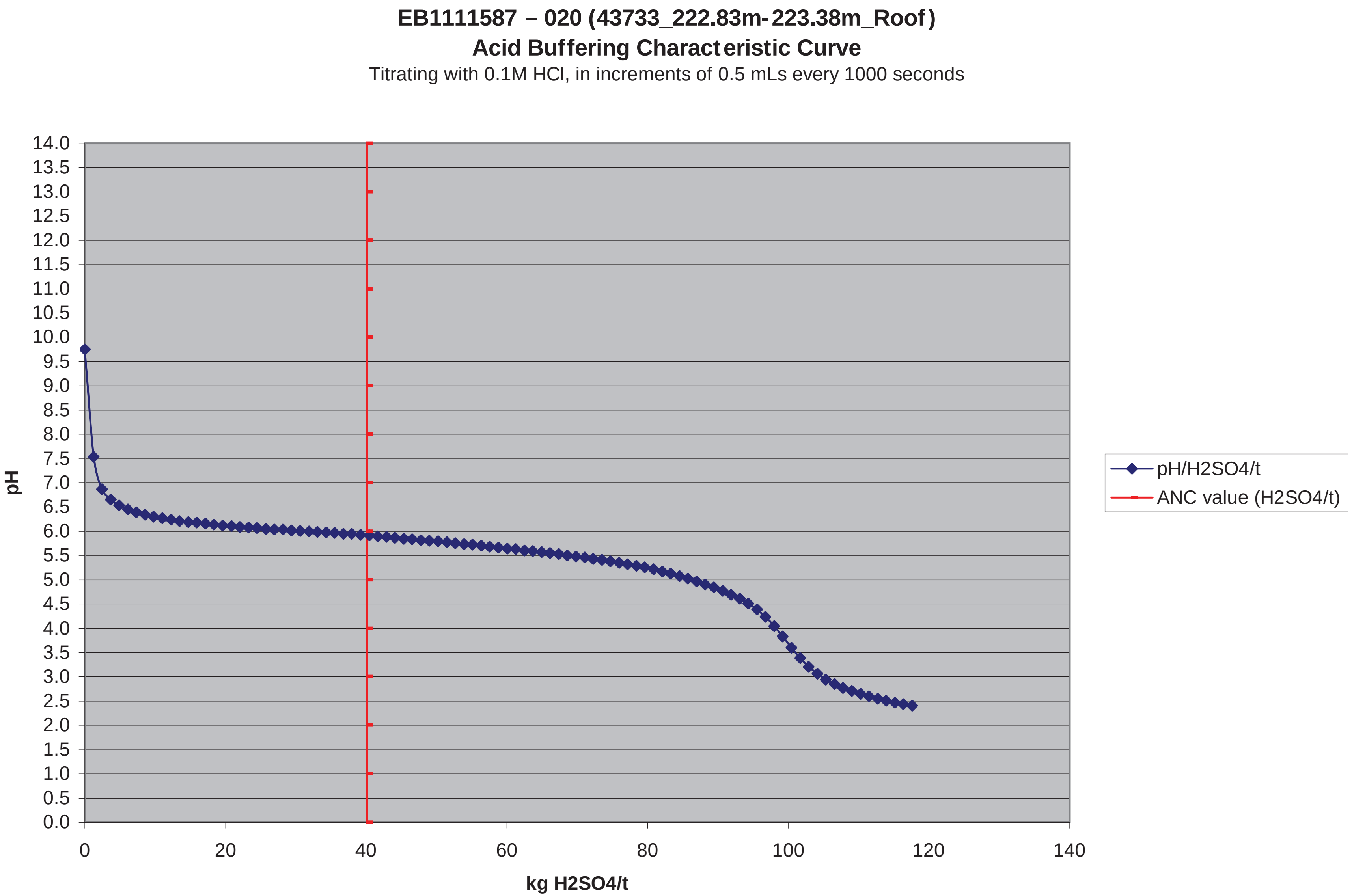
Titrating with 0.1M HCl, in increments of 0.5 mLs every 1000 seconds




EB1111587 010 (43723_400.2m-400.7m_Floor)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.1 mLs every 1000 seconds
pH
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
kg H2SO4/t
pH/H2SO4/t
ANC value (H2SO4/t)

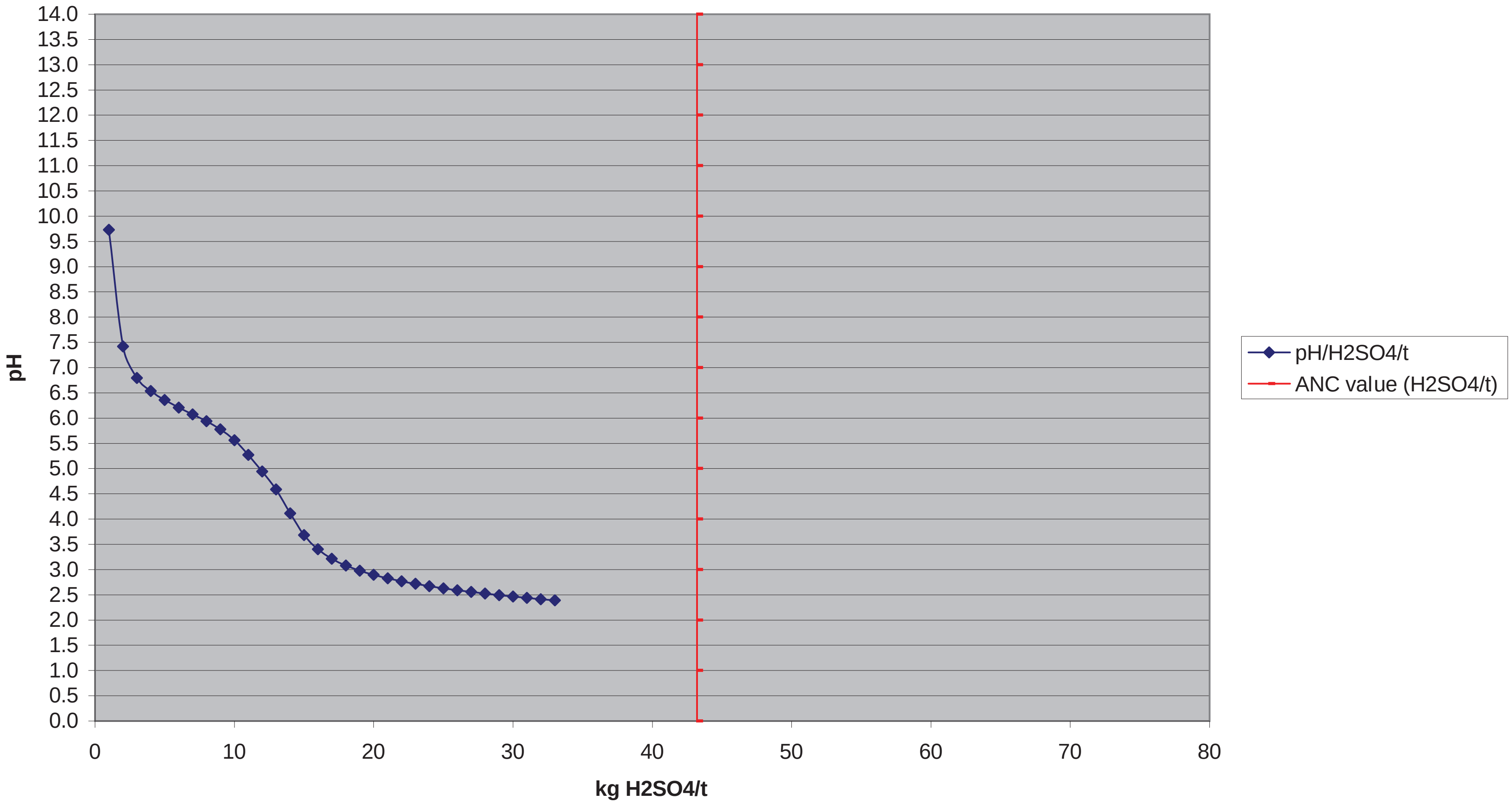
EB1111587 – 014 (43733_127.02m-127.5m_OB)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.5 mLs every 1000 seconds



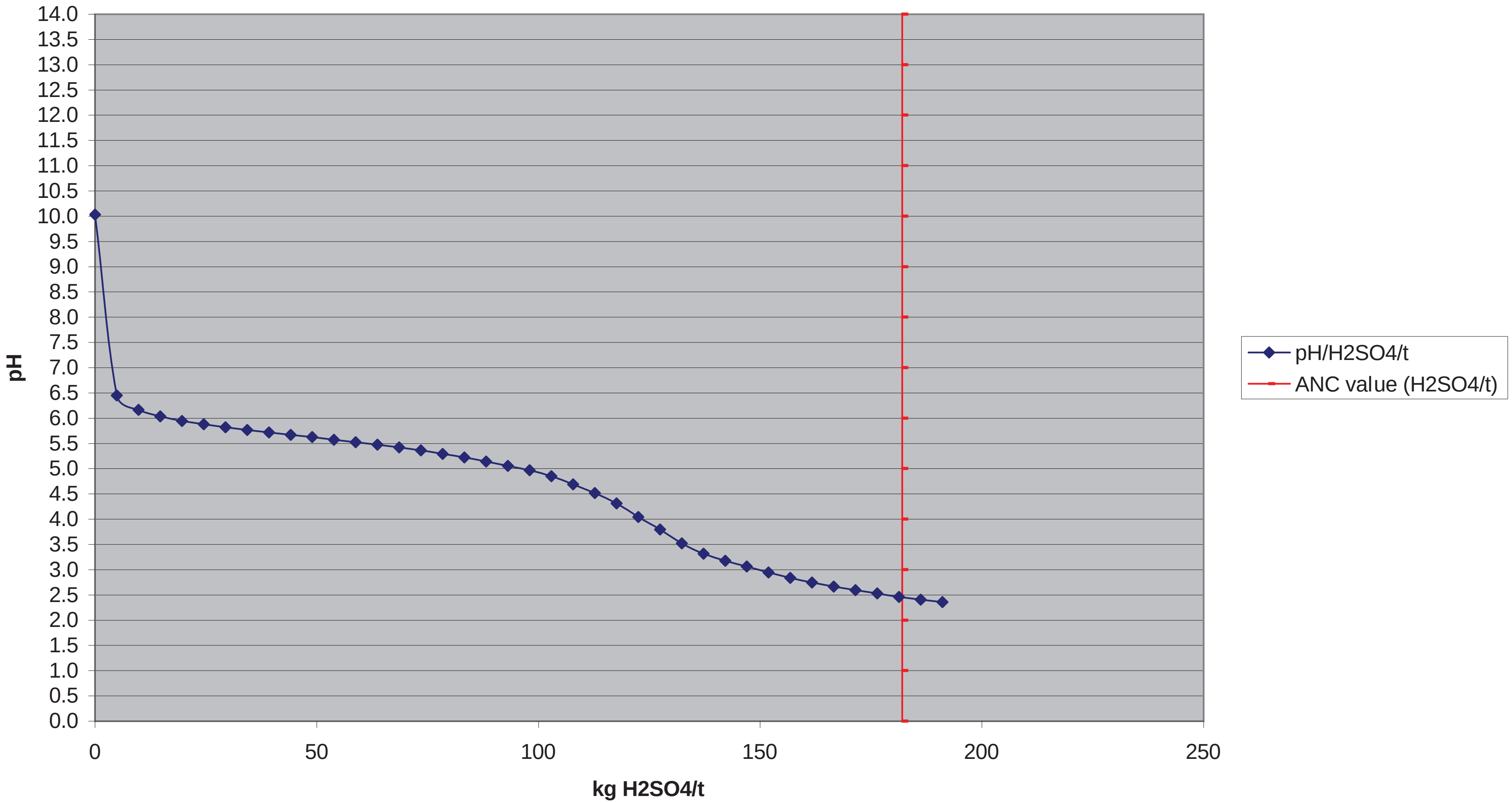


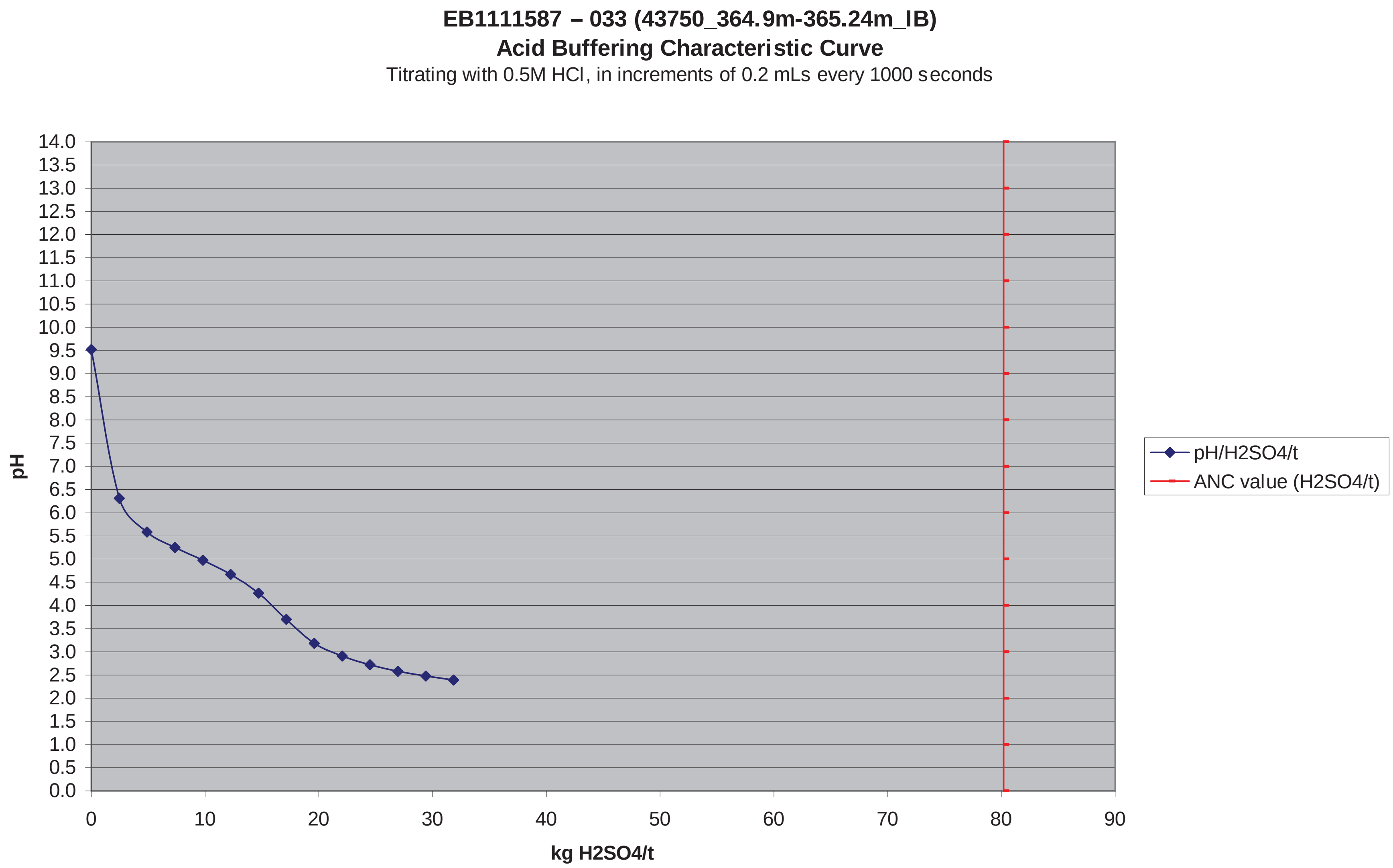
EB1111587 – 020 (43733_222.83m-223.38m_Roof)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.5 mLs every 1000 seconds
pH
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
20
40
60
80
100
120
140
kg H2SO4/t
pH/H2SO4/t
ANC value (H2SO4/t)

EB1111587 – 029 (43750_273m-273.5m_OB)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.5 mLs every 1000 seconds

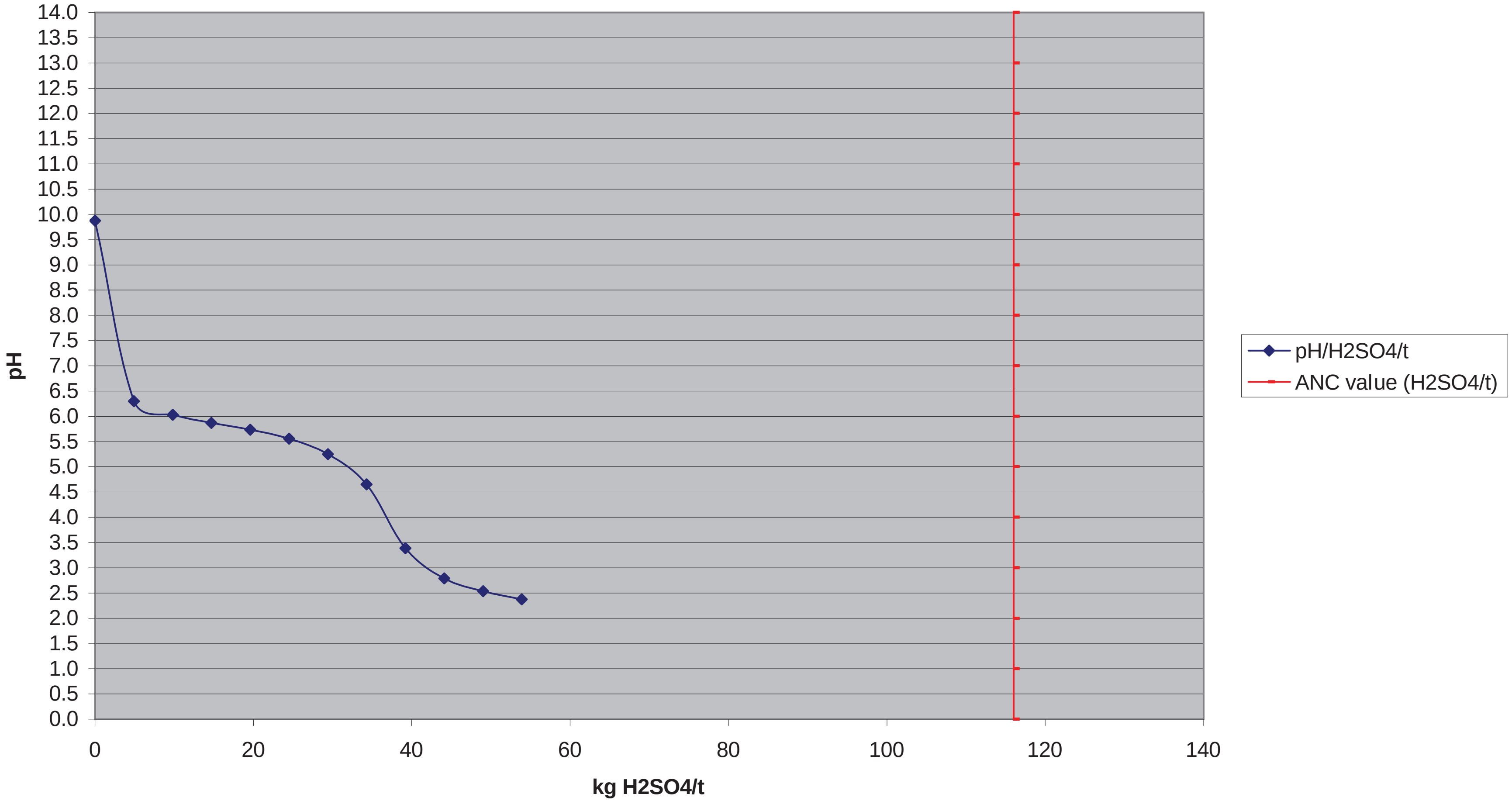


EB1111587 – 032 (43750_361m-361.5m_IB)
Acid Buffering Characteristic Curve
Titrating with 0.5M HCl, in increments of 0.4 mLs every 1000 seconds




EB1111587 – 033 (43750_364.9m-365.24m_IB)
Acid Buffering Characteristic Curve
Titrating with 0.5M HCl, in increments of 0.2 mLs every 1000 seconds
pH
kg H2SO4/t
pH/H2SO4/t
ANC value (H2SO4/t)
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
50
60
70
80
90

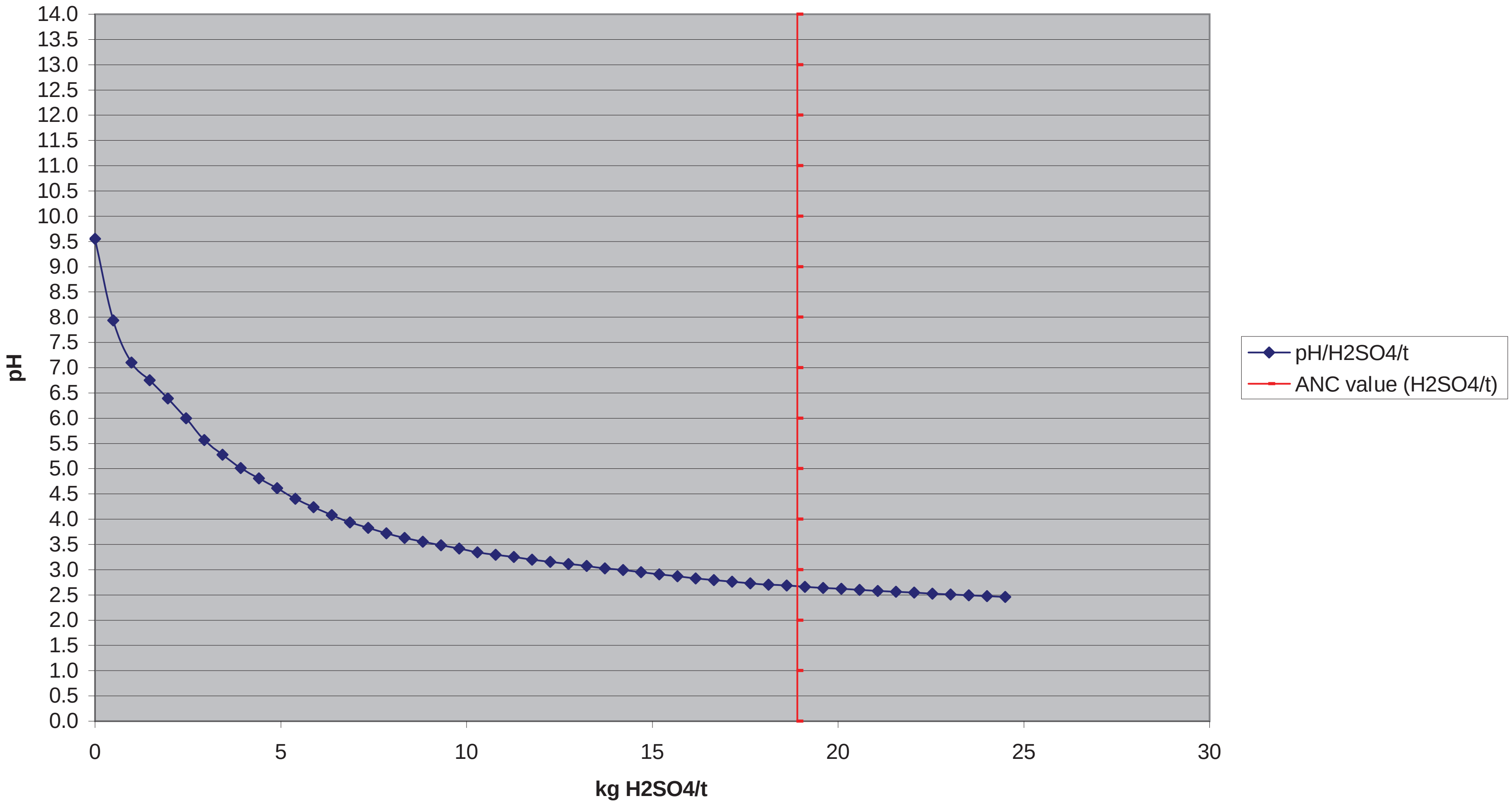
EB1111587 – 036 (43750_378.5m-379m_Floor)
Acid Buffering Characteristic Curve
Titrating with 0.5M HCl, in increments of 0.4 mLs every 1000 seconds

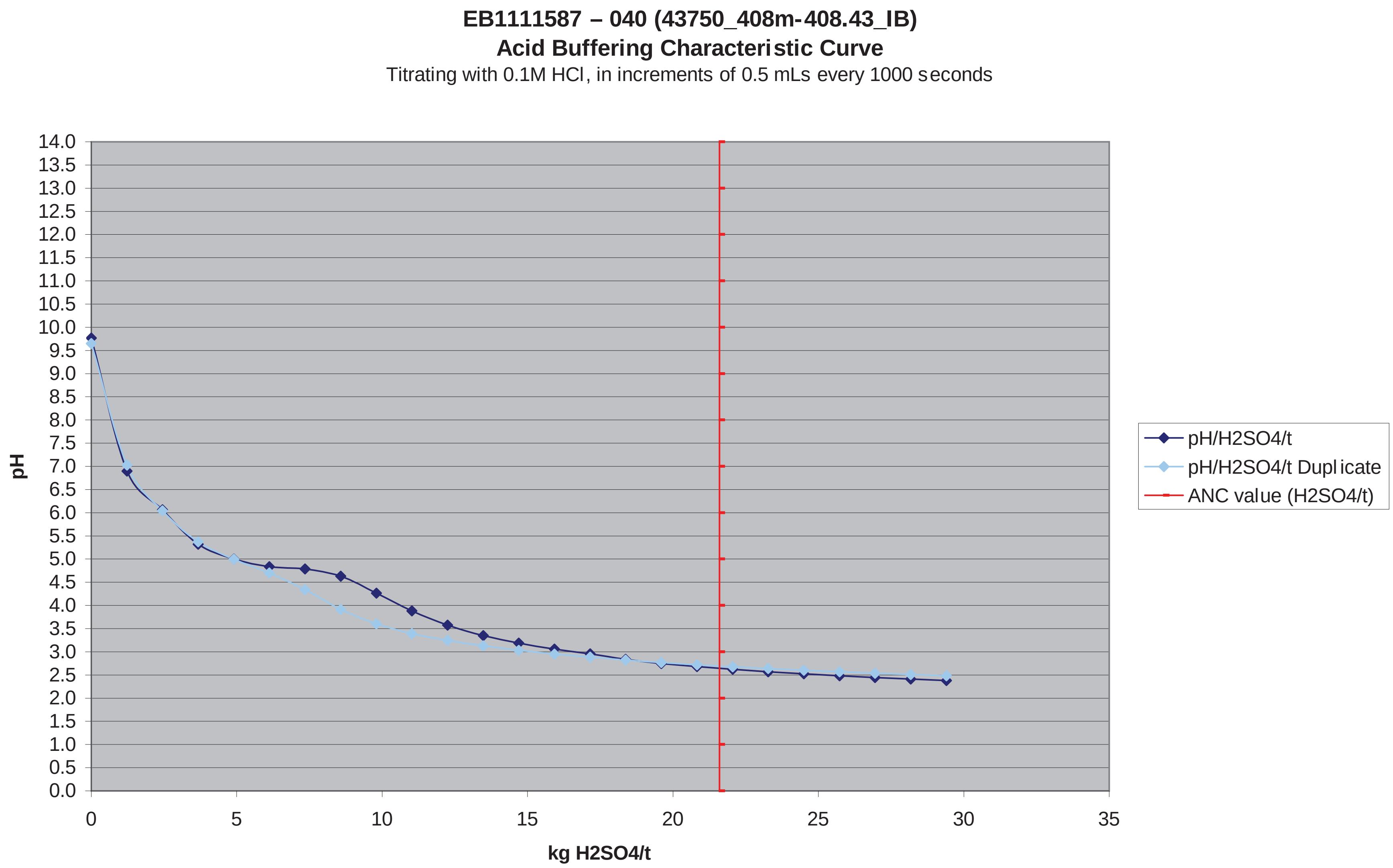


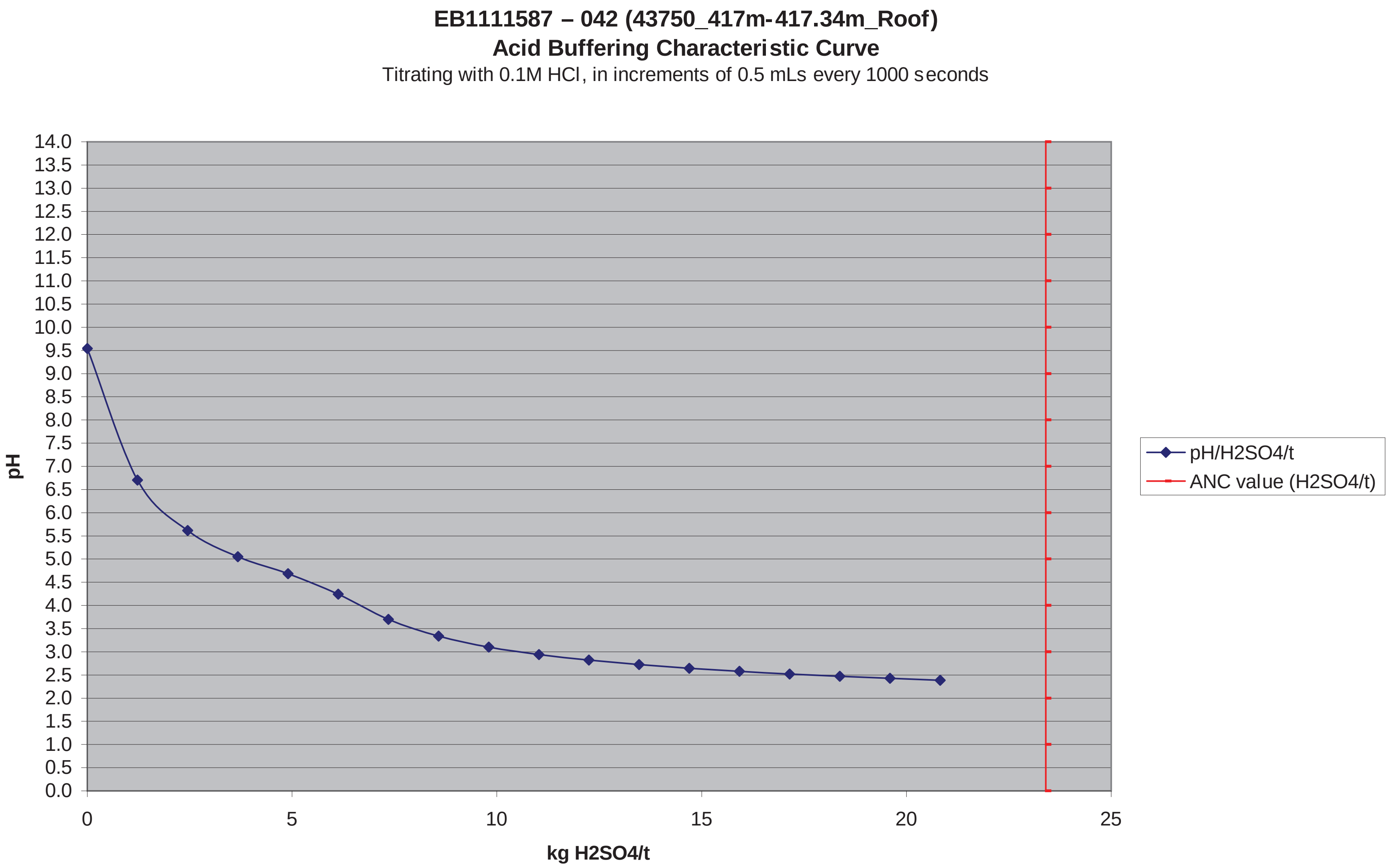
EB1111587 – 039 (43750_404m-404.5m_IB)

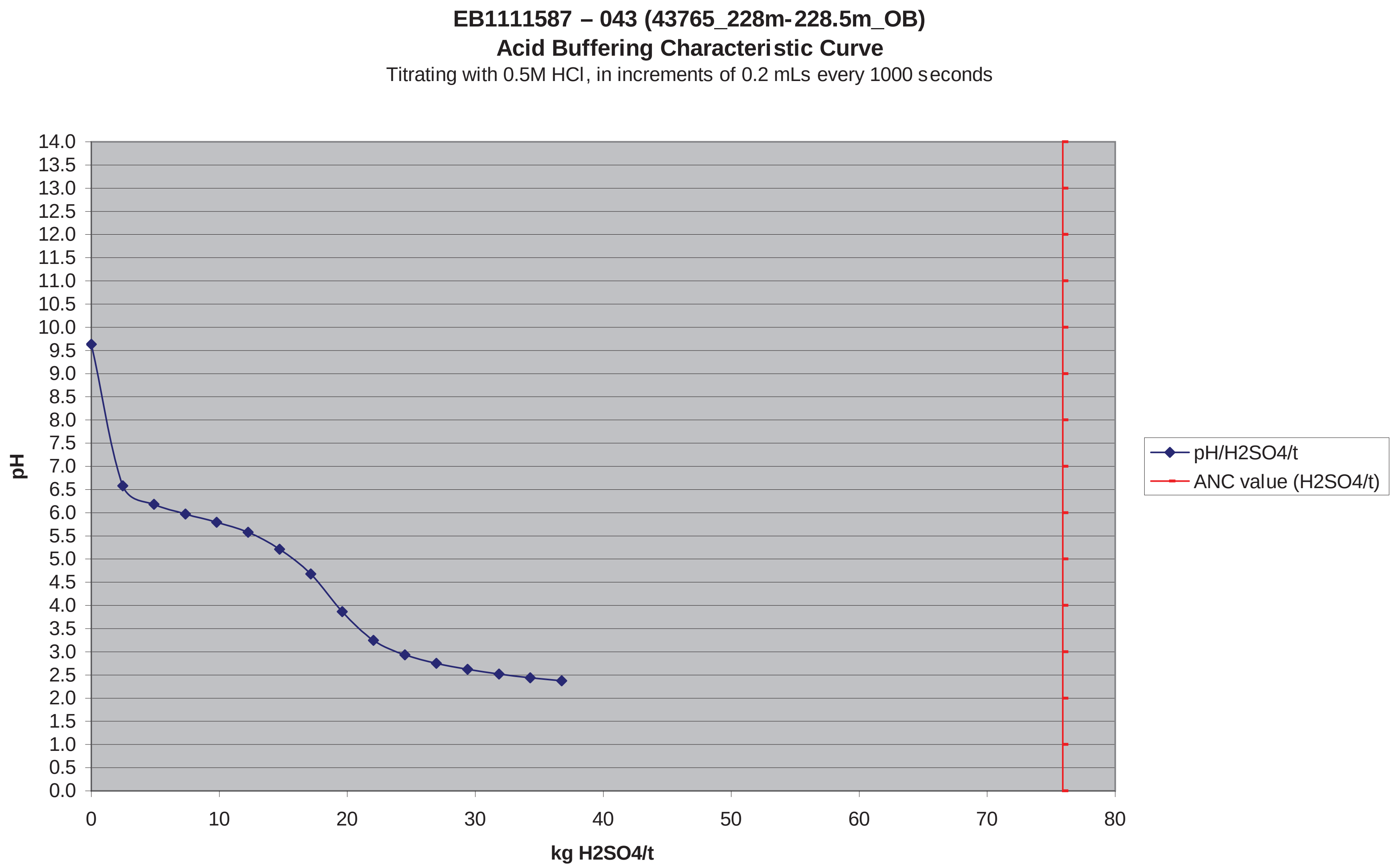
Acid Buffering Characteristic Curve

Titrating with 0.1M HCl, in increments of 0.2 mLs every 1000 seconds

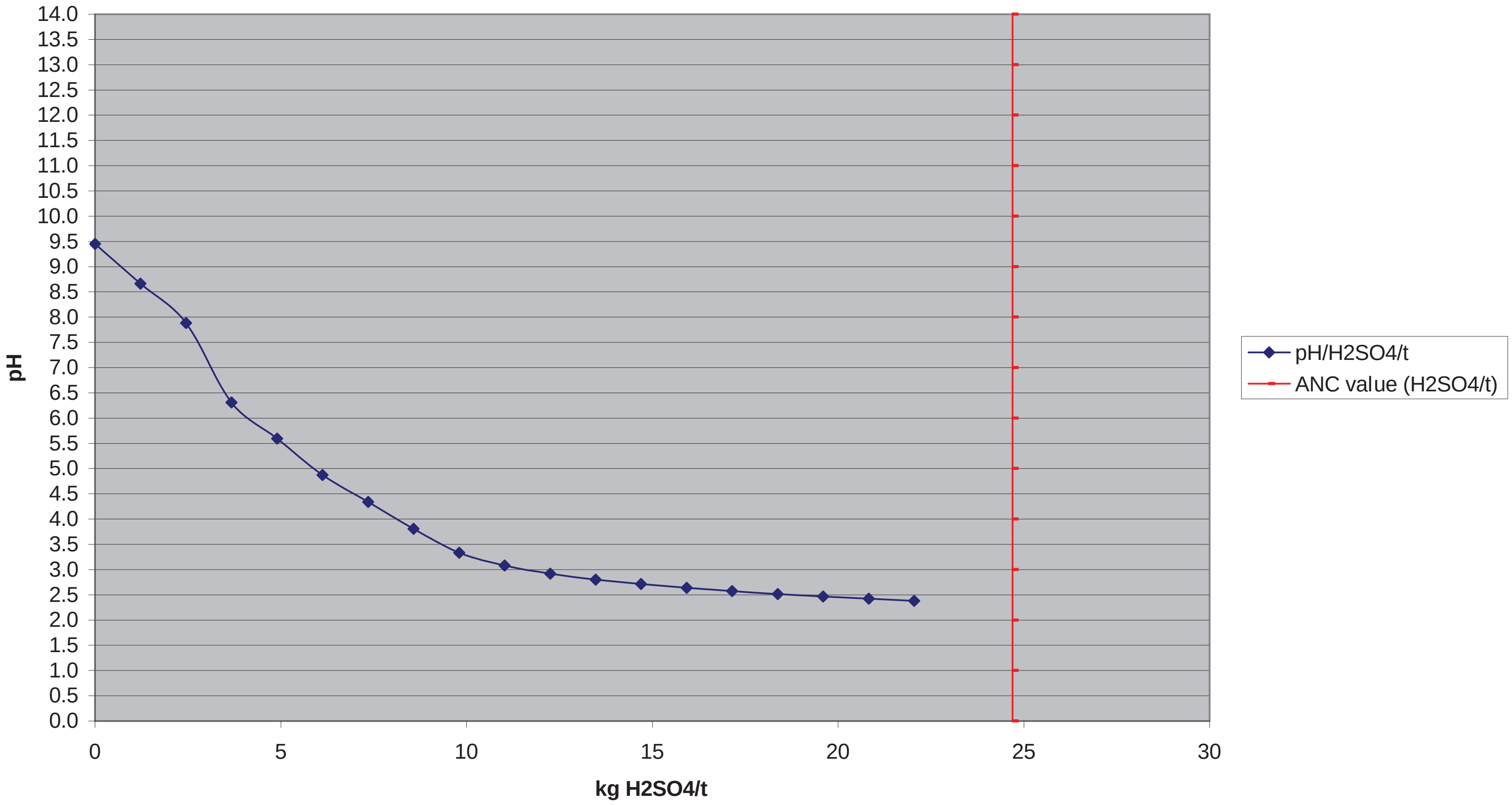



EB1111587 – 040 (43750_408m-408.43_IB)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.5 mLs every 1000 seconds
pH
kg H2SO4/t
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
5
10
15
20
25
30
35
pH/H2SO4/t
pH/H2SO4/t Duplicate
ANC value (H2SO4/t)

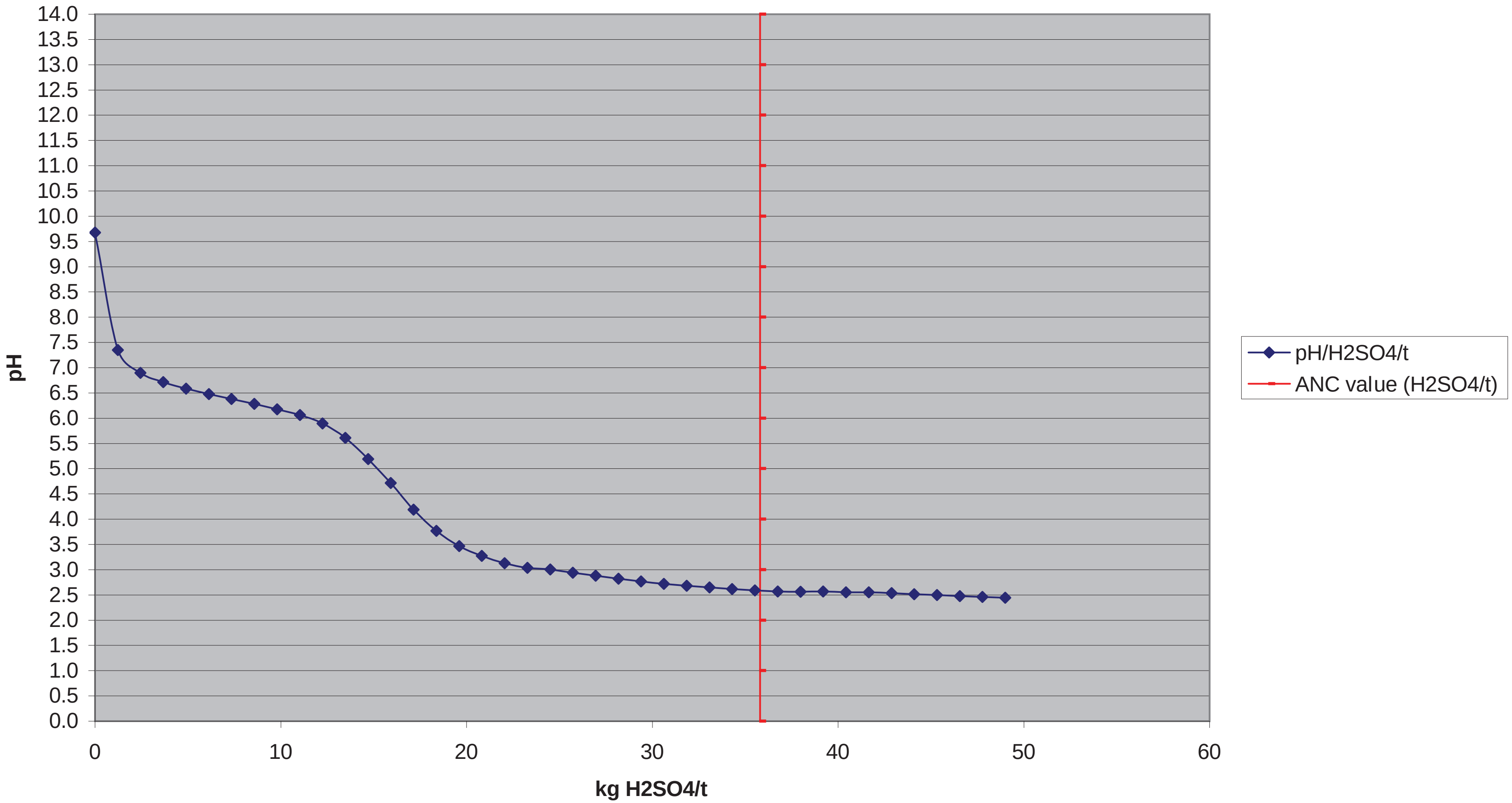

EB1111587 – 042 (43750_417m-417.34m_Roof)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.5 mLs every 1000 seconds
pH
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
5
10
15
20
25
kg H2SO4/t
pH/H2SO4/t
ANC value (H2SO4/t)


EB1111587 – 043 (43765_228m-228.5m_OB)
Acid Buffering Characteristic Curve
Titrating with 0.5M HCl, in increments of 0.2 mLs every 1000 seconds
pH
kg H2SO4/t
pH/H2SO4/t
ANC value (H2SO4/t)
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
10
20
30
40
50
60
70
80

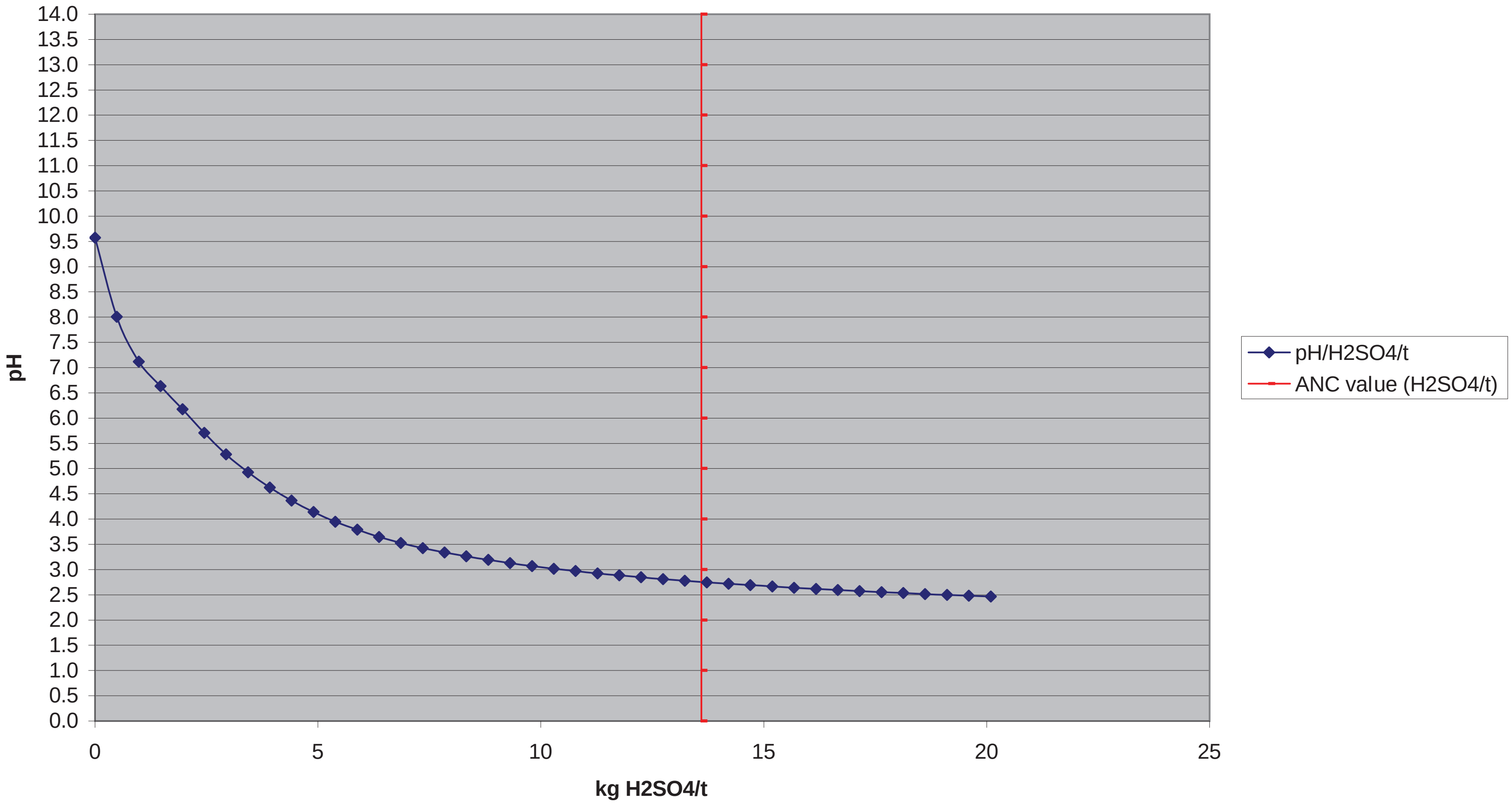
EB1111587 – 049 (43765_389.5m-390m_IB)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.5 mLs every 1000 seconds



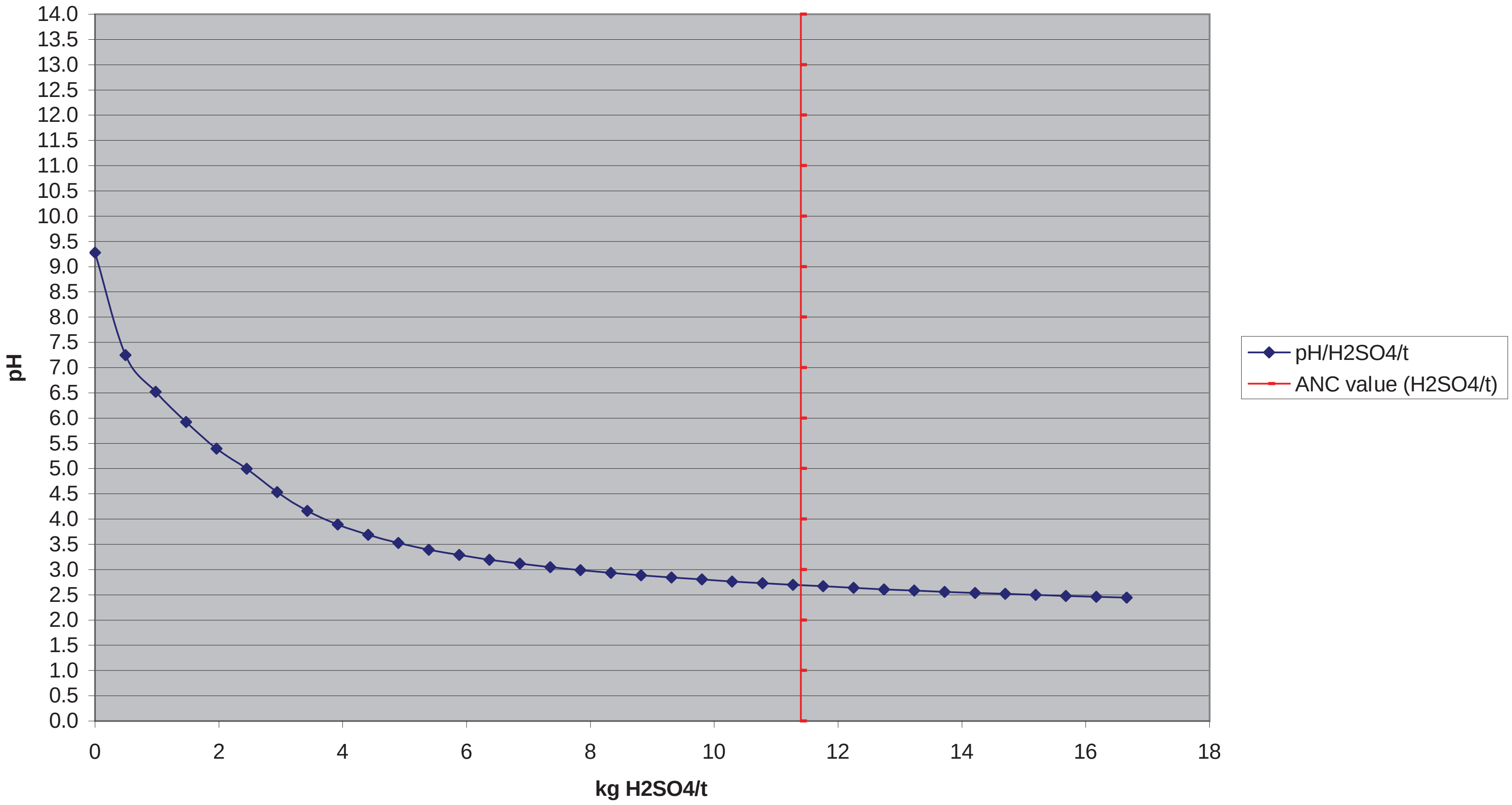
EB1111587 – 050 (43765_390.8m-391.36m_IB)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.5 mLs every 1000 seconds



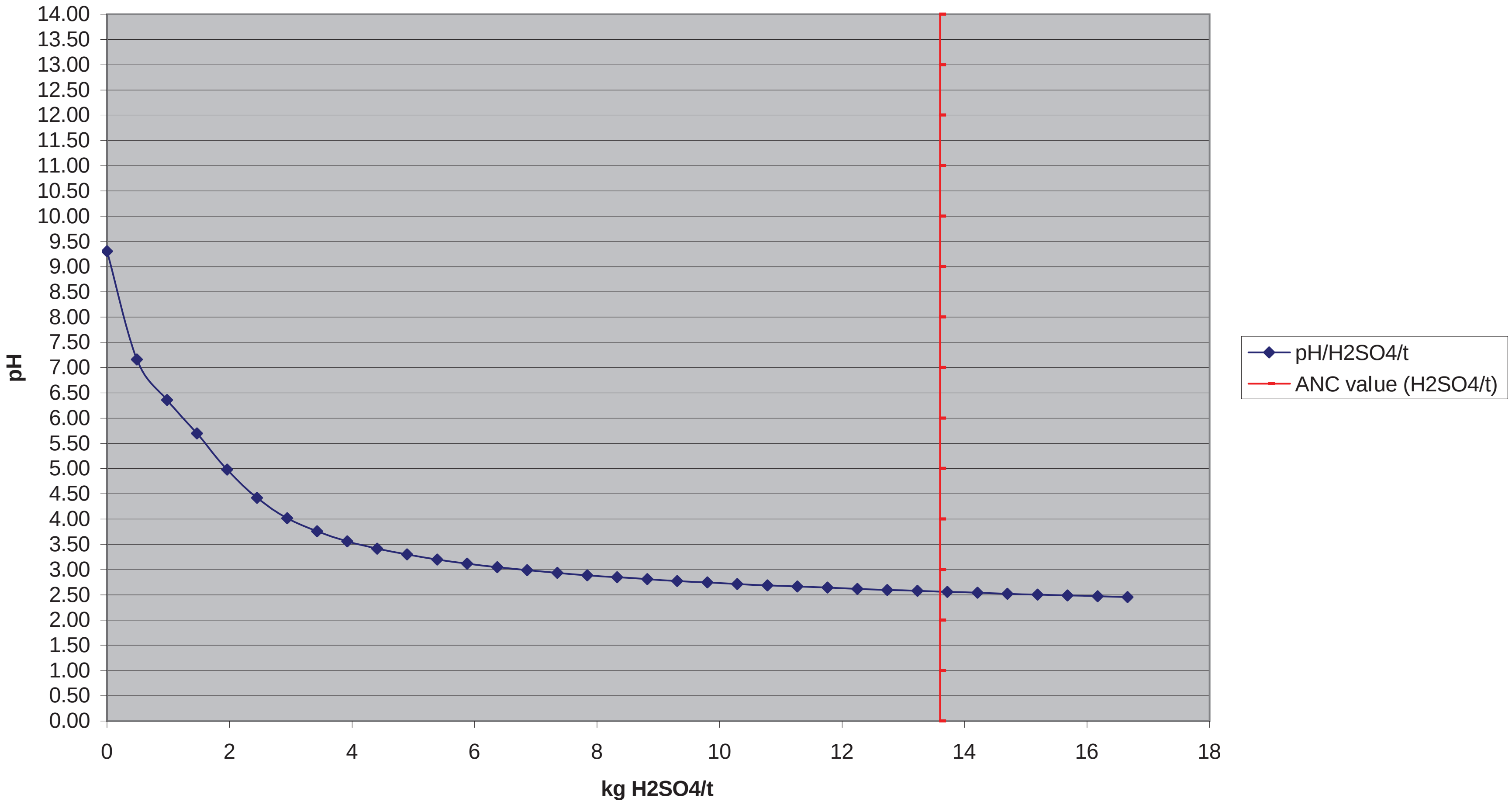
EB1111587 – 060 (43893_315.8m-316.3m_IB)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.2 mLs every 1000 seconds



EB1111587 – 062 (43893_324.46m-324.88m_IB)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.2 mLs every 1000 seconds



EB1111587 – 063 (43893_336m-336.38m_Floor)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.2 mLs every 1000 seconds



Environmental Division
Brisbane
Work Order
EB1111587

Telephone : +61-7-3243 7222

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD

FROM: Tony Jong
Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED: Rapid turn-around

Project Name: GRM_EIS
Project No: 42626689
Project Manager: Kim Bidle
Agreement No.: EN/001/10
Quote No.: BN/060/11

Sampler Name: Samples at ALS
Sampler Contact:

Released by: Lawrie Duck
Date: 14/06/2011 **Time:** 15:00

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

Container Identification						
Type*	PsB	PsB	PsB	PsB		
Preservative Code	none	none	none	none		
Analytes	EA011 - Nett Acid Generation (NAG)	EA011E - Modified NAG with Extended Boil	Carbon (EP005, EP006, EP007)	EA046 - Acid Buffering Characteristic Curves (ABCC)		NOTES

Laboratory ID	ALS Code ID	Core Hole ID	Depth from (m)	Depth to (m)	Sample ID	Matrix	Type	Type Code	Lithology	No of bags	Analysis as per ALS Quotation BN/060/11 - Phase 2: Part A - Solids Analysis	EA011	EA011E	Carbon	EA046		NOTES
1	EB1109393-001	43723	209.50	210.00	43723_209.5m-210m_OB	solid	Overburden	OB	Siltstone	1		X					
2	EB1109393-002	43723	213.12	213.98	43723_213.12m-213.98m_OB	solid	Overburden	OB	Siltstone	1		X					
3	EB1109393-003	43723	217.92	218.30	43723_217.92m-218.3m_Roof	solid	Coal roof	Roof	Siltstone	1		X					
4	EB1109393-004	43723	260.57	261.14	43723_260.57m-261.14m_IB	solid	Interburden	IB	Siltstone	1		X			X		
5	EB1109393-005	43723	264.65	265.15	43723_264.65m-265.15m_Floor	solid	Coal floor	Floor	Claystone	1		X			X		
6	EB1109393-006	43723	372.00	372.50	43723_372m-372.5m_IB	solid	Interburden	IB	Sandstone	1		X					
7	EB1109393-007	43723	375.00	375.48	43723_375m-375.48m_IB	solid	Interburden	IB	Claystone	1		X					
8	EB1109393-008	43723	377.00	377.50	43723_377m-377.5m_IB	solid	Interburden	IB	Siltstone	1		X					
9	EB1109393-009	43723	384.00	384.50	43723_384m-384.5m_IB	solid	Interburden	IB	Sandstone	1		X					
10	EB1109393-010	43723	400.20	400.70	43723_400.2m-400.7m_Floor	solid	Coal floor	Floor	Siltstone	1		X			X		
11	EB1109393-011	43733	74.00	74.50	43733_74m-74.5m_OB	solid	Overburden	OB	Claystone	1		X					
12	EB1109393-012	43733	121.10	121.40	43733_121.1m-121.4m_OB	solid	Overburden	OB	Siltstone	1		X					
13	EB1109393-013	43733	124.35	124.71	43733_124.35m-124.71m_OB	solid	Overburden	OB	Claystone	1		X					
14	EB1109393-014	43733	127.02	127.50	43733_127.02m-127.5m_OB	solid	Overburden	OB	Carbonaceous Claystone	1		X			X		
15	EB1109393-015	43733	128.79	129.29	43733_128.79m-129.29m_Roof	solid	Coal roof	Roof	Carbonaceous Claystone	1		X					
16	EB1109393-016	43733	133.50	134.00	43733_133.5m-134m_Floor	solid	Coal floor	Floor	Siltstone	1		X	X	X			
17	EB1109393-017	43733	135.00	135.38	43733_135m-135.38m_IB	solid	Interburden	IB	Sandstone	1		X					
18	EB1109393-018	43733	214.50	215.00	43733_214.5m-215m_IB	solid	Interburden	IB	Siltstone	1		X					
19	EB1109393-019	43733	219.50	220.04	43733_219.5m-220.04m_IB	solid	Interburden	IB	Siltstone	1		X					
20	EB1109393-020	43733	222.83	223.38	43733_222.83m-223.38m_Roof	solid	Coal roof	Roof	Siltstone	1		X			X		
21	EB1109393-021	43733	235.00	235.43	43733_235m-235.43m_IB	solid	Interburden	IB	Claystone	1		X					
22	EB1109393-022	43733	239.12	239.50	43733_239.12m-239.5m_IB	solid	Interburden	IB	Siltstone	1		X					
23	EB1109393-023	43733	241.50	241.98	43733_241.5m-241.98m_IB	solid	Interburden	IB	Carbonaceous Claystone	1		X					
24	EB1109393-024	43733	245.50	246.00	43733_245.5m-246m_IB	solid	Interburden	IB	Sandstone	1		X					
25	EB1109393-025	43733	256.00	256.36	43733_256m-256.36m_IB	solid	Interburden	IB	Carbonaceous Claystone	1		X					
26	EB1109393-026	43733	267.20	267.75	43733_267.2m-267.75m_IB	solid	Interburden	IB	Siltstone/claystone/sandstone	1		X					
27	EB1109393-027	43733	279.66	280.00	43733_279.66m-280m_Floor	solid	Coal floor	Floor	Siltstone	1		X					
28	EB1109393-028	43750	264.51	265.00	43750_264.51m-265m_OB	solid	Overburden	OB	Siltstone	1		X					
29	EB1109393-029	43750	273.00	273.50	43750_273m-273.5m_OB	solid	Overburden	OB	Sandstone	1		X			X		
30	EB1109393-030	43750	282.20	282.50	43750_282.2m-282.5m_Floor	solid	Coal floor	Floor	Claystone	1		X					
31	EB1109393-031	43750	284.50	285.00	43750_284.5m-285m_IB	solid	Interburden	IB	Siltstone	1		X					

Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY
Job Code:
Due Date:
Comments:
Custody seal intact? YES NO N/A
Sample cold? YES NO N/A

FROM: Tony Jong
Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

Project Name: GRM_EIS
Project No: 42626689
Project Manager: Kim Bidle
Agreement No.: EN/001/10
Quote No.: BN/060/11

Released by: Lawrie Duck
Date: 14/06/2011 **Time:** 15:00

RESULTS REQUIRED: Rapid turn-around

Sampler Name: Samples at ALS
Sampler Contact:

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

	Container Identification					
Type*	PsB	PsB	PsB	PsB		
Preservative Code	none	none	none	none		
Analytes	EA011 - Nett Acid Generation (NAG)	EA011E - Modified NAG with Extended Boil	Carbon (EP005, EP006, EP007)	EA046 - Acid Buffering Characteristic Curves (ABCC)		NOTES

Analysis as per ALS Quotation BN/060/11 - Phase 2: Part A - Solids Analysis

Laboratory ID	ALS Code ID	Core Hole ID	Depth from (m)	Depth to (m)	Sample ID	Matrix	Type	Type Code	Lithology	No of bags		EA011	EA011E	Carbon	EA046		NOTES
32	EB1109393-032	43750	361.00	361.50	43750_361m-361.5m_IB	solid	Interburden	IB	Sandstone	1		X			X		
33	EB1109393-033	43750	364.90	365.24	43750_364.9m-365.24m_IB	solid	Interburden	IB	Conglomerate	1		X			X		
34	EB1109393-034	43750	366.50	366.95	43750_366.5m-366.95m_IB	solid	Interburden	IB	Siltstone	1		X					
35	EB1109393-035	43750	368.69	369.08	43750_368.69m-369.08m_Roof	solid	Coal roof	Roof	Siltstone	1		X					
36	EB1109393-036	43750	378.50	379.00	43750_378.5m-379m_Floor	solid	Coal floor	Floor	Sandstone	1		X			X		
37	EB1109393-037	43750	383.00	383.50	43750_383m-383.5m_IB	solid	Interburden	IB	Sandstone	1		X					
38	EB1109393-038	43750	400.00	400.50	43750_400m-400.5m_IB	solid	Interburden	IB	Siltstone	1		X					
39	EB1109393-039	43750	404.00	404.50	43750_404m-404.5m_IB	solid	Interburden	IB	Carbonaceous Claystone	1		X			X		
40	EB1109393-040	43750	408.00	408.43	43750_408m-408.43m_IB	solid	Interburden	IB	Claystone	1		X			X		
41	EB1109393-041	43750	414.14	414.47	43750_414.14m-414.47m_IB	solid	Interburden	IB	Sandstone	1		X					
42	EB1109393-042	43750	417.00	417.34	43750_417m-417.34m_Roof	solid	Coal roof	Roof	Sandstone/silstone	1		X			X		
43	EB1109393-043	43765	228.00	228.50	43765_228m-228.5m_OB	solid	Overburden	OB	Siltstone	1		X			X		
44	EB1109393-044	43765	241.50	242.00	43765_241.5m-242m_IB	solid	Interburden	IB	Sandstone/siltstone	1		X					
45	EB1109393-045	43765	322.50	323.00	43765_322.5m-323m_IB	solid	Interburden	IB	Siltstone	1		X					
46	EB1109393-046	43765	324.60	325.10	43765_324.6m-325.1m_IB	solid	Interburden	IB	Claystone	1		X					
47	EB1109393-047	43765	337.60	338.10	43765_337.6m-338.1m_IB	solid	Interburden	IB	Carbonaceous Claystone	1		X					
48	EB1109393-048	43765	385.00	385.50	43765_385m-385.5m_IB	solid	Interburden	IB	Siltstone	1		X					
49	EB1109393-049	43765	389.50	390.00	43765_389.5m-390m_IB	solid	Interburden	IB	Carbonaceous Siltstone	1		X			X		
50	EB1109393-050	43765	390.80	391.36	43765_390.8m-391.36m_IB	solid	Interburden	IB	Sandstone/siltstone	1		X			X		
51	EB1109393-051	43765	392.30	392.63	43765_392.3m-392.63m_Roof	solid	Coal roof	Roof	siltstone/claystone	1		X					
52	EB1109393-052	43893	177.50	178.00	43893_177.5m-178m_OB	solid	Overburden	OB	Sandstone	1		X					
53	EB1109393-053	43893	182.00	182.50	43893_182m-182.5m_OB	solid	Overburden	OB	Siltstone	1		X					
54	EB1109393-054	43893	186.96	187.37	43893_186.96m-187.37m_Roof	solid	Coal roof	Roof	Shale	1		X	X	X			
55	EB1109393-055	43893	192.12	192.62	43893_192.12m-192.62m_Floor	solid	Coal floor	Floor	Siltstone	1		X					
56	EB1109393-056	43893	194.00	194.50	43893_194m-194.5m_IB	solid	Interburden	IB	Sandstone	1		X					
57	EB1109393-057	43893	299.46	299.94	43893_299.46m-299.94m_Roof	solid	Coal roof	Roof	Shale/Siltstone	1		X					
58	EB1109393-058	43893	307.57	308.07	43893_307.57m-308.07m_Floor	solid	Coal floor	Floor	Shale/Sandstone	1		X					
59	EB1109393-059	43893	312.00	312.50	43893_312m-312.5m_IB	solid	Interburden	IB	Sandstone	1		X					
60	EB1109393-060	43893	315.80	316.30	43893_315.8m-316.3m_IB	solid	Interburden	IB	Shale	1		X			X		
61	EB1109393-061	43893	322.80	323.30	43893_322.8m-323.3m_IB	solid	Interburden	IB	Siltstone	1		X					
62	EB1109393-062	43893	324.46	324.88	43893_324.46m-324.88m_IB	solid	Interburden	IB	Mudstone	1		X			X		

Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222, 26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY
Job Code:
Due Date:
Comments:
Custody seal intact? YES NO N/A
Sample cold? YES NO N/A

FROM: Tony Jong
Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED: Rapid turn-around

Project Name: GRM_EIS
Project No: 42626689
Project Manager: Kim Bidle
Agreement No.: EN/001/10
Quote No.: BN/060/11

Sampler Name: Samples at ALS
Sampler Contact:

Released by: Lawrie Duck
Date: 14/06/2011 **Time:** 15:00

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis — Container Identification

Type*	PsB	PsB	PsB	PsB	
Preservative Code	none	none	none	none	
Analytes	EA011 - Nett Acid Generation (NAG)	EA011E - Modified NAG with Extended Boil	Carbon (EP005, EP006, EP007)	EA046 - Acid Buffering Characteristic Curves (ABCC)	

NOTES

Laboratory ID	ALS Code ID	Core Hole ID	Depth from (m)	Depth to (m)	Sample ID	Matrix	Type	Type Code	Lithology	No of bags	Analysis as per ALS Quotation BN/060/11 - Phase 2: Part A - Solids Analysis	EA011	EA011E	Carbon	EA046		NOTES
63	EB1109393-063	43893	336.00	336.38	43893_336m-336.38m_Floor	solid	Coal floor	Floor	Carbonaceous Mudstone/Siltstone	1		X	X	X	X		
64	EB1109393-064	43893	357.09	357.59	43893_357.09m-357.59m_Roof	solid	Coal roof	Roof	Siltstone	1		X					
65	EB1109393-065	43893	363.61	364.11	43893_363.61m-364.11m_Floor	solid	Coal floor	Floor	Siltstone	1		X					
Remarks to Lab:	Analysis as per ALS Quotation BN/060/11 - Phase 2: Part A - Solids Analysis								**TOTAL number of bags**	65	**TOTAL number of each analyte**	65	3	3	18		

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

Email Results to: tony_jong@urscorp.com lawrie_duck@urscorp.com

NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES. GLOVES SHOULD BE WORN WHILST HANDLING SAMPLES.

Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY
Job Code:
Due Date:
Comments:
Custody seal intact? YES NO N/A
Sample cold? YES NO N/A

FROM: Tony Jong
URS Australia: Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED: Rapid turn-around

Project Name: GRM_EIS
Project No: 42626689
Project Manager: Kim Bidle
Agreement No.: EN/001/10
Quote No.: BN/060/11

Sampler Name: Samples at ALS
Sampler Contact:

Released by: Lawrie Duck
Date: 14/06/2011 **Time:** 15:00

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

	Container Identification								
Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB
Preservative Code	none	none	none	none	none	none	none	none	none
Analytes	Compositing of samples (EN020)	CEC (ED007)	Exchangeable (Ca, Mg, Na, K) (ED007)	ESP (ED007)	Four Acid 'Near Total' Digest with ICPAES/ICPMS finish (ME-MS61)	Mercury (ME-MS42)	Total Carbon (C-IR07)	1:5 Leach (EN34)	Analysis of 1:5 Leach (as per COC_3_GRM_EIS_Geochem_Composites_1:5 Leach)

Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B - Composites Analysis

	Laboratory ID	ALS Code	Core Hole ID	Depth from (m)	Depth to (m)	Sample ID	Matrix	Type	Type Code	Lithology	Composite #		Compositing of samples (EN020)	CEC (ED007)	Exchangeable (Ca, Mg, Na, K) (ED007)	ESP (ED007)	Four Acid 'Near Total' Digest (ME-MS61)	Mercury (ME-MS42)	Total Carbon (C-IR07)	1:5 Leach (EN34)	Analysis of 1:5 Leach	NOTES
COMP1		EB1109393-001	43723	209.50	210.00	43723_209.5m-210m_OB	Solid	Overburden	OB	Siltstone	GRM01	66	X	X	X	X	X	X	X	X	X	67
		EB1109393-002	43723	213.12	213.98	43723_213.12m-213.98m_OB	Solid	Overburden	OB	Siltstone												
		EB1109393-012	43733	121.10	121.40	43733_121.1m-121.4m_OB	Solid	Overburden	OB	Siltstone												
		EB1109393-028	43750	264.51	265.00	43750_264.51m-265m_OB	Solid	Overburden	OB	Siltstone												
		EB1109393-043	43765	228.00	228.50	43765_228m-228.5m_OB	Solid	Overburden	OB	Siltstone												
		EB1109393-053	43893	182.00	182.50	43893_182m-182.5m_OB	Solid	Overburden	OB	Siltstone												
COMP2		EB1109393-011	43733	74.00	74.50	43733_74m-74.5m_OB	Solid	Overburden	OB	Claystone	GRM02	67 ~~68~~	X	X	X	X	X	X	X	X	X	69
		EB1109393-013	43733	124.35	124.71	43733_124.35m-124.71m_OB	Solid	Overburden	OB	Claystone												
3		EB1109393-014	43733	127.02	127.50	43733_127.02m-127.5m_OB	Solid	Overburden	OB	Carbonaceous Claystone	GRM03	68 ~~70~~	X	X	X	X	X	X	X	X	X	~~71~~
4		EB1109393-029	43750	273.00	273.50	43750_273m-273.5m_OB	Solid	Overburden	OB	Sandstone	GRM04	69 ~~72~~	X	X	X	X	X	X	X	X	X	~~73~~
		EB1109393-052	43893	177.50	178.00	43893_177.5m-178m_OB	Solid	Overburden	OB	Sandstone												
5		EB1109393-004	43723	260.57	261.14	43723_260.57m-261.14m_IB	Solid	Interburden	IB	Siltstone	GRM05	70 ~~74~~	X	X	X	X	X	X	X	X	X	~~75~~
		EB1109393-031	43750	284.50	285.00	43750_284.5m-285m_IB	Solid	Interburden	IB	Siltstone												
6		EB1109393-018	43733	214.50	215.00	43733_214.5m-215_IB	Solid	Interburden	IB	Siltstone	GRM06	71 ~~76~~	X	X	X	X	X	X	X	X	X	~~77~~
		EB1109393-019	43733	219.50	220.04	43733_219.5m-220.04m_IB	Solid	Interburden	IB	Siltstone												
		EB1109393-034	43750	366.50	366.95	43750_366.5m-366.95m_IB	Solid	Interburden	IB	Siltstone												
		EB1109393-045	43765	322.50	323.00	43765_322.5m-323m_IB	Solid	Interburden	IB	Siltstone												
7		EB1109393-022	43733	239.12	239.50	43733_239.12m-239.5m_IB	Solid	Interburden	IB	Siltstone	GRM07	72 ~~78~~	X	X	X	X	X	X	X	X	X	79
		EB1109393-038	43750	400.00	400.50	43750_400m-400.5m_IB	Solid	Interburden	IB	Siltstone												
		EB1109393-048	43765	385.00	385.50	43765_385m-385.5m_IB	Solid	Interburden	IB	Siltstone												
		EB1109393-061	43893	322.80	323.30	43893_322.8m-323.3m_IB	Solid	Interburden	IB	Siltstone												
8		EB1109393-008	43723	377.00	377.50	43723_377m-377.5m_IB	Solid	Interburden	IB	Siltstone	GRM08	73 ~~80~~	X	X	X	X	X	X	X	X	X	~~81~~
9		EB1109393-056	43893	194.00	194.50	43893_194m-194.5m_IB	Solid	Interburden	IB	Sandstone	GRM09	74 ~~82~~	X	X	X	X	X	X	X	X	X	83
		EB1109393-017	43733	135.00	135.38	43733_135m-135.38m_IB	Solid	Interburden	IB	Sandstone												
10 9		EB1109393-032	43750	361.00	361.50	43750_361m-361.5m_IB	Solid	Interburden	IB	Sandstone	GRM10	75 ~~84~~	X	X	X	X	X	X	X	X	X	~~85~~
10		EB1109393-024	43733	245.50	246.00	43733_245.5m-246m_IB	Solid	Interburden	IB	Sandstone	GRM11	76 ~~86~~	X	X	X	X	X	X	X	X	X	87
		EB1109393-037	43750	383.00	383.50	43750_383m-383.5m_IB	Solid	Interburden	IB	Sandstone												
		EB1109393-041	43750	414.14	414.47	43750_414.14m-414.47m_IB	Solid	Interburden	IB	Sandstone												
12		EB1109393-059	43893	312.00	312.50	43893_312m-312.5m_IB	Solid	Interburden	IB	Sandstone	GRM12	77 ~~88~~	X	X	X	X	X	X	X	X	X	~~89~~

THIS SECTION FOR LAB USE ONLY
Job Code:
Due Date:
Comments:
Custody seal intact? YES NO N/A
Sample cold? YES NO N/A

FROM: Tony Jong
URS Australia: Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED: Rapid turn-around

Project Name: GRM_EIS
Project No: 42626689
Project Manager: Kim Bidle
Agreement No.: EN/001/10
Quote No.: BN/060/11

Sampler Name: Samples at ALS
Sampler Contact:

Released by: Lawrie Duck
Date: 14/06/2011 **Time:** 15:00

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

Container Identification

	Analytes	Compositing of samples (EN020)	CEC (ED007)	Exchangeable (Ca, Mg, Na, K) (ED007)	ESP (ED007)	Four Acid 'Near Total' Digest with ICPAES/ICPMS finish (ME-MS61)	Mercury (ME-MS42)	Total Carbon (C-IR07)	1:5 Leach (EN34)	Analysis of 1:5 Leach (as per COC_3_GRM_EIS_Geochem_Composites_1:5 Leach)	NOTES
Type*		PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	
Preservative Code		none	none	none	none	none	none	none	none	none	

	Laboratory ID	ALS Code	Core Hole ID	Depth from (m)	Depth to (m)	Sample ID	Matrix	Type	Type Code	Lithology	Composite #	Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B - Composites Analysis										
13		EB1109393-006	43723	372.00	372.50	43723_372m-372.5m_IB	Solid	Interburden	IB	Sandstone	GRM13	78 ~~90~~	X	X	X	X	X	X	X	X	X	~~91~~
		EB1109393-009	43723	384.00	384.50	43723_384m-384.5m_IB	Solid	Interburden	IB	Sandstone												
14		EB1109393-046	43765	324.60	325.10	43765_324.6m-325.1m_IB	Solid	Interburden	IB	Claystone	GRM14	79 ~~92~~	X	X	X	X	X	X	X	X	X	~~93~~
15		EB1109393-021	43733	235.00	235.43	43733_235m-235.43m_IB	Solid	Interburden	IB	Claystone	GRM15	80 ~~94~~	X	X	X	X	X	X	X	X	X	~~95~~
		EB1109393-040	43750	408.00	408.43	43750_408m-408.43m_IB	Solid	Interburden	IB	Claystone												
16		EB1109393-007	43723	375.00	375.48	43723_375m-375.48m_IB	Solid	Interburden	IB	Claystone	GRM16	81 ~~96~~	X	X	X	X	X	X	X	X	X	~~97~~
17		EB1109393-023	43733	241.50	241.98	43733_241.5m-241.98m_IB	Solid	Interburden	IB	Carbonaceous Claystone	GRM17	82 ~~98~~	X	X	X	X	X	X	X	X	X	~~99~~
		EB1109393-025	43733	256.00	256.36	43733_256m-256.36m_IB	Solid	Interburden	IB	Carbonaceous Claystone												
		EB1109393-039	43750	404.00	404.50	43750_404m-404.5m_IB	Solid	Interburden	IB	Carbonaceous Claystone												
		EB1109393-047	43765	337.60	338.10	43765_337.6m-338.1m_IB	Solid	Interburden	IB	Carbonaceous Claystone												
		EB1109393-049	43765	389.50	390.00	43765_389.5m-390m_IB	Solid	Interburden	IB	Carbonaceous Siltstone												
18		EB1109393-044	43765	241.50	242.00	43765_241.5m-242m_IB	Solid	Interburden	IB	Sandstone/siltstone	GRM18.	83 ~~100~~	X	X	X	X	X	X	X	X	X	~~101~~
19		EB1109393-033	43750	364.90	365.24	43750_364.9m-365.24m_IB	Solid	Interburden	IB	Conglomerate	GRM19	84 ~~102~~	X	X	X	X	X	X	X	X	X	~~103~~
20		EB1109393-026	43733	267.20	267.75	43733_267.2m-267.75m_IB	Solid	Interburden	IB	Siltstone/claystone/sandstone	GRM20	85 ~~104~~	X	X	X	X	X	X	X	X	X	~~105~~
		EB1109393-050	43765	390.80	391.36	43765_390.8m-391.36m_IB	Solid	Interburden	IB	Sandstone/siltstone												
21		EB1109393-060	43893	315.80	316.30	43893_315.8m-316.3m_IB	Solid	Interburden	IB	Shale	GRM21	86 ~~106~~	X	X	X	X	X	X	X	X	X	~~107~~
22		EB1109393-062	43893	324.46	324.88	43893_324.46m-324.88m_IB	Solid	Interburden	IB	Mudstone	GRM22	87 ~~108~~	X	X	X	X	X	X	X	X	X	~~109~~
23		EB1109393-015	43733	128.79	129.29	43733_128.79m-129.29m_Roof	Solid	Roof	Roof	Carbonaceous Claystone	GRM23	88 ~~110~~	X	X	X	X	X	X	X	X	X	~~111~~
24		EB1109393-003	43723	217.92	218.30	43723_217.92m-218.3m_Roof	Solid	Roof	Roof	Siltstone	GRM24	89 ~~112~~	X	X	X	X	X	X	X	X	X	~~113~~
25		EB1109393-020	43733	222.83	223.38	43733_222.83m-223.38m_Roof	Solid	Roof	Roof	Siltstone	GRM25	90 ~~114~~	X	X	X	X	X	X	X	X	X	~~115~~
		EB1109393-035	43750	368.69	369.08	43750_368.69m-369.08m_Roof	Solid	Roof	Roof	Siltstone												
		EB1109393-057	43893	299.46	299.94	43893_299.46m-299.94m_Roof	Solid	Roof	Roof	Shale/Siltstone												
26		EB1109393-042	43750	417.00	417.34	43750_417m-417.34m_Roof	Solid	Roof	Roof	Sandstone/Siltstone	GRM26	91 ~~116~~	X	X	X	X	X	X	X	X	X	~~117~~.
		EB1109393-051	43765	392.30	392.63	43765_392.3m-392.63m_Roof	Solid	Roof	Roof	Siltstone/Claystone												
		EB1109393-064	43893	357.09	357.59	43893_357.09m-357.59m_Roof	Solid	Roof	Roof	Siltstone												
27		EB1109393-054	43893	186.96	187.37	43893_186.96m-187.37m_Roof	Solid	Roof	Roof	Shale	GRM27	92 ~~118~~	X	X	X	X	X	X	X	X	X	~~119~~
28		EB1109393-055	43893	192.12	192.62	43893_192.12m-192.62m_Floor	Solid	Floor	Floor	Siltstone	GRM28	93 ~~120~~	X	X	X	X	X	X	X	X	X	~~121~~
29		EB1109393-010	43723	400.20	400.70	43723_400.2m-400.7m_Floor	Solid	Floor	Floor	Siltstone	GRM29	94 ~~122~~	X	X	X	X	X	X	X	X	X	~~123~~
		EB1109393-065	43893	363.61	364.11	43893_363.61m-364.11m_Floor	Solid	Floor	Floor	Siltstone												
		EB1109393-027	43733	279.66	280.00	43733_279.66m-280m_Floor	Solid	Floor	Floor	Siltstone												
30		EB1109393-058	43893	307.57	308.07	43893_307.57m-308.07m_Floor	Solid	Floor	Floor	Shale/Sandstone	GRM30	95 ~~124~~	X	X	X	X	X	X	X	X	X	~~125~~
31		EB1109393-036	43750	378.50	379.00	43750_378.5m-379m_Floor	Solid	Floor	Floor	Sandstone	GRM31	96 ~~126~~	X	X	X	X	X	X	X	X	X	~~127~~

THIS SECTION FOR LAB USE ONLY

Job Code:

Due Date:

Comments:

Custody seal intact? YES NO N/A

Sample cold? YES NO N/A

FROM: Tony Jong

URS Australia: Level 17, 240 Queen Street Brisbane QLD 4000

Contact: Tony Jong or Lawrie Duck

Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED: Rapid turn-around

Project Name: GRM_EIS

Project No: 42626689

Project Manager: Kim Bidle

Agreement No.: EN/001/10

Quote No.: BN/060/11

Sampler Name: Samples at ALS

Sampler Contact:

Released by: Lawrie Duck

Date: 14/06/2011 **Time:** 15:00

Received for Laboratory by:

Date: **Time:**

Container Type, Preservative and Analysis

Container Identification

												Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	
												Preservative Code	none	none	none	none	none	none	none	none	none	
												Analytes	Compositing of samples (EN020)	CEC (ED007)	Exchangeable (Ca, Mg, Na, K) (ED007)	ESP (ED007)	Four Acid 'Near Total' Digest with ICPAES/ICPMS finish (ME-MS61)	Mercury (ME-MS42)	Total Carbon (C-IR07)	1:5 Leach (EN34)	Analysis of 1:5 Leach (as per COC_3_GRM_EIS_Geochem_Composites_1:5 Leach)	NOTES
	Laboratory ID	ALS Code	Core Hole ID	Depth from (m)	Depth to (m)	Sample ID	Matrix	Type	Type Code	Lithology	Composite #	Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B - Composites Analysis										
32		EB1109393-005	43723	264.65	265.15	43723_264.65m-265.15m_Floor	Solid	Floor	Floor	Claystone	GRM32 97	128	X	X	X	X	X	X	X	X	X	129
		EB1109393-030	43750	282.20	282.50	43750_282.2m-282.5m_Floor	Solid	Floor	Floor	Claystone												
33		EB1109393-016	43733	133.50	134.00	43733_133.5m-134m_Floor	Solid	Floor	Floor	Siltstone	GRM33 98	130	X	X	X	X	X	X	X	X	X	131
34		EB1109393-063	43893	336.00	336.38	43893_336m-336.38m_Floor	Solid	Floor	Floor	Carbonaceous Mudstone/Siltstone	GRM34 99	132	X	X	X	X	X	X	X	X	X	133
	Remarks to Lab:	Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B - Composites Analysis								TOTAL number of Composites	34	TOTAL number of each analyte	34	34	34	34	34	34	34	34	34	

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

Email Results to: tony_jong@urscorp.com lawrie_duck@urscorp.com

NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES. GLOVES SHOULD BE WORN WHILST HANDLING SAMPLES.

Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY
Job Code:
Due Date:
Comments:
Custody seal intact? YES NO N/A
Sample cold? YES NO N/A

FROM: Tony Jong **RESULTS REQUIRED:** Rapid Turn-around
URS Australia: Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

Project Name: GRM_EIS
Project No: 42626689
Project Manager: Kim Bidle
Agreement No.: EN/001/10
Quote No.: BN/060/11

Samples to be produced as per URS COC_2_GRM_EIS_Geochem_Phase 2-Part B_Composites_Solids

Released by:
Date: **Time:**

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

	Container Identification										
Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	
Preservative Code	none	none	none	none	none	none	none	none	none	none	
Analytes	Soluble Metals by ICP-MS (Ag, Al, As, Cd, Co, Cr, Cu, Pb, Ni, Mn, Mo, Sb, Se, U, V, Zn) (EG020S)	Soluble Metals by ICP-AES (B, Fe) (EG005S)	Soluble Mercury (Hg) by FIMS (EG035S)	pH (1:5) (EA002)	EC (1:5) (EA010)	Soluble Cations by ICP-AES (Ca, Mg, Na, K) (ED093S)	Soluble Chloride (ED045G)	Soluble Sulfate (ED040S)	Alkalinity (ED037)	Sodium Adsorption Ratio (SAR) (EA006)	NOTES

Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B - Composites Analysis - Analysis of 1:5 Leach

Laboratory ID	Sample Date	Sample ID	Matrix	Type	Containers	EG020S	EG005S	EG035S	EA002	EA010	ED093S	ED045G	ED040S	ED037	EA006	NOTES
		Composite 1	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 2	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 3	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 4	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 5	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 6	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 7	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 8	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 9	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 10	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 11	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 12	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 13	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 14	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 15	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 16	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 17	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 18	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 19	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 20	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 21	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 22	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 23	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 24	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 25	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	
		Composite 26	Liquid	1:5 Leach		X	X	X	X	X	X	X	X	X	X	

THIS SECTION FOR LAB USE ONLY	FROM: Tony Jong	RESULTS REQUIRED: Rapid Turn-around
Job Code:	URS Australia: Level 17, 240 Queen Street Brisbane QLD 4000	
Due Date:	Contact: Tony Jong or Lawrie Duck	
	Ph: 07 3243 2119 / 0409 130 088	
Comments:	Project Name: GRM_EIS Project No: 42626689 Project Manager: Kim Bidle Agreement No.: EN/001/10 Quote No.: BN/060/11	Samples to be produced as per URS COC_2_GRM_EIS_Geochem_Phase 2-Part B_Composites_Solids
Custody seal intact? YES NO N/A Sample cold? YES NO N/A	Released by: Date: Time:	Received for Laboratory by: Date: Time:

Container Type, Preservative and Analysis

Container Identification

						Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	NOTES
						Preservative Code	none	none	none	none	none	none	none	none	none	none	
						Analytes	Soluble Metals by ICP-MS (Ag, Al, As, Cd, Co, Cr, Cu, Pb, Ni, Mn, Mo, Sb, Se, U, V, Zn) (EG020S)	Soluble Metals by ICP-AES (B, Fe) (EG005S)	Soluble Mercury (Hg) by FIMS (EG035S)	pH (1:5) (EA002)	EC (1:5) (EA010)	Soluble Cations by ICP-AES (Ca, Mg, Na, K) (ED093S)	Soluble Chloride (ED045G)	Soluble Sulfate (ED040S)	Alkalinity (ED037)	Sodium Adsorption Ratio (SAR) (EA006)	
Laboratory ID	Sample Date	Sample ID	Matrix	Type	Containers	Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B - Composites Analysis - Analysis of 1:5 Leach											
		Composite 27	Liquid	1:5 Leach			X	X	X	X	X	X	X	X	X	X	
		Composite 28	Liquid	1:5 Leach			X	X	X	X	X	X	X	X	X	X	
		Composite 29	Liquid	1:5 Leach			X	X	X	X	X	X	X	X	X	X	
		Composite 30	Liquid	1:5 Leach			X	X	X	X	X	X	X	X	X	X	
		Composite 31	Liquid	1:5 Leach			X	X	X	X	X	X	X	X	X	X	
		Composite 32	Liquid	1:5 Leach			X	X	X	X	X	X	X	X	X	X	
		Composite 33	Liquid	1:5 Leach			X	X	X	X	X	X	X	X	X	X	
		Composite 34	Liquid	1:5 Leach			X	X	X	X	X	X	X	X	X	X	
Remarks to Lab:	Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B - Composites Analysis - Analysis of 1:5 Leach			TOTAL number of Samples	0	TOTAL number of each analyte	34	34	34	34	34	34	34	34	34	34	

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

Email Results to:	tony_jong@urscorp.com lawrie_duck@urscorp.com	NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES. GLOVES SHOULD BE WORN WHILST HANDLING SAMPLES.

CERTIFICATE OF ANALYSIS

Work Order	: **EB1111587**	Page	: 1 of 5L
i lnevy	: **URS AUSTRALIA PTY LTD (QLD)**	bar otayotC	: EvmtovDevyal c mmsrov Btrsr ave
i ovyaMy	: c R bAWREI i E c Ui K	i ovyaMy	: c eav u SIlmav
Addtess	: GPO BOX 2N5 BRQ BAI E , bc TAUu 4RAbQA hNN1	Addtess	: 25 u- avd uyteeyu yaffotd , bc ASsytalra hN02
EwD arl	: la_trekdSM@ StsMot. +MoD	EwD arl	: deav+sSllmavp alsglor al+MoD
4ele. - ove	: 671 25h25111	4ele. - ove	: 671 3 25h2 31hh
FaMsrD rle	: 671 N3 25h251LL	FaMsrD rle	: 671 3 25h2 3519
PtoseMy	: h575779L GRj kEQ	, i beml	: I EPj 1LLL uM edSle B(2) avd Abu , i u2 teqSrleDevy
Otdet vSDr et	: www		
i wOwi vSDr et	: www	c aye u aD . les ReMemed	: 1hwYUI w5N11
uaD . let	: www	QsSe c aye	: 50wYUbw5N11
u rye	: www		
		I o+of saD . les teMemed	: LL
, Soye vSDr et	: BI JN7NJ11	I o+of saD . les avalCsed	: LL

4-rs te. oty sS. etsedes avC . temoSs te. oty(s) _ny- y-rs tefetevMe+ ResSlys a. . IC yo y-e saD . le(s) as sSr Dnyed+ All . ages of y-rs te. oty - ame r eev M eM@d avd a. . tomed fot telease+

4-rs i etyifrMaye of AvalCsrs Movyarvs y-e follo_rvg rvfotDayrov:

- Gevetal i oD Devys
- AvalCyrMal ResSlys

I A4A AMMednyed bar otayotC 950

4-rs doMSDevyrs rssSed rv aMMotdavMe _ny- I A4A aMMednyayrov teqSrleDevys+

AMMednyed fot MoD . lravMe _ny- QI OJEi 13N50+

Signatories

4-rs doMSDevy -as r eev eleMytovrMallC srgved r C y-e aSy-otrled srgvayotres rvdrMayed relo_+ EleMytovrM srgvrvg -as r eev Mattred oSy rv MoD . lravMe _ny- . toMedStes s. eMrfred rv 51 i FR Paty11+

Signatories	*Position*	*Accreditation Category*
KrD j M ar e	uevrot QotgavrMi - eD rsy	Btrsr ave AMrd u SI. - aye u orls
KrD j M ar e	uevrot QotgavrMi - eD rsy	Btrsr ave QotgavrMs
KrD j M ar e	uevrot QotgavrMi - eD rsy	u yaffotd j rvetals wAz

General Comments

4- e avalCyrMal . toMedStes Ssed r C y- e EvmtovDevyal c mmsrov - ame r eev demelo. ed ftoD esyar lrs- ed rvyetvayovallC teMogvrl ed . toMedStes sSM as y- ose . Sr lrs- ed r C y- e UuEPAT APHAT Au avd I EPj + Q - oSse demelo. ed . toMedStes ate eD. loCed rv y- e ar sevMe of doMSDevyed syavdatds ot r CMrevyteqSesy+

W- ete DorsySte deyetDrvayov - as r eev . etfotDedTtesSlys ate te. otyed ov a dtC_ erg- yr asrs+

W- ete a te. otyed less y- av (<) tesSlyrs - rg- et y- av y- e bORTy- rs DaCr e dSe yo . trDatCsaD. le exytaMyUrgesyaye drlSyov avdJot rvsSffrevysaD. le fot avalCsrs+

W- ete y- e bOR of a te. otyed tesSlydrffets ftoD syavdatd bORTy- rs DaCr e dSe yo - rg- DorsySte MovyevyTrvsSffrMevysaD. le (tedSMed _ erg- yeD. loCed) ot Daytrx rvyetfetevMe+

W- ev saD. lrvg yrDe rvfotDayov rs voy. tomded r Cy- e MrevyTsaD. lrvg dayes ate s- o_ v _ ry- oSya yrDe MoD. ovevy+ Q y- ese rvsyavMesTy- e yrDe MoD. ovevy- as r eev assSDed r Cy- e lar otayotCfot . toMessrvg . St. oses+

KeC: i Au I SDr et = i Au tegrsytCvSDr et ftoD dayar ase Darvyarved r Ci - eDrMal ArsytaMs uetmrMes+4- e i - eDrMal ArsytaMs uetmrMe rs a drmsrov of y- e ADetrMav i - eDrMal uoMeyC+
bOR = brDryof te. otyrvg
^ = 4- rs tesSlyrs MoD. Syed ftoD rvdrmrdSal avalCye deyeMyrovs ayot ar ome y- e lemel of te. otyrvg

- **$$: NATA accreditation does not cover performance of this service.**
- **EG020-S (Soluble Metals): LORs for EB1111587 have been raised due to matrix interference.**

Analytical Results

u Sr wj aytrx: PULP			Client sample ID	43723_209.5m-210m_OB	43723_213.12m-213.98m_OB	43723_217.92m-218.3m_Roof	43723_260.57m-261.14m_IB	43723_264.65m-265.15m_Floor
			Client sampling date / time	11wj Az w5N11 10:NN	11wj Az w5N11 10:NN	11wj Az w5N11 10:NN	11wj Az w5N11 10:NN	11wj Az w5N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111587-001**	**EB1111587-002**	**EB1111587-003**	**EB1111587-004**	**EB1111587-005**
EA011: Net Acid Generation								
pH (OX)	www	N#1	. H Uvry	**9.4**	**9.5**	**9.0**	**9.6**	**8.8**
NAG (pH 4.5)	www	N#1	@ H5u OhJy	<N#1	<N#1	<N#1	<N#1	<N#1
NAG (pH 7.0)	www	N#1	@ H5u OhJy	<N#1	<N#1	<N#1	<N#1	<N#1

Analytical Results

uSr wj aytrx: PULP			Client sample ID	43723_372m-372.5m_IB	43723_375m-375.48m_IB	43723_377m-377.5m_IB	43723_384m-384.5m_IB	43723_400.2m-400.7m_Floor
			Client sampling date / time	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	EB1111587-006	EB1111587-007	EB1111587-008	EB1111587-009	EB1111587-010
EA011: Net Acid Generation								
pH (OX)	www	N⊦1	. H Uvry	**10.5**	**8.9**	**9.0**	**9.1**	**8.9**
NAG (pH 4.5)	www	N⊦1	@ H5u OhJy	<N⊦1	<N⊦1	<N⊦1	<N⊦1	<N⊦1
NAG (pH 7.0)	www	N⊦1	@ H5u OhJy	<N⊦1	<N⊦1	<N⊦1	<N⊦1	<N⊦1

Analytical Results

uSr wj aytrx: **PULP**

Client sample ID				43733_74m-74.5m_OB	43733_121.1m-121.4m_OB	43733_124.35m-124.71m_OB	43733_127.02m-127.5m_OB	43733_128.79m-129.29m_Roof
Client sampling date / time				11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111587-011**	**EB1111587-012**	**EB1111587-013**	**EB1111587-014**	**EB1111587-015**
EA011: Net Acid Generation								
pH (OX)	www	N⊧1	. H Uvry	**7.6**	**9.1**	**9.3**	**9.4**	**8.6**
NAG (pH 4.5)	www	N⊧1	@g H5u OhJy	<N⊧1	<N⊧1	<N⊧1	<N⊧1	<N⊧1
NAG (pH 7.0)	www	N⊧1	@g H5u OhJy	<N⊧1	<N⊧1	<N⊧1	<N⊧1	<N⊧1

Analytical Results

uSr wj aytrx: **PULP**

			Client sample ID	43733_133.5m-134m_ Floor	43733_135m-135.38m _IB	43733_214.5m-215m_ IB	43733_219.5m-220.04 m_IB	43733_222.83m-223.3 8m_Roof
			Client sampling date / time	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111587-016**	**EB1111587-017**	**EB1111587-018**	**EB1111587-019**	**EB1111587-020**
EA011: Net Acid Generation								
pH (OX)	www	N#1	. H Uvny	**7.5**	**9.3**	**9.1**	**9.1**	**9.1**
NAG (pH 4.5)	www	N#1	@ H5u OhJy	<N#1	<N#1	<N#1	<N#1	<N#1
NAG (pH 7.0)	www	N#1	@ H5u OhJy	<N#1	<N#1	<N#1	<N#1	<N#1
EA011-A: pH Ox								
pH (OX)	www	N#1	. H Uvny	**7.5**	www	www	www	www
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	www	N#N5	µ	**3.24**	www	www	www	www
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	www	N#N5	µ	**3.35**	www	www	www	www
EP003TIC: Total inorganic Carbon (TIC) in Soil								
^ Total Inorganic Carbon	www	N#N5	µ	**0.12**	www	www	www	www

Analytical Results

uSr wj aytrx: **PULP**			*Client sample ID*	43733_235m-235.43m_IB	43733_239.12m-239.5m_IB	43733_241.5m-241.98m_IB	43733_245.5m-246m_IB	43733_256m-256.36m_IB
			Client sampling date / time	11wj Az w6N11 10:NN	11wj Az w6N11 10:NN	11wj Az w6N11 10:NN	11wj Az w6N11 10:NN	11wj Az w6N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	EB1111587-021	EB1111587-022	EB1111587-023	EB1111587-024	EB1111587-025
EA011: Net Acid Generation								
pH (OX)	www	N#1	. H Uvry	7.5	8.9	4.6	10.2	8.6
NAG (pH 4.5)	www	N#1	@ H5u OhJy	<N#1	<N#1	<N#1	<N#1	<N#1
NAG (pH 7.0)	www	N#1	@ H5u OhJy	<N#1	<N#1	10.2	<N#1	<N#1

Analytical Results

uSr wj aytrx: **PULP**			Client sample ID	43733_267.2m-267.75m_IB	43733_279.66m-280m_Floor	43750_264.51m-265m_OB	43750_273m-273.5m_OB	43750_282.2m-282.5m_Floor
			Client sampling date / time	11wj Azw5N11 10:NN	11wj Azw5N11 10:NN	11wj Azw5N11 10:NN	11wj Azw5N11 10:NN	11wj Azw5N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	EB1111587-026	EB1111587-027	EB1111587-028	EB1111587-029	EB1111587-030
EA011: Net Acid Generation								
pH (OX)	www	N#1	. H Uvry	**9.8**	**7.1**	**9.3**	**9.1**	**7.8**
NAG (pH 4.5)	www	N#1	@ H5u OhJy	<N#1	<N#1	<N#1	<N#1	<N#1
NAG (pH 7.0)	www	N#1	@ H5u OhJy	<N#1	<N#1	<N#1	<N#1	<N#1

Analytical Results

uSr wj aytrx: **PULP**			Client sample ID	43750_284.5m-285m_IB	43750_361m-361.5m_IB	43750_364.9m-365.24m_IB	43750_366.5m-366.95m_IB	43750_368.69m-369.08m_Roof
			Client sampling date / time	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN
Compound	CAS Number	LOR	Unit	EB1111587-031	EB1111587-032	EB1111587-033	EB1111587-034	EB1111587-035
EA011: Net Acid Generation								
pH (OX)	ww	N⋕	. H Uvry	**9.4**	**9.0**	**9.0**	**9.0**	**9.5**
NAG (pH 4.5)	ww	N⋕	@ H5u OhJy	<N⋕	<N⋕	<N⋕	<N⋕	<N⋕
NAG (pH 7.0)	ww	N⋕	@ H5u OhJy	<N⋕	<N⋕	<N⋕	<N⋕	<N⋕

Analytical Results

uSr wj aytrx: PULP			Client sample ID	43750_378.5m-379m_Floor	43750_383m-383.5m_IB	43750_400m-400.5m_IB	43750_404m-404.5m_IB	43750_408m-408.43_IB
			Client sampling date / time	11wj Azw5N11 10:NN	11wj Azw5N11 10:NN	11wj Azw5N11 10:NN	11wj Azw5N11 10:NN	11wj Azw5N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111587-036**	**EB1111587-037**	**EB1111587-038**	**EB1111587-039**	**EB1111587-040**
EA011: Net Acid Generation								
pH (OX)	www	N#1	. H Uvry	**10.5**	**8.9**	**9.2**	**8.9**	**9.1**
NAG (pH 4.5)	www	N#1	@ H5u OhJy	<N#1	<N#1	<N#1	<N#1	<N#1
NAG (pH 7.0)	www	N#1	@ H5u OhJy	<N#1	<N#1	<N#1	<N#1	<N#1

Wot@Otdet : EB1111093
i lmevy : URu AUu4RAbQA P4z b4c (, bc)
Pto8eMy : h575779L GRj kEQu

Analytical Results

uSr wj aytnx: **PULP**

Compound	CAS Number	LOR	Unit	43750_414.14m-414.47m_IB	43750_417m-417.34m_Roof	43765_228m-228.5m_OB	43765_241.5m-242m_IB	43765_322.5m-323m_IB
			Client sampling date / time	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN
				EB1111587-041	**EB1111587-042**	**EB1111587-043**	**EB1111587-044**	**EB1111587-045**
EA011: Net Acid Generation								
pH (OX)	www	N+1	. H Uvry	**9.5**	**8.8**	**8.8**	**9.1**	**9.5**
NAG (pH 4.5)	www	N+1	@g H5u OhJy	<N+1	<N+1	<N+1	<N+1	<N+1
NAG (pH 7.0)	www	N+1	@g H5u OhJy	<N+1	<N+1	<N+1	<N+1	<N+1

Analytical Results

uSr wj aytnx: **PULP**			*Client sample ID*	**43765_324.6m-325.1 m_IB**	**43765_337.6m-338.1 m_IB**	**43765_385m-385.5m_ IB**	**43765_389.5m-390m_ IB**	**43765_390.8m-391.36 m_IB**
			Client sampling date / time	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111587-046**	**EB1111587-047**	**EB1111587-048**	**EB1111587-049**	**EB1111587-050**
EA011: Net Acid Generation								
pH (OX)	www	N⊦1	. H Uvry	**8.9**	**9.0**	**9.0**	**8.9**	**9.0**
NAG (pH 4.5)	www	N⊦1	@ H5u OhJy	<N⊦1	<N⊦1	<N⊦1	<N⊦1	<N⊦1
NAG (pH 7.0)	www	N⊦1	@ H5u OhJy	<N⊦1	<N⊦1	<N⊦1	<N⊦1	<N⊦1

Analytical Results

uSr vj aytrx: PULP			Client sample ID	43765_392.3m-392.63m_Roof	43893_177.5m-178m_OB	43893_182m-182.5m_OB	43893_186.96m-187.37m_Roof	43893_192.12m-192.62m_Floor
			Client sampling date / time	11vj Azv6N11 10:NN	11vj Azv6N11 10:NN	11vj Azv6N11 10:NN	11vj Azv6N11 10:NN	11vj Azv6N11 10:NN
Compound	CAS Number	LOR	Unit	EB1111587-051	EB1111587-052	EB1111587-053	EB1111587-054	EB1111587-055
EA011: Net Acid Generation								
pH (OX)	ww	N+1	. H Uvry	**8.8**	**9.1**	**9.3**	**3.7**	**3.5**
NAG (pH 4.5)	ww	N+1	@ H5u Oh Jy	<N+1	<N+1	<N+1	**1.3**	**1.8**
NAG (pH 7.0)	ww	N+1	@ H5u Oh Jy	<N+1	<N+1	<N+1	**5.9**	**5.6**
EA011-A: pH Ox								
pH (OX)	ww	N+1	. H Uvry	ww	ww	ww	**3.7**	ww
pH -2 (ext)	ww	N+1	. H Uvry	ww	ww	ww	**3.0**	ww
EA011-B: Dissolved Major Anions								
Sulfur as S	723N0vN0v0	1	Dg Jb	ww	ww	ww	**41**	ww
Chloride	17993vNNv7	1	Dg Jb	ww	ww	ww	**1**	ww
EA011-C: Dissolved Major Cations								
Calcium	3hhNv3Nv5	1	Dg Jb	ww	ww	ww	**11**	ww
Magnesium	3h2LvL0vh	1	Dg Jb	ww	ww	ww	**4**	ww
Sodium	3hhNv52v0	1	Dg Jb	ww	ww	ww	**22**	ww
Potassium	3hhNvNLv3	1	Dg Jb	ww	ww	ww	**5**	ww
EA011-D: Calculated Components								
Calculated Acid Component	ww	N+1	@ H5u Oh Jy	ww	ww	ww	**12.6**	ww
Calculated Neutralisng Component	ww	N+1	@ H5u Oh Jy	ww	ww	ww	**9.7**	ww
Calculated NAG Acidity	ww	N+1	@ H5u Oh Jy	ww	ww	ww	**2.9**	ww
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	ww	N+N5	µ	ww	ww	ww	**2.52**	ww
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	ww	N+N5	µ	ww	ww	ww	**2.55**	ww
EP003TIC: Total inorganic Carbon (TIC) in Soil								
^ Total Inorganic Carbon	ww	N+N5	µ	ww	ww	ww	**0.04**	ww

Analytical Results

uSr wj aytrx: **PULP**			Client sample ID	43893_194m-194.5m_IB	43893_299.46m-299.94m_Roof	43893_307.57m-308.07m_Floor	43893_312m-312.5m_IB	43893_315.8m-316.3m_IB
			Client sampling date / time	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN	11wj Azw6N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	EB1111587-056	EB1111587-057	EB1111587-058	EB1111587-059	EB1111587-060
EA011: Net Acid Generation								
pH (OX)	www	N#1	. H Uvry	9.3	7.0	6.6	8.9	8.8
NAG (pH 4.5)	www	N#1	@ H5u OhJy	<N#1	<N#1	<N#1	<N#1	<N#1
NAG (pH 7.0)	www	N#1	@ H5u OhJy	<N#1	<N#1	0.6	<N#1	<N#1

Analytical Results

uSr wj aytnx: PULP			Client sample ID	43893_322.8m-323.3m_IB	43893_324.46m-324.88m_IB	43893_336m-336.38m_Floor	438.93_357.09m-357.59m_Roof	43893_363.61m-364.11_Floor
			Client sampling date / time	11wj Azv6N11 10:NN	11wj Azv6N11 10:NN	11wj Azv6N11 10:NN	11wj Azv6N11 10:NN	11wj Azv6N11 10:NN
Compound	CAS Number	LOR	Unit	EB1111587-061	EB1111587-062	EB1111587-063	EB1111587-064	EB1111587-065
EA011: Net Acid Generation								
pH (OX)	www	N+1	. H Uvny	9.3	8.6	8.1	9.4	8.4
NAG (pH 4.5)	www	N+1	@ H5u OhJy	<N+1	<N+1	<N+1	<N+1	<N+1
NAG (pH 7.0)	www	N+1	@ H5u OhJy	<N+1	<N+1	<N+1	<N+1	<N+1
EA011-A: pH Ox								
pH (OX)	www	N+1	. H Uvny	www	www	8.1	www	www
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	www	N+N5	μ	www	www	1.45	www	www
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	www	N+N5	μ	www	www	3.53	www	www
EP003TIC: Total inorganic Carbon (TIC) in Soil								
^ Total Inorganic Carbon	www	N+N5	μ	www	www	2.07	www	www

Analytical Results

uSr vj aytrx: PULP

Compound	CAS Number	LOR	Unit	GRM01 COMPOSITE	GRM02 COMPOSITE	GRM03 COMPOSITE	GRM04 COMPOSITE	GRM05 COMPOSITE
Client sample ID				GRM01 COMPOSITE	GRM02 COMPOSITE	GRM03 COMPOSITE	GRM04 COMPOSITE	GRM05 COMPOSITE
Client sampling date / time				17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN
				EB1111587-066	EB1111587-067	EB1111587-068	EB1111587-069	EB1111587-070
EA002 : pH (Soils)								
pH Value	www	N+1	. H Uvry	9.8	9.5	9.6	9.6	9.9
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Absorption Ratio	www	N+N1	w	42.4	30.7	20.6	37.0	49.1
EA010: Conductivity								
Electrical Conductivity @ 25°C	www	1	%u JMD	540	391	438	541	597
ED007: Exchangeable Cations								
^ Exchangeable Calcium	www	N+1	DeqJ1NNg	7.1	7.3	25.5	6.0	17.6
^ Exchangeable Magnesium	www	N+1	DeqJ1NNg	1.8	2.8	2.7	1.8	1.1
^ Exchangeable Potassium	www	N+1	DeqJ1NNg	1.1	1.0	0.8	0.8	0.8
^ Exchangeable Sodium	www	N+1	DeqJ1NNg	6.1	4.1	3.1	6.8	6.7
^ Cation Exchange Capacity	www	N+1	DeqJ1NNg	16.1	15.2	32.2	15.4	26.1
^ Exchangeable Sodium Percent	www	N+1	µ	38.4	27.4	9.8	44.2	25.7
ED037: Alkalinity								
Total Alkalinity as CaCO3	www	1	DgJ@	2930	1560	1140	1990	2000
Bicarbonate Alkalinity as CaCO3	31v05v2	1	DgJ@	2410	1300	972	1240	269
Carbonate Alkalinity as CaCO3	2915v25v7	1	DgJ@	521	261	164	750	1730
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	1h9N9v3Lv9	1N	DgJ@	210	160	150	130	170
ED045G: Chloride Discrete analyser								
Chloride	17993vNNv7	1N	DgJ@	80	140	170	50	40
ED093S: Soluble Major Cations								
Calcium	3hhNv3Nv5	1N	DgJ@	<1N	<1N	<1N	<1N	<1N
Magnesium	3h2LvL0vh	1N	DgJ@	<1N	<1N	<1N	<1N	<1N
Sodium	3hhNv52v0	1N	DgJ@	570	390	410	580	620
Potassium	3hhNvNLv3	1N	DgJ@	20	20	20	10	10
EG005S : Soluble Metals by ICPAES								
Boron	3hhNvh5v9	1	DgJ@	<1	<1	<1	<1	<1
Iron	3h2Lv9Lv7	1	DgJ@	<1	<1	<1	<1	<1
EG020S: Soluble Metals by ICPMS								
Arsenic	3hhNv29v5	N+N1	DgJ@	0.44	0.27	0.03	0.86	1.08
Selenium	3395vhLv5	N+1	DgJ@	<1+N	<1+N	<N+1	<N+1	0.1
Silver	3hhNv65vh	N+N1	DgJ@	<N+1N	<N+1N	<N+N1	<N+N1	<N+N1
Cadmium	3hhNvh2vL	N+N1	DgJ@	<N+1N	<N+1N	<N+N1	<N+N1	<N+N1
Cobalt	3hhNvh9vh	N+N1	DgJ@	<N+1N	<N+1N	<N+N1	<N+N1	<N+N1
Chromium	3hhNvh3v2	N+N1	DgJ@	<N+1N	<N+1N	<N+N1	<N+N1	<N+N1
Copper	3hhNv0Nv9	N+N1	DgJ@	<N+1N	<N+1N	<N+N1	<N+N1	<N+N1

Analytical Results

uSr wj aytrx: **PULP**			Client sample ID	GRM01 COMPOSITE	GRM02 COMPOSITE	GRM03 COMPOSITE	GRM04 COMPOSITE	GRM05 COMPOSITE
			Client sampling date / time	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111587-066**	**EB1111587-067**	**EB1111587-068**	**EB1111587-069**	**EB1111587-070**
EG020S: Soluble Metals by ICPMS - Continued								
Manganese	3h2LwL7w0	NHN1	DgJ@	<NH1N	<NH1N	<NHN1	<NHN1	<NHN1
Molybdenum	3h2LwL9w3	NHN1	DgJ@	**0.28**	**0.16**	**0.12**	**0.18**	**0.29**
Nickel	3hhNwN5wN	NHN1	DgJ@	<NH1N	<NH1N	<NHN1	<NHN1	<NHN1
Lead	3h2LwL5w1	NHN1	DgJ@	<NH1N	<NH1N	<NHN1	<NHN1	<NHN1
Antimony	3hhNw27wN	NHN1	DgJ@	<NH1N	<NH1N	<NHN1	**0.02**	<NHN1
Uranium	3hhNw71w1	NHN1	DgJ@	<NH1N	<NH1N	<NHN1	<NHN1	<NHN1
Zinc	3hhNw77w7	NHN1	DgJ@	<NH1N	<NH1N	<NHN1	<NHN1	<NHN1
Vanadium	3hhNw75w6	NH1	DgJ@	<1HN	<1HN	<NH1	**0.1**	**0.3**
Aluminium	3h5LwLNw0	NH1	DgJ@	**1.8**	<1HN	**0.7**	**2.4**	**2.4**
EG035S: Soluble Mercury by FIMS								
Mercury	3h2LwL3w7	NHNNN0	DgJ@	<NHNN0N	<NHNN0N	<NHNNN0	<NHNNN0	<NHNNN0
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	www	NHN5	µ	**1.65**	**2.76**	**2.97**	**2.72**	**5.77**

Analytical Results

uSrvjy aytrx: **PULP**

Compound	CAS Number	LOR	Unit	GRM06 COMPOSITE	GRM07 COMPOSITE	GRM08 COMPOSITE	GRM09 COMPOSITE	GRM10 COMPOSITE
			Client sampling date / time	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN
				EB1111587-071	EB1111587-072	EB1111587-073	EB1111587-074	EB1111587-075
EA002 : pH (Soils)								
pH Value	www	N+1	. H Uvny	9.6	9.6	9.6	9.8	9.8
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Absorption Ratio	www	N+N1	w	39.6	9.26	65.6	36.0	31.2
EA010: Conductivity								
Electrical Conductivity @ 25°C	www	1	%u JMD	412	358	446	532	545
ED007: Exchangeable Cations								
^ Exchangeable Calcium	www	N+1	DeqJ1NNg	6.0	4.2	4.1	19.0	8.6
^ Exchangeable Magnesium	www	N+1	DeqJ1NNg	2.8	2.0	1.7	2.1	3.9
^ Exchangeable Potassium	www	N+1	DeqJ1NNg	1.0	1.0	1.0	0.8	0.6
^ Exchangeable Sodium	www	N+1	DeqJ1NNg	5.3	5.8	7.1	5.5	4.8
^ Cation Exchange Capacity	www	N+1	DeqJ1NNg	15.1	12.9	13.8	27.4	18.0
^ Exchangeable Sodium Percent	www	N+1	µ	35.4	45.0	51.5	20.3	27.0
ED037: Alkalinity								
Total Alkalinity as CaCO3	www	1	DgJ@	1210	1230	1490	1790	1830
Bicarbonate Alkalinity as CaCO3	31w05w2	1	DgJ@	574	387	644	386	750
Carbonate Alkalinity as CaCO3	2915w25w7	1	DgJ@	633	843	843	1410	1080
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	1h9N9w3Lw9	1N	DgJ@	190	140	170	160	50
ED045G: Chloride Discrete analyser								
Chloride	17993wNNw7	1N	DgJ@	30	20	30	80	20
ED093S: Soluble Major Cations								
Calcium	3hhNw3Nw5	1N	DgJ@	<1N	<1N	<1N	<1N	<1N
Magnesium	3h2LwL0wh	1N	DgJ@	<1N	<1N	<1N	<1N	<1N
Sodium	3hhNw52w0	1N	DgJ@	430	360	460	490	570
Potassium	3hhNwNLw3	1N	DgJ@	10	10	10	10	10
EG005S : Soluble Metals by ICPAES								
Boron	3hhNwh5w9	1	DgJ@	<1	<1	<1	1	1
Iron	3h2Lw9Lw7	1	DgJ@	<1	<1	1	<1	<1
EG020S: Soluble Metals by ICPMS								
Arsenic	3hhNw29w5	N+N1	DgJ@	0.49	0.73	0.10	0.82	0.16
Selenium	3395whLw5	N+1	DgJ@	<N+1	0.1	0.2	<1+N	<1+N
Silver	3hhNw55wh	N+N1	DgJ@	<N+N1	<N+N1	<N+N1	<N+1N	<N+1N
Cadmium	3hhNwh2wL	N+N1	DgJ@	<N+N1	<N+N1	<N+N1	<N+1N	<N+1N
Cobalt	3hhNwh9wh	N+N1	DgJ@	<N+N1	<N+N1	<N+N1	<N+1N	<N+1N
Chromium	3hhNwh3w2	N+N1	DgJ@	<N+N1	<N+N1	<N+N1	<N+1N	<N+1N
Copper	3hhNw0Nw9	N+N1	DgJ@	<N+N1	<N+N1	<N+N1	<N+1N	<N+1N

Analytical Results

uSr wj aytrx: **PULP**			Client sample ID	GRM06 COMPOSITE	GRM07 COMPOSITE	GRM08 COMPOSITE	GRM09 COMPOSITE	GRM10 COMPOSITE
			Client sampling date / time	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111587-071**	**EB1111587-072**	**EB1111587-073**	**EB1111587-074**	**EB1111587-075**
EG020S: Soluble Metals by ICPMS - Continued								
Manganese	3h2LwL7w0	NHN1	DgJ@	<NHN1	<NHN1	<NHN1	<NH1N	<NH1N
Molybdenum	3h2LwL9w3	NHN1	DgJ@	**0.21**	**0.35**	**0.17**	**0.16**	<NH1N
Nickel	3hhNwN5wN	NHN1	DgJ@	<NHN1	<NHN1	<NHN1	<NH1N	<NH1N
Lead	3h2LwL5w1	NHN1	DgJ@	<NHN1	<NHN1	<NHN1	<NH1N	<NH1N
Antimony	3hhNw27wN	NHN1	DgJ@	**0.01**	**0.02**	**0.01**	<NH1N	<NH1N
Uranium	3hhNw71w1	NHN1	DgJ@	<NHN1	<NHN1	<NHN1	<NH1N	<NH1N
Zinc	3hhNw77w7	NHN1	DgJ@	<NHN1	<NHN1	**0.01**	<NH1N	<NH1N
Vanadium	3hhNw75w5	NH1	DgJ@	**0.2**	**0.2**	**0.2**	<1HN	<1HN
Aluminium	3h5LwLNw0	NH1	DgJ@	**3.4**	**4.2**	**7.6**	**6.2**	<1HN
EG035S: Soluble Mercury by FIMS								
Mercury	3h2LwL3w7	NHNNN0	DgJ@	<NHNNN0	<NHNNN0	<NHNNN0	<NHNNN0	<NHNNN0
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	www	NHN5	µ	**2.42**	**2.09**	**1.59**	**2.24**	**5.18**

Analytical Results

uSr vj aytrx: PULP

Compound	CAS Number	LOR	Unit	GRM11 COMPOSITE	GRM12 COMPOSITE	GRM13 COMPOSITE	GRM14 COMPOSITE	GRM15 COMPOSITE
			Client sample ID	GRM11 COMPOSITE	GRM12 COMPOSITE	GRM13 COMPOSITE	GRM14 COMPOSITE	GRM15 COMPOSITE
			Client sampling date / time	17wYUI v5N11 10:NN	17wYUI v5N11 10:NN	17wYUI v5N11 10:NN	17wYUI v5N11 10:NN	17wYUI v5N11 10:NN
				EB1111587-076	EB1111587-077	EB1111587-078	EB1111587-079	EB1111587-080
EA002 : pH (Soils)								
pH Value	www	N+1	. H Uvny	9.7	9.6	9.7	9.7	9.6
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Absorption Ratio	www	NN1	w	33.0	36.4	43.8	38.4	43.2
EA010: Conductivity								
Electrical Conductivity @ 25°C	www	1	%u JVD	440	402	471	357	360
ED007: Exchangeable Cations								
^ Exchangeable Calcium	www	N+1	DeqJ1NNg	5.5	4.7	4.4	5.1	4.3
^ Exchangeable Magnesium	www	N+1	DeqJ1NNg	2.6	2.1	1.6	3.0	1.9
^ Exchangeable Potassium	www	N+1	DeqJ1NNg	0.6	0.6	0.8	0.8	1.0
^ Exchangeable Sodium	www	N+1	DeqJ1NNg	3.8	4.5	6.0	5.5	6.1
^ Cation Exchange Capacity	www	N+1	DeqJ1NNg	12.6	11.9	12.8	14.4	13.4
^ Exchangeable Sodium Percent	www	N+1	µ	30.6	38.3	47.6	38.6	46.2
ED037: Alkalinity								
Total Alkalinity as CaCO3	www	1	DgJ@	1560	1580	1540	1210	1150
Bicarbonate Alkalinity as CaCO3	31w05w2	1	DgJ@	269	1020	645	570	797
Carbonate Alkalinity as CaCO3	2915w25w7	1	DgJ@	1290	562	890	637	351
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	1h9N9w3Lw9	1N	DgJ@	110	90	200	100	170
ED045G: Chloride Discrete analyser								
Chloride	17993wNNw7	1N	DgJ@	20	20	30	10	20
ED093S: Soluble Major Cations								
Calcium	3hhNw3Nw5	1N	DgJ@	<1N	<1N	<1N	<1N	<1N
Magnesium	3h2LwL0wh	1N	DgJ@	<1N	<1N	<1N	<1N	<1N
Sodium	3hhNw52w0	1N	DgJ@	480	460	500	380	340
Potassium	3hhNwNLw3	1N	DgJ@	20	10	10	<1N	<1N
EG005S : Soluble Metals by ICPAES								
Boron	3hhNwh5w9	1	DgJ@	<1	<1	<1	<1	1
Iron	3h2Lw9Lw7	1	DgJ@	<1	<1	<1	<1	<1
EG020S: Soluble Metals by ICPMS								
Arsenic	3hhNw29w5	NN1	DgJ@	0.93	0.47	0.41	0.46	0.30
Selenium	3395whLw5	N+1	DgJ@	<N+1	<N+1	<N+1	<N+1	<1+N
Silver	3hhNw55wh	NN1	DgJ@	<NN1	<NN1	<NN1	<NN1	<N+1N
Cadmium	3hhNwh2wL	NN1	DgJ@	<NN1	<NN1	<NN1	<NN1	<N+1N
Cobalt	3hhNwh9wh	NN1	DgJ@	<NN1	<NN1	<NN1	<NN1	<N+1N
Chromium	3hhNwh3w2	NN1	DgJ@	<NN1	<NN1	<NN1	<NN1	<N+1N
Copper	3hhNw0Nw9	NN1	DgJ@	<NN1	<NN1	<NN1	<NN1	<N+1N

Analytical Results

uSr vj aytrx: **PULP**			*Client sample ID*	**GRM11 COMPOSITE**	**GRM12 COMPOSITE**	**GRM13 COMPOSITE**	**GRM14 COMPOSITE**	**GRM15 COMPOSITE**
			Client sampling date / time	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111587-076**	**EB1111587-077**	**EB1111587-078**	**EB1111587-079**	**EB1111587-080**
EG020S: Soluble Metals by ICPMS - Continued								
Manganese	3h2Lwl7w0	NHN1	DgJ@	<NHN1	<NHN1	<NHN1	<NHN1	<NH1N
Molybdenum	3h2Lwl9w8	NHN1	DgJ@	**0.24**	**0.14**	**0.28**	**0.22**	**0.24**
Nickel	3hhNwN5wN	NHN1	DgJ@	<NHN1	<NHN1	<NHN1	<NHN1	<NH1N
Lead	3h2Lwl5w1	NHN1	DgJ@	<NHN1	<NHN1	<NHN1	<NHN1	<NH1N
Antimony	3hhNw27wN	NHN1	DgJ@	**0.01**	**0.02**	**0.02**	<NHN1	<NH1N
Uranium	3hhNw71w1	NHN1	DgJ@	<NHN1	<NHN1	<NHN1	<NHN1	<NH1N
Zinc	3hhNw77w7	NHN1	DgJ@	<NHN1	<NHN1	<NHN1	<NHN1	<NH1N
Vanadium	3hhNw75w6	NH1	DgJ@	**0.2**	**0.1**	**0.2**	**0.1**	<1HN
Aluminium	3h5LwLNw0	NH1	DgJ@	**3.1**	**3.8**	**3.8**	**2.8**	**1.3**
EG035S: Soluble Mercury by FIMS								
Mercury	3h2Lwl3w7	NHNNN0	DgJ@	<NHNNN0	<NHNNN0	<NHNNN0	<NHNNN0	<NHNNN0
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	www	NHN5	µ	**3.06**	**3.01**	**1.53**	**3.24**	**2.64**

Analytical Results

uSr wj aytrx: PULP			Client sample ID	GRM16 COMPOSITE	GRM17 COMPOSITE	GRM18 COMPOSITE	GRM19 COMPOSITE	GRM20 COMPOSITE
			Client sampling date / time	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN
Compound	CAS Number	LOR	Unit	EB1111587-081	EB1111587-082	EB1111587-083	EB1111587-084	EB1111587-085
EA002 : pH (Soils)								
pH Value	www	N+1	. H Uvry	9.6	9.5	9.7	9.7	9.5
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Absorption Ratio	www	N+N1	w	29.3	24.8	28.9	45.7	30.9
EA010: Conductivity								
Electrical Conductivity @ 25°C	www	1	%u JMD	336	301	200	499	402
ED007: Exchangeable Cations								
^ Exchangeable Calcium	www	N+1	DeqJ1NNg	3.0	4.5	8.8	6.1	6.1
^ Exchangeable Magnesium	www	N+1	DeqJ1NNg	1.0	2.0	3.9	2.8	2.7
^ Exchangeable Potassium	www	N+1	DeqJ1NNg	0.9	1.0	0.7	0.8	0.8
^ Exchangeable Sodium	www	N+1	DeqJ1NNg	7.7	5.7	4.8	6.6	4.0
^ Cation Exchange Capacity	www	N+1	DeqJ1NNg	12.6	13.2	18.3	16.4	13.7
^ Exchangeable Sodium Percent	www	N+1	µ	62.3	43.5	26.6	40.4	29.6
ED037: Alkalinity								
Total Alkalinity as CaCO3	www	1	DgJ@	764	867	1660	1670	1470
Bicarbonate Alkalinity as CaCO3	31w05w2	1	DgJ@	413	680	1060	1150	1150
Carbonate Alkalinity as CaCO3	2915w25w7	1	DgJ@	351	187	609	521	322
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	1h9N9w3Lw9	1N	DgJ@	260	100	120	230	240
ED045G: Chloride Discrete analyser								
Chloride	17993wNNw7	1N	DgJ@	20	10	70	20	20
ED093S: Soluble Major Cations								
Calcium	3hhNw3Nw5	1N	DgJ@	<1N	<1N	<1N	<1N	<1N
Magnesium	3h2LwL0wh	1N	DgJ@	<1N	<1N	<1N	<1N	<1N
Sodium	3hhNw52w0	1N	DgJ@	300	280	530	530	430
Potassium	3hhNwNLw3	1N	DgJ@	<1N	<1N	10	10	20
EG005S : Soluble Metals by ICPAES								
Boron	3hhNwh5w9	1	DgJ@	2	1	1	1	2
Iron	3h2Lw9Lw7	1	DgJ@	<1	<1	<1	<1	<1
EG020S: Soluble Metals by ICPMS								
Arsenic	3hhNw29w5	N+N1	DgJ@	0.23	0.78	0.41	0.36	4.53
Selenium	3395whLw5	N+1	DgJ@	<1+N	<1+N	<1+N	<1+N	<1+N
Silver	3hhNw65wh	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Cadmium	3hhNwh2wL	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Cobalt	3hhNwh9wh	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Chromium	3hhNwh3w2	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Copper	3hhNw0Nw9	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N

Analytical Results

uSr wj aytrx: **PULP**

	Client sample ID			GRM16 COMPOSITE	GRM17 COMPOSITE	GRM18 COMPOSITE	GRM19 COMPOSITE	GRM20 COMPOSITE
	Client sampling date / time			17wYUI w6N11 10:NN	17wYUI w6N11 10:NN	17wYUI w6N11 10:NN	17wYUI w6N11 10:NN	17wYUI w6N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111587-081**	**EB1111587-082**	**EB1111587-083**	**EB1111587-084**	**EB1111587-085**
EG020S: Soluble Metals by ICPMS - Continued								
Manganese	3h2LwL7w0	N-N1	DgJ@	<N-1N	<N-1N	<N-1N	<N-1N	<N-1N
Molybdenum	3h2LwL9w3	N-N1	DgJ@	**0.32**	**0.20**	**0.10**	**0.46**	**0.49**
Nickel	3hhNwN5wN	N-N1	DgJ@	<N-1N	<N-1N	<N-1N	<N-1N	<N-1N
Lead	3h2LwL5w1	N-N1	DgJ@	<N-1N	<N-1N	<N-1N	<N-1N	<N-1N
Antimony	3hhNw27wN	N-N1	DgJ@	<N-1N	<N-1N	<N-1N	<N-1N	<N-1N
Uranium	3hhNw71w1	N-N1	DgJ@	<N-1N	<N-1N	<N-1N	<N-1N	<N-1N
Zinc	3hhNw77w7	N-N1	DgJ@	<N-1N	<N-1N	<N-1N	<N-1N	<N-1N
Vanadium	3hhNw75w5	N-1	DgJ@	<1-N	<1-N	<1-N	<1-N	<1-N
Aluminium	3h5LwLNw0	N-1	DgJ@	<1-N	**4.3**	<1-N	<1-N	<1-N
EG035S: Soluble Mercury by FIMS								
Mercury	3h2LwL3w7	N-NNN0	DgJ@	<N-NNN0	<N-NNN0	<N-NNN0	<N-NNN0	<N-NNN0
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	ww	N-N5	µ	**1.20**	**5.78**	**2.83**	**2.86**	**2.02**

Analytical Results

uSr wj aytrx: PULP				Client sample ID	GRM21 COMPOSITE	GRM22 COMPOSITE	GRM23 COMPOSITE	GRM24 COMPOSITE	GRM25 COMPOSITE
				Client sampling date / time	17wYUI w6N11 10:NN	17wYUI w6N11 10:NN	17wYUI w6N11 10:NN	17wYUI w6N11 10:NN	17wYUI w6N11 10:NN
Compound	CAS Number	LOR	Unit		EB1111587-086	EB1111587-087	EB1111587-088	EB1111587-089	EB1111587-090
EA002 : pH (Soils)									
pH Value	www	N-1	. H Uvry		9.4	9.5	8.9	9.4	9.5
EA006: Sodium Adsorption Ratio (SAR)									
^ Sodium Absorption Ratio	www	N-N1	w		35.8	19.0	24.4	25.5	26.4
EA010: Conductivity									
Electrical Conductivity @ 25°C	www	1	%u JMD		327	264	381	384	412
ED007: Exchangeable Cations									
^ Exchangeable Calcium	www	N-1	DeqJ1NNg		3.2	4.2	5.8	3.7	6.2
^ Exchangeable Magnesium	www	N-1	DeqJ1NNg		1.6	1.4	3.3	1.0	2.5
^ Exchangeable Potassium	www	N-1	DeqJ1NNg		1.0	1.1	1.0	1.1	1.0
^ Exchangeable Sodium	www	N-1	DeqJ1NNg		6.6	9.1	3.8	7.0	7.1
^ Cation Exchange Capacity	www	N-1	DeqJ1NNg		12.4	15.8	13.8	12.8	16.9
^ Exchangeable Sodium Percent	www	N-1	µ		53.3	57.7	27.2	54.8	42.3
ED037: Alkalinity									
Total Alkalinity as CaCO3	www	1	DgJ@		1330	1030	679	1030	1450
Bicarbonate Alkalinity as CaCO3	31w05w2	1	DgJ@		1070	1030	609	797	984
Carbonate Alkalinity as CaCO3	2915w25w7	1	DgJ@		254	<1	70	234	469
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	1h9N9w3Lw9	1N	DgJ@		50	100	210	150	150
ED045G: Chloride Discrete analyser									
Chloride	17993wNw7	1N	DgJ@		20	<1N	130	80	20
ED093S: Soluble Major Cations									
Calcium	3hhNw3Nw5	1N	DgJ@		<1N	<1N	<1N	<1N	<1N
Magnesium	3h2LwL0wh	1N	DgJ@		<1N	<1N	<1N	<1N	<1N
Sodium	3hhNw52w0	1N	DgJ@		340	250	330	320	390
Potassium	3hhNwNLw3	1N	DgJ@		<1N	<1N	20	<1N	<1N
EG005S : Soluble Metals by ICPAES									
Boron	3hhNwh5w9	1	DgJ@		2	2	1	2	2
Iron	3h2Lw9Lw7	1	DgJ@		<1	<1	<1	<1	<1
EG020S: Soluble Metals by ICPMS									
Arsenic	3hhNw29w5	N-N1	DgJ@		0.25	0.32	<N-1N	<N-1N	0.88
Selenium	3395whLw5	N-1	DgJ@		<1-N	<1-N	<1-N	<1-N	<1-N
Silver	3hhNw55wh	N-N1	DgJ@		<N-1N	<N-1N	<N-1N	<N-1N	<N-1N
Cadmium	3hhNwh2wL	N-N1	DgJ@		<N-1N	<N-1N	<N-1N	<N-1N	<N-1N
Cobalt	3hhNwh9wh	N-N1	DgJ@		<N-1N	<N-1N	<N-1N	<N-1N	<N-1N
Chromium	3hhNwh3w2	N-N1	DgJ@		<N-1N	<N-1N	<N-1N	<N-1N	<N-1N
Copper	3hhNw0Nw9	N-N1	DgJ@		<N-1N	<N-1N	<N-1N	<N-1N	<N-1N

Analytical Results

uSr wj aytrx: **PULP**

Client sample ID				GRM21 COMPOSITE	GRM22 COMPOSITE	GRM23 COMPOSITE	GRM24 COMPOSITE	GRM25 COMPOSITE
Client sampling date / time				17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111587-086**	**EB1111587-087**	**EB1111587-088**	**EB1111587-089**	**EB1111587-090**
EG020S: Soluble Metals by ICPMS - Continued								
Manganese	3h2LwL7w0	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Molybdenum	3h2LwL9w3	N+N1	DgJ@	<N+1N	**0.46**	<N+1N	**0.37**	**0.26**
Nickel	3hhNwN5wN	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Lead	3h2LwL5w1	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Antimony	3hhNw27wN	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Uranium	3hhNw71w1	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Zinc	3hhNw77w7	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Vanadium	3hhNw75w5	N+1	DgJ@	<1+N	<1+N	<1+N	<1+N	<1+N
Aluminium	3h5LwLNw0	N+1	DgJ@	**1.9**	**3.4**	<1+N	**5.9**	**2.6**
EG035S: Soluble Mercury by FIMS								
Mercury	3h2LwL3w7	N+NNN0	DgJ@	<N+NNN0	<N+NNN0	<N+NNN0	<N+NNN0	<N+NNN0
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	www	N+N5	µ	**2.71**	**6.33**	**1.94**	**1.20**	**1.86**

Analytical Results

uSr wj aytrx: PULP

Compound	CAS Number	LOR	Unit	GRM26 COMPOSITE	GRM27 COMPOSITE	GRM28 COMPOSITE	GRM29 COMPOSITE	GRM30 COMPOSITE
			Client sample ID	GRM26 COMPOSITE	GRM27 COMPOSITE	GRM28 COMPOSITE	GRM29 COMPOSITE	GRM30 COMPOSITE
			Client sampling date / time	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN
				EB1111587-091	EB1111587-092	EB1111587-093	EB1111587-094	EB1111587-095
EA002 : pH (Soils)								
pH Value	www	N#1	. H Uvry	9.6	7.6	9.5	9.4	9.4
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Absorption Ratio	www	N#N1	w	34.1	64.9	27.0	7.62	9.23
EA010: Conductivity								
Electrical Conductivity @ 25°C	www	1	%u JMD	384	583	247	301	236
ED007: Exchangeable Cations								
^ Exchangeable Calcium	www	N#1	DeqJ1NNg	5.5	2.8	4.7	4.0	3.6
^ Exchangeable Magnesium	www	N#1	DeqJ1NNg	1.6	1.2	1.6	0.9	1.0
^ Exchangeable Potassium	www	N#1	DeqJ1NNg	1.1	1.0	1.8	1.1	0.8
^ Exchangeable Sodium	www	N#1	DeqJ1NNg	6.7	7.7	14.0	8.6	7.3
^ Cation Exchange Capacity	www	N#1	DeqJ1NNg	14.8	12.8	22.1	14.6	12.7
^ Exchangeable Sodium Percent	www	N#1	µ	45.1	60.8	63.4	59.0	57.7
ED037: Alkalinity								
Total Alkalinity as CaCO3	www	1	DgJ@	1240	281	843	937	820
Bicarbonate Alkalinity as CaCO3	31w05w2	1	DgJ@	820	281	609	656	633
Carbonate Alkalinity as CaCO3	2915w25w7	1	DgJ@	422	<1	234	281	187
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	1h9N9w3Lw0	1N	DgJ@	150	1040	80	110	90
ED045G: Chloride Discrete analyser								
Chloride	17993wNNw7	1N	DgJ@	10	70	30	20	20
ED093S: Soluble Major Cations								
Calcium	3hhNw3Nw5	1N	DgJ@	<1N	<1N	<1N	<1N	<1N
Magnesium	3h2LwL0wh	1N	DgJ@	<1N	<1N	<1N	<1N	<1N
Sodium	3hhNw52w0	1N	DgJ@	350	530	190	250	200
Potassium	3hhNwNLw3	1N	DgJ@	<1N	10	<1N	<1N	<1N
EG005S : Soluble Metals by ICPAES								
Boron	3hhNwh5w0	1	DgJ@	2	2	2	2	2
Iron	3h2Lw0Lw7	1	DgJ@	<1	<1	<1	<1	<1
EG020S: Soluble Metals by ICPMS								
Arsenic	3hhNw29w5	N#N1	DgJ@	1.84	<N#1N	<N#1N	<N#1N	0.36
Selenium	3395whLw5	N#1	DgJ@	<1#N	<1#N	<1#N	<1#N	<1#N
Silver	3hhNw55wh	N#N1	DgJ@	<N#1N	<N#1N	<N#1N	<N#1N	<N#1N
Cadmium	3hhNwh2wL	N#N1	DgJ@	<N#1N	<N#1N	<N#1N	<N#1N	<N#1N
Cobalt	3hhNwh9wh	N#N1	DgJ@	<N#1N	<N#1N	<N#1N	<N#1N	<N#1N
Chromium	3hhNwh3w2	N#N1	DgJ@	<N#1N	<N#1N	<N#1N	<N#1N	<N#1N
Copper	3hhNw0Nw0	N#N1	DgJ@	<N#1N	<N#1N	<N#1N	<N#1N	<N#1N

Wot@Otdet : EB1111093
i lnevy : URu AUu4RAbOA P4z b4c (, bc)
Pto8eMy : h575779L GRj kEOu

Analytical Results

uSrvj aytrx: PULP			Client sample ID	GRM26 COMPOSITE	GRM27 COMPOSITE	GRM28 COMPOSITE	GRM29 COMPOSITE	GRM30 COMPOSITE
			Client sampling date / time	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN	17wYUI v6N11 10:NN
Compound	CAS Number	LOR	Unit	EB1111587-091	EB1111587-092	EB1111587-093	EB1111587-094	EB1111587-095
EG020S: Soluble Metals by ICPMS - Continued								
Manganese	3h2LwL7w0	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Molybdenum	3h2LwL9w3	N+N1	DgJ@	**0.48**	**0.30**	**0.13**	**0.11**	**0.42**
Nickel	3hhNwN5wN	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Lead	3h2LwL5w1	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Antimony	3hhNw27wN	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Uranium	3hhNw71w1	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Zinc	3hhNw77w7	N+N1	DgJ@	<N+1N	<N+1N	<N+1N	<N+1N	<N+1N
Vanadium	3hhNw75w5	N+1	DgJ@	<1+N	<1+N	<1+N	<1+N	<1+N
Aluminium	3h5LwLNw0	N+1	DgJ@	**3.6**	<1+N	**12.9**	**7.5**	**9.5**
EG035S: Soluble Mercury by FIMS								
Mercury	3h2LwL3w7	N+NNN0	DgJ@	**0.0005**	<N+NNN0	<N+NNN0	<N+NNN0	<N+NNN0
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	www	N+N5	µ	**1.87**	**2.67**	**0.87**	**1.06**	**1.46**

Analytical Results

uSr vj aytrx: PULP			Client sample ID	GRM31 COMPOSITE	GRM32 COMPOSITE	GRM33 COMPOSITE	GRM34 COMPOSITE	www
			Client sampling date / time	17wYUI v5N11 10:NN	17wYUI v5N11 10:NN	17wYUI v5N11 10:NN	17wYUI v5N11 10:NN	www
Compound	*CAS Number*	*LOR*	*Unit*	EB1111587-096	EB1111587-097	EB1111587-098	EB1111587-099	----
EA002 : pH (Soils)								
pH Value	www	N+1	. H Uvry	9.6	9.4	8.9	9.2	www
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Absorption Ratio	www	N+N1	w	28.7	15.7	19.8	26.0	www
EA010: Conductivity								
Electrical Conductivity @ 25°C	www	1	%u JMD	518	303	447	296	www
ED007: Exchangeable Cations								
^ Exchangeable Calcium	www	N+1	DeqJ1NNg	7.2	3.5	8.4	2.7	www
^ Exchangeable Magnesium	www	N+1	DeqJ1NNg	3.4	1.1	3.6	1.1	www
^ Exchangeable Potassium	www	N+1	DeqJ1NNg	0.6	1.0	0.7	1.0	www
^ Exchangeable Sodium	www	N+1	DeqJ1NNg	5.2	9.3	4.1	6.1	www
^ Cation Exchange Capacity	www	N+1	DeqJ1NNg	16.5	14.9	16.7	10.9	www
^ Exchangeable Sodium Percent	www	N+1	µ	31.8	62.4	24.5	55.9	www
ED037: Alkalinity								
Total Alkalinity as CaCO3	www	1	DgJ@g	1780	796	586	890	www
Bicarbonate Alkalinity as CaCO3	31v05v2	1	DgJ@g	1120	656	516	796	www
Carbonate Alkalinity as CaCO3	2915v25v7	1	DgJ@g	656	141	70	94	www
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	1h9N9v8Lv0	1N	DgJ@g	210	190	430	180	www
ED045G: Chloride Discrete analyser								
Chloride	17993vNNv7	1N	DgJ@g	30	50	120	20	www
ED093S: Soluble Major Cations								
Calcium	3hhNv3Nv5	1N	DgJ@g	<1N	<1N	<1N	<1N	www
Magnesium	3h2LvL0vh	1N	DgJ@g	<1N	<1N	<1N	<1N	www
Sodium	3hhNv52v0	1N	DgJ@g	570	260	450	300	www
Potassium	3hhNvNLv3	1N	DgJ@g	10	<1N	10	<1N	www
EG005S : Soluble Metals by ICPAES								
Boron	3hhNvh5v0	1	DgJ@g	1	2	1	2	www
Iron	3h2Lv0Lv7	1	DgJ@g	<1	<1	<1	<1	www
EG020S: Soluble Metals by ICPMS								
Arsenic	3hhNv29v5	N+N1	DgJ@g	0.40	<N+1N	0.86	0.18	www
Selenium	3395vhLv5	N+1	DgJ@g	<1+N	<1+N	<1+N	<1+N	www
Silver	3hhNv55vh	N+N1	DgJ@g	<N+1N	<N+1N	<N+1N	<N+1N	www
Cadmium	3hhNvh2vL	N+N1	DgJ@g	<N+1N	<N+1N	<N+1N	<N+1N	www
Cobalt	3hhNvh9vh	N+N1	DgJ@g	<N+1N	<N+1N	<N+1N	<N+1N	www
Chromium	3hhNvh3v2	N+N1	DgJ@g	<N+1N	<N+1N	<N+1N	<N+1N	www
Copper	3hhNv0Nv0	N+N1	DgJ@g	<N+1N	<N+1N	<N+1N	<N+1N	www

Analytical Results

uSr vj aytrx: **PULP**			Client sample ID	GRM31 COMPOSITE	GRM32 COMPOSITE	GRM33 COMPOSITE	GRM34 COMPOSITE	www
			Client sampling date / time	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN	17wYUI w5N11 10:NN	www
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111587-096**	**EB1111587-097**	**EB1111587-098**	**EB1111587-099**	**----**
EG020S: Soluble Metals by ICPMS - Continued								
Manganese	3h2LwL7w0	NHN1	DgJ@	<NH1N	<NH1N	<NH1N	<NH1N	www
Molybdenum	3h2LwL9w3	NHN1	DgJ@	**0.31**	**0.40**	**0.31**	**0.20**	www
Nickel	3hhNwN5wN	NHN1	DgJ@	<NH1N	<NH1N	<NH1N	<NH1N	www
Lead	3h2LwL5w1	NHN1	DgJ@	<NH1N	<NH1N	<NH1N	<NH1N	www
Antimony	3hhNw27wN	NHN1	DgJ@	<NH1N	<NH1N	<NH1N	<NH1N	www
Uranium	3hhNw71w1	NHN1	DgJ@	<NH1N	<NH1N	<NH1N	<NH1N	www
Zinc	3hhNw77w7	NHN1	DgJ@	<NH1N	<NH1N	<NH1N	<NH1N	www
Vanadium	3hhNw75w5	NH1	DgJ@	<1HN	<1HN	<1HN	<1HN	www
Aluminium	3h5LwLNw0	NH1	DgJ@	**2.1**	**7.9**	**1.4**	**4.3**	www
EG035S: Soluble Mercury by FIMS								
Mercury	3h2LwL3w7	NHNNN0	DgJ@	<NHNNN0	<NHNNN0	<NHNNN0	<NHNNN0	www
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	www	NHN5	µ	**1.82**	**2.11**	**3.07**	**3.58**	www

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **EB1111587**	Page	: 1 of 12
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: DR LAWRENCE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 14-JUN-2011
Sampler	: ----	Issue Date	: 25-JUL-2011
Order number	: ----		
		No. of samples received	: 99
Quote number	: BN/060/11	No. of samples analysed	: 99

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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA WORLD RECOGNISED ACCREDITATION

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.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot

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

RPD = Relative Percentage Difference

= Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA002 : pH (Soils) (QC Lot: 1842535)									
EB1111539-001	Anonymous	EA002: pH Value	----	0.1	pH Unit	8.6	8.6	0.0	0% - 20%
EB1111539-007	Anonymous	EA002: pH Value	----	0.1	pH Unit	7.7	7.8	0.0	0% - 20%
EA010: Conductivity (QC Lot: 1842537)									
EB1111539-001	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	273	280	2.5	0% - 20%
EB1111539-007	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	389	371	4.7	0% - 20%
EA011: Net Acid Generation (QC Lot: 1834328)									
EB1111587-016	43733_133.5m-134m_Floor	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: pH (OX)	----	0.1	pH Unit	7.5	7.6	1.3	0% - 20%
EA011: Net Acid Generation (QC Lot: 1845028)									
EB1111587-001	43723_209.5m-210m_OB	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: pH (OX)	----	0.1	pH Unit	9.4	9.5	1.0	0% - 20%
EB1111587-012	43733_121.1m-121.4m_OB	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: pH (OX)	----	0.1	pH Unit	9.1	9.1	0.0	0% - 20%
EA011: Net Acid Generation (QC Lot: 1845029)									
EB1111587-022	43733_239.12m-239.5m_IB	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: pH (OX)	----	0.1	pH Unit	8.9	8.9	0.0	0% - 20%
EB1111587-033	43750_364.9m-365.24m_IB	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: pH (OX)	----	0.1	pH Unit	9.0	9.0	0.0	0% - 20%
EA011: Net Acid Generation (QC Lot: 1845030)									
EB1111587-042	43750_417m-417.34m_Roof	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: pH (OX)	----	0.1	pH Unit	8.8	8.8	0.0	0% - 20%
EB1111587-053	43893_182m-182.5m_OB	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: pH (OX)	----	0.1	pH Unit	9.3	9.4	1.1	0% - 20%
EA011: Net Acid Generation (QC Lot: 1845031)									
EB1111587-064	438.93_357.09m-357.59m_Roof	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EA011: Net Acid Generation (QC Lot: 1845031) - continued									
EB1111587-064	438.93_357.09m-357.59m_ Roof	EA011: pH (OX)	----	0.1	pH Unit	9.4	9.4	0.0	0% - 20%
ED007: Exchangeable Cations (QC Lot: 1834303)									
EB1111587-066	GRM01 COMPOSITE	ED007: Exchangeable Calcium	----	0.1	meq/100g	7.1	7.3	2.3	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	1.8	1.8	0.0	0% - 50%
		ED007: Exchangeable Sodium	----	0.1	meq/100g	6.1	5.9	3.2	0% - 20%
EB1111587-074	GRM09 COMPOSITE	ED007: Exchangeable Calcium	----	0.1	meq/100g	19.0	18.9	0.0	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	2.1	2.0	0.0	0% - 20%
		ED007: Exchangeable Sodium	----	0.1	meq/100g	5.5	5.5	0.0	0% - 20%
ED007: Exchangeable Cations (QC Lot: 1847317)									
EB1111587-086	GRM21 COMPOSITE	ED007: Exchangeable Calcium	----	0.1	meq/100g	3.2	3.3	3.3	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	1.6	1.6	0.0	0% - 50%
		ED007: Exchangeable Potassium	----	0.1	meq/100g	1.0	1.1	0.0	0% - 50%
		ED007: Exchangeable Sodium	----	0.1	meq/100g	6.6	6.8	2.7	0% - 20%
EB1111587-094	GRM29 COMPOSITE	ED007: Exchangeable Calcium	----	0.1	meq/100g	4.0	4.0	0.0	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	0.9	0.9	0.0	No Limit
		ED007: Exchangeable Potassium	----	0.1	meq/100g	1.1	1.1	0.0	0% - 50%
		ED007: Exchangeable Sodium	----	0.1	meq/100g	8.6	8.6	0.0	0% - 20%
ED037: Alkalinity (QC Lot: 1842540)									
EB1111539-001	Anonymous	ED037: Total Alkalinity as CaCO3	----	1	meq/kg	652	586	10.7	0% - 20%
EB1111539-007	Anonymous	ED037: Total Alkalinity as CaCO3	----	1	meq/kg	130	130	0.0	0% - 20%
ED040S: Soluble Major Anions (QC Lot: 1842536)									
EB1111539-001	Anonymous	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	360	340	5.0	0% - 20%
EB1111539-007	Anonymous	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	700	670	4.7	0% - 20%
ED045G: Chloride Discrete analyser (QC Lot: 1842544)									
EB1111539-001	Anonymous	ED045G: Chloride	16887-00-6	10	mg/kg	70	50	# 21.5	No Limit
EB1111539-007	Anonymous	ED045G: Chloride	16887-00-6	10	mg/kg	<10	<10	0.0	No Limit
ED093S: Soluble Major Cations (QC Lot: 1842539)									
EB1111539-001	Anonymous	ED093S: Calcium	7440-70-2	10	mg/kg	<10	<10	0.0	No Limit
		ED093S: Magnesium	7439-95-4	10	mg/kg	<10	<10	0.0	No Limit
		ED093S: Sodium	7440-23-5	10	mg/kg	260	250	0.0	0% - 20%
		ED093S: Potassium	7440-09-7	10	mg/kg	<10	<10	0.0	No Limit
EB1111539-007	Anonymous	ED093S: Calcium	7440-70-2	10	mg/kg	140	130	0.0	0% - 50%
		ED093S: Magnesium	7439-95-4	10	mg/kg	80	80	0.0	No Limit
		ED093S: Sodium	7440-23-5	10	mg/kg	90	80	0.0	No Limit
		ED093S: Potassium	7440-09-7	10	mg/kg	20	20	0.0	No Limit
EG005S : Soluble Metals by ICPAES (QC Lot: 1842538)									
EB1111539-001	Anonymous	EG005S: Boron	7440-42-8	1	mg/kg	<1	<1	0.0	No Limit
		EG005S: Iron	7439-89-6	1	mg/kg	<1	<1	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG005S : Soluble Metals by ICPAES (QC Lot: 1842538) - continued									
EB1111539-007	Anonymous	EG005S: Boron	7440-42-8	1	mg/kg	<1	<1	0.0	No Limit
		EG005S: Iron	7439-89-6	1	mg/kg	<1	<1	0.0	No Limit
EG020S: Soluble Metals by ICPMS (QC Lot: 1842324)									
EB1111587-085	GRM20 COMPOSITE	EG020X-S: Arsenic	7440-38-2	0.01	mg/kg	4.53	4.55	0.5	0% - 20%
		EG020X-S: Cobalt	7440-48-4	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Chromium	7440-47-3	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Copper	7440-50-8	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Manganese	7439-96-5	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Molybdenum	7439-98-7	0.01	mg/kg	0.49	0.48	2.2	0% - 20%
		EG020X-S: Nickel	7440-02-0	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Lead	7439-92-1	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Antimony	7440-36-0	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Uranium	7440-61-1	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Zinc	7440-66-6	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Vanadium	7440-62-2	0.1	mg/kg	<1.0	<1.0	0.0	No Limit
		EG020X-S: Aluminium	7429-90-5	0.1	mg/kg	<1.0	<1.0	0.0	No Limit
EG020S: Soluble Metals by ICPMS (QC Lot: 1842541)									
EB1111539-007	Anonymous	EG020X-S: Arsenic	7440-38-2	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Cobalt	7440-48-4	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Chromium	7440-47-3	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Copper	7440-50-8	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Manganese	7439-96-5	0.01	mg/kg	0.34	0.36	5.5	0% - 20%
		EG020X-S: Molybdenum	7439-98-7	0.01	mg/kg	0.01	<0.01	0.0	No Limit
		EG020X-S: Nickel	7440-02-0	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Lead	7439-92-1	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Antimony	7440-36-0	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Uranium	7440-61-1	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Zinc	7440-66-6	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Vanadium	7440-62-2	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020X-S: Aluminium	7429-90-5	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EB1111587-067	GRM02 COMPOSITE	EG020X-S: Arsenic	7440-38-2	0.01	mg/kg	0.27	0.31	13.8	0% - 20%
		EG020X-S: Cobalt	7440-48-4	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Chromium	7440-47-3	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Copper	7440-50-8	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Manganese	7439-96-5	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Molybdenum	7439-98-7	0.01	mg/kg	0.16	0.15	0.0	0% - 50%
		EG020X-S: Nickel	7440-02-0	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Lead	7439-92-1	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Antimony	7440-36-0	0.01	mg/kg	<0.10	<0.10	0.0	No Limit

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG020S: Soluble Metals by ICPMS (QC Lot: 1842541) - continued									
EB1111587-067	GRM02 COMPOSITE	EG020X-S: Uranium	7440-61-1	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Zinc	7440-66-6	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Vanadium	7440-62-2	0.1	mg/kg	<1.0	<1.0	0.0	No Limit
		EG020X-S: Aluminium	7429-90-5	0.1	mg/kg	<1.0	<1.0	0.0	No Limit
EG020S: Soluble Metals by ICPMS (QC Lot: 1842542)									
EB1111539-001	Anonymous	EG020Y-S: Cadmium	7440-43-9	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020Y-S: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EB1111539-007	Anonymous	EG020Y-S: Cadmium	7440-43-9	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020Y-S: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EG020S: Soluble Metals by ICPMS (QC Lot: 1842543)									
EB1111539-001	Anonymous	EG020Z-S: Silver	7440-22-4	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
EB1111539-007	Anonymous	EG020Z-S: Silver	7440-22-4	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
EG035S: Soluble Mercury by FIMS (QC Lot: 1842545)									
EB1111539-001	Anonymous	EG035S: Mercury	7439-97-6	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EB1111539-007	Anonymous	EG035S: Mercury	7439-97-6	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 1833758)									
EB1111587-016	43733_133.5m-134m_Floor	EP003: Total Organic Carbon	----	0.02	%	3.24	3.06	5.8	0% - 20%
EP003TC: Total Carbon (TC) in Soil (QC Lot: 1833759)									
EB1111587-016	43733_133.5m-134m_Floor	EP003TC: Total Carbon	----	0.02	%	3.35	3.46	3.0	0% - 20%
EB1111587-073	GRM08 COMPOSITE	EP003TC: Total Carbon	----	0.02	%	1.59	1.62	1.7	0% - 20%
EP003TC: Total Carbon (TC) in Soil (QC Lot: 1833760)									
EB1111587-083	GRM18 COMPOSITE	EP003TC: Total Carbon	----	0.02	%	2.83	2.79	1.6	0% - 20%
EB1111587-093	GRM28 COMPOSITE	EP003TC: Total Carbon	----	0.02	%	0.87	0.88	0.0	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002 : pH (Soils) (QCLot: 1842318)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	102	97	103
EA002 : pH (Soils) (QCLot: 1842329)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	98.8	97	103
EA002 : pH (Soils) (QCLot: 1842535)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	100	97	103
EA006: Sodium Adsorption Ratio (SAR) (QCLot: 1838733)								
EA006: Sodium Absorption Ratio	----	0.01		<0.01	----	----	----	----
EA006: Sodium Adsorption Ratio (SAR) (QCLot: 1838737)								
EA006: Sodium Absorption Ratio	----	0.01		<0.01	----	----	----	----
EA010: Conductivity (QCLot: 1842320)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	91.8	85	115
EA010: Conductivity (QCLot: 1842331)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	91.8	85	115
EA010: Conductivity (QCLot: 1842537)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	97.4	85	115
EA011: Net Acid Generation (QCLot: 1834328)								
EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	----	12 kg H2SO4/t	102	84	114
EA011: Net Acid Generation (QCLot: 1845028)								
EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	----	12 kg H2SO4/t	101	84	114
EA011: Net Acid Generation (QCLot: 1845029)								
EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	----	12 kg H2SO4/t	103	84	114
EA011: Net Acid Generation (QCLot: 1845030)								
EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	----	12 kg H2SO4/t	100	84	114
EA011: Net Acid Generation (QCLot: 1845031)								
EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	----	12 kg H2SO4/t	95.6	84	114
EA011-A: pH Ox (QCLot: 1834329)								
EA011E: pH (OX)	----	0.1	pH Unit	----	2.7 pH Unit	100	80	120
EA011E: pH -2 (ext)	----	0.1	pH Unit	----	2.6 pH Unit	96.2	80	120
EA011-B: Dissolved Major Anions (QCLot: 1834329)								
EA011E: Sulfur as S	63705-05-5	1	mg/L	----	53 mg/L	93.0	80	120
EA011E: Chloride	16887-00-6	1	mg/L	----	.9 mg/L	# Not Determined	80	120
EA011-C: Dissolved Major Cations (QCLot: 1834329)								

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA011-C: Dissolved Major Cations (QCLot: 1834329) - continued								
EA011E: Calcium	7440-70-2	1	mg/L	----	1 mg/L	# Not Determined	80	120
EA011E: Magnesium	7439-95-4	1	mg/L	----	.1 mg/L	# Not Determined	80	120
EA011E: Sodium	7440-23-5	1	mg/L	----	2 mg/L	85.5	80	120
EA011E: Potassium	7440-09-7	1	mg/L	----	1 mg/L	# Not Determined	80	120
EA011-D: Calculated Components (QCLot: 1834329)								
EA011E: Calculated Acid Component	----	0.1	kg H2SO4/t	----	16.2 kg H2SO4/t	93.1	80	120
EA011E: Calculated Neutralisng Component	----	0.1	kg H2SO4/t	----	.6 kg H2SO4/t	96.8	80	120
EA011E: Calculated NAG Acidity	----	0.1	kg H2SO4/t	----	16.2 kg H2SO4/t	89.5	80	120
ED007: Exchangeable Cations (QCLot: 1834303)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	1.2 meq/100g	101	70	130
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	0.65 meq/100g	100	70	130
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.4 meq/100g	90.2	70	130
ED007: Exchangeable Cations (QCLot: 1847317)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	1.2 meq/100g	108	70	130
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	0.65 meq/100g	108	70	130
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	0.20 meq/100g	72.8	70	130
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.4 meq/100g	87.0	70	130
ED007: Cation Exchange Capacity	----	0.1	meq/100g	----	2.46 meq/100g	101	70	130
ED037: Alkalinity (QCLot: 1842323)								
ED037: Total Alkalinity as CaCO3	----	1	meq/kg	<1	200 meq/kg	93.5	85	115
ED037: Alkalinity (QCLot: 1842334)								
ED037: Total Alkalinity as CaCO3	----	1	meq/kg	<1	200 meq/kg	93.5	85	115
ED037: Alkalinity (QCLot: 1842540)								
ED037: Total Alkalinity as CaCO3	----	1	meq/kg	<1	200 meq/kg	97.5	85	115
ED040S: Soluble Major Anions (QCLot: 1842319)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	238 mg/kg	96.1	77	125
ED040S: Soluble Major Anions (QCLot: 1842330)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	238 mg/kg	96.0	77	125
ED040S: Soluble Major Anions (QCLot: 1842536)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	238 mg/kg	103	77	125
ED045G: Chloride Discrete analyser (QCLot: 1842327)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	5000 mg/kg	90.4	73	129
ED045G: Chloride Discrete analyser (QCLot: 1842338)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	5000 mg/kg	98.6	73	129
ED045G: Chloride Discrete analyser (QCLot: 1842544)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	5000 mg/kg	91.9	73	129
ED093S: Soluble Major Cations (QCLot: 1842322)								

Work Order : EB1111587
Client : URS AUSTRALIA PTY LTD (QLD)
Project : 42626689 GRM_EIS

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
ED093S: Soluble Major Cations (QCLot: 1842322) - continued								
ED093S: Calcium	7440-70-2	10	mg/kg	<10	----	----	----	----
ED093S: Magnesium	7439-95-4	10	mg/kg	<10	----	----	----	----
ED093S: Sodium	7440-23-5	10	mg/kg	<10	----	----	----	----
ED093S: Potassium	7440-09-7	10	mg/kg	<10	----	----	----	----
ED093S: Soluble Major Cations (QCLot: 1842333)								
ED093S: Calcium	7440-70-2	10	mg/kg	<10	----	----	----	----
ED093S: Magnesium	7439-95-4	10	mg/kg	<10	----	----	----	----
ED093S: Sodium	7440-23-5	10	mg/kg	<10	----	----	----	----
ED093S: Potassium	7440-09-7	10	mg/kg	<10	----	----	----	----
ED093S: Soluble Major Cations (QCLot: 1842539)								
ED093S: Calcium	7440-70-2	10	mg/kg	<10	----	----	----	----
ED093S: Magnesium	7439-95-4	10	mg/kg	<10	----	----	----	----
ED093S: Sodium	7440-23-5	10	mg/kg	<10	----	----	----	----
ED093S: Potassium	7440-09-7	10	mg/kg	<10	----	----	----	----
EG005S : Soluble Metals by ICPAES (QCLot: 1842321)								
EG005S: Boron	7440-42-8	1.00	mg/kg	<1	----	----	----	----
EG005S: Iron	7439-89-6	1.00	mg/kg	<1	----	----	----	----
EG005S : Soluble Metals by ICPAES (QCLot: 1842332)								
EG005S: Boron	7440-42-8	1.00	mg/kg	<1	----	----	----	----
EG005S: Iron	7439-89-6	1.00	mg/kg	<1	----	----	----	----
EG005S : Soluble Metals by ICPAES (QCLot: 1842538)								
EG005S: Boron	7440-42-8	1.00	mg/kg	<1	----	----	----	----
EG005S: Iron	7439-89-6	1.00	mg/kg	<1	----	----	----	----
EG020S: Soluble Metals by ICPMS (QCLot: 1842324)								
EG020X-S: Arsenic	7440-38-2	0.01	mg/kg	<0.01	0.5 mg/kg	105	84.7	124
EG020X-S: Cobalt	7440-48-4	0.01	mg/kg	<0.01	0.5 mg/kg	105	72	130
EG020X-S: Chromium	7440-47-3	0.01	mg/kg	<0.01	0.5 mg/kg	109	70	125
EG020X-S: Copper	7440-50-8	0.01	mg/kg	<0.01	1.0 mg/kg	104	70	130
EG020X-S: Manganese	7439-96-5	0.01	mg/kg	<0.01	0.5 mg/kg	106	77.6	130
EG020X-S: Molybdenum	7439-98-7	0.01	mg/kg	<0.01	0.5 mg/kg	101	83	117
EG020X-S: Nickel	7440-02-0	0.01	mg/kg	<0.01	0.5 mg/kg	104	78	124
EG020X-S: Lead	7439-92-1	0.01	mg/kg	<0.01	0.5 mg/kg	103	70	117
EG020X-S: Antimony	7440-36-0	0.01	mg/kg	<0.01	0.5 mg/kg	99.2	77	117
EG020X-S: Uranium	7440-61-1	0.01	mg/kg	<0.01	----	----	----	----
EG020X-S: Zinc	7440-66-6	0.01	mg/kg	<0.01	1.0 mg/kg	105	70	125
EG020X-S: Vanadium	7440-62-2	0.1	mg/kg	<0.1	0.5 mg/kg	102	83	125
EG020X-S: Aluminium	7429-90-5	0.1	mg/kg	<0.1	2.5 mg/kg	100	70	121
EG020S: Soluble Metals by ICPMS (QCLot: 1842325)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EG020S: Soluble Metals by ICPMS (QCLot: 1842325) - continued								
EG020Y-S: Selenium	7782-49-2	0.1	mg/kg	<0.1	0.5 mg/kg	94.1	77	116
EG020Y-S: Cadmium	7440-43-9	0.01	mg/kg	<0.01	0.5 mg/kg	105	79	116
EG020S: Soluble Metals by ICPMS (QCLot: 1842326)								
EG020Z-S: Silver	7440-22-4	0.01	mg/kg	<0.01	0.5 mg/kg	101	75	130
EG020S: Soluble Metals by ICPMS (QCLot: 1842335)								
EG020X-S: Arsenic	7440-38-2	0.01	mg/kg	<0.01	0.5 mg/kg	102	84.7	124
EG020X-S: Cobalt	7440-48-4	0.01	mg/kg	<0.01	0.5 mg/kg	106	72	130
EG020X-S: Chromium	7440-47-3	0.01	mg/kg	<0.01	0.5 mg/kg	109	70	125
EG020X-S: Copper	7440-50-8	0.01	mg/kg	<0.01	1.0 mg/kg	104	70	130
EG020X-S: Manganese	7439-96-5	0.01	mg/kg	<0.01	0.5 mg/kg	106	77.6	130
EG020X-S: Molybdenum	7439-98-7	0.01	mg/kg	<0.01	0.5 mg/kg	98.8	83	117
EG020X-S: Nickel	7440-02-0	0.01	mg/kg	<0.01	0.5 mg/kg	105	78	124
EG020X-S: Lead	7439-92-1	0.01	mg/kg	<0.01	0.5 mg/kg	102	70	117
EG020X-S: Antimony	7440-36-0	0.01	mg/kg	<0.01	0.5 mg/kg	98.6	77	117
EG020X-S: Uranium	7440-61-1	0.01	mg/kg	--	----	----	----	----
EG020X-S: Zinc	7440-66-6	0.01	mg/kg	<0.01	1.0 mg/kg	105	70	125
EG020X-S: Vanadium	7440-62-2	0.1	mg/kg	<0.1	0.5 mg/kg	99.1	83	125
EG020X-S: Aluminium	7429-90-5	0.1	mg/kg	<0.1	2.5 mg/kg	110	70	121
EG020S: Soluble Metals by ICPMS (QCLot: 1842336)								
EG020Y-S: Selenium	7782-49-2	0.1	mg/kg	<0.1	0.5 mg/kg	94.7	77	116
EG020Y-S: Cadmium	7440-43-9	0.01	mg/kg	<0.01	0.5 mg/kg	102	79	116
EG020S: Soluble Metals by ICPMS (QCLot: 1842337)								
EG020Z-S: Silver	7440-22-4	0.01	mg/kg	<0.01	0.5 mg/kg	102	75	130
EG020S: Soluble Metals by ICPMS (QCLot: 1842541)								
EG020X-S: Arsenic	7440-38-2	0.01	mg/kg	<0.01	0.5 mg/kg	105	84.7	124
EG020X-S: Cobalt	7440-48-4	0.01	mg/kg	<0.01	0.5 mg/kg	103	72	130
EG020X-S: Chromium	7440-47-3	0.01	mg/kg	<0.01	0.5 mg/kg	109	70	125
EG020X-S: Copper	7440-50-8	0.01	mg/kg	<0.01	1.0 mg/kg	101	70	130
EG020X-S: Manganese	7439-96-5	0.01	mg/kg	<0.01	0.5 mg/kg	105	77.6	130
EG020X-S: Molybdenum	7439-98-7	0.01	mg/kg	<0.01	0.5 mg/kg	98.8	83	117
EG020X-S: Nickel	7440-02-0	0.01	mg/kg	<0.01	0.5 mg/kg	102	78	124
EG020X-S: Lead	7439-92-1	0.01	mg/kg	<0.01	0.5 mg/kg	104	70	117
EG020X-S: Antimony	7440-36-0	0.01	mg/kg	<0.01	0.5 mg/kg	99.9	77	117
EG020X-S: Uranium	7440-61-1	0.01	mg/kg	<0.01	----	----	----	----
EG020X-S: Zinc	7440-66-6	0.01	mg/kg	<0.01	1.0 mg/kg	104	70	125
EG020X-S: Vanadium	7440-62-2	0.1	mg/kg	<0.1	0.5 mg/kg	103	83	125
EG020X-S: Aluminium	7429-90-5	0.1	mg/kg	<0.1	2.5 mg/kg	106	70	121
EG020S: Soluble Metals by ICPMS (QCLot: 1842542)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report Result	Laboratory Control Spike (LCS) Report Spike Concentration	Spike Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High
EG020S: Soluble Metals by ICPMS (QCLot: 1842542) - continued								
EG020Y-S: Selenium	7782-49-2	0.1	mg/kg	<0.1	0.5 mg/kg	94.1	77	116
EG020Y-S: Cadmium	7440-43-9	0.01	mg/kg	<0.01	0.5 mg/kg	100	79	116
EG020S: Soluble Metals by ICPMS (QCLot: 1842543)								
EG020Z-S: Silver	7440-22-4	0.01	mg/kg	<0.01	0.5 mg/kg	100	75	130
EG035S: Soluble Mercury by FIMS (QCLot: 1842328)								
EG035S: Mercury	7439-97-6	0.0005	mg/kg	<0.0005	0.05 mg/kg	103	74	116
EG035S: Soluble Mercury by FIMS (QCLot: 1842339)								
EG035S: Mercury	7439-97-6	0.0005	mg/kg	<0.0005	0.05 mg/kg	105	74	116
EG035S: Soluble Mercury by FIMS (QCLot: 1842545)								
EG035S: Mercury	7439-97-6	0.0005	mg/kg	<0.0005	0.05 mg/kg	98.2	74	116
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 1833758)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	100	70	130
EP003TC: Total Carbon (TC) in Soil (QCLot: 1833759)								
EP003TC: Total Carbon	----	0.02	%	<0.02	100 %	98.5	70	130
EP003TC: Total Carbon (TC) in Soil (QCLot: 1833760)								
EP003TC: Total Carbon	----	0.02	%	<0.02	100 %	98.5	70	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EG035S: Soluble Mercury by FIMS (QCLot: 1842328)							
EB1111587-069	GRM04 COMPOSITE	EG035S: Mercury	7439-97-6	0.05 mg/kg	105	70	130
EG035S: Soluble Mercury by FIMS (QCLot: 1842339)							
EB1111587-090	GRM25 COMPOSITE	EG035S: Mercury	7439-97-6	0.05 mg/kg	104	70	130
EG035S: Soluble Mercury by FIMS (QCLot: 1842545)							
EB1111539-002	Anonymous	EG035S: Mercury	7439-97-6	0.05 mg/kg	111	70	130

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1111587**	Page	: 1 of 16
Client	: URS AUSTRALIA PTY LTD (QLD)	Laboratory	: Environmental Division Brisbane
Contact	: DR LAWRENCE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 14-JUN-2011
Sampler	: ----	Issue Date	: 25-JUL-2011
Order number	: ----		
		No. of samples received	: 99
Quote number	: BN/060/11	No. of samples analysed	: 99

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 Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non -volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **SOIL**

Evaluation: ✘ = Holding time breach ; ✓ = Within holding time.

Method		*Sample Date*	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)			*Date extracted*	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EA002 : pH (Soils)								
Pulp Bag								
GRM03 - COMPOSITE,	GRM04 - COMPOSITE,	**16-JUN-2011**	**23-JUN-2011**	23-JUN-2011	✓	**27-JUN-2011**	23-JUN-2011	✘
GRM05 - COMPOSITE,	GRM06 - COMPOSITE,							
GRM07 - COMPOSITE,	GRM08 - COMPOSITE,							
GRM09 - COMPOSITE,	GRM10 - COMPOSITE,							
GRM11 - COMPOSITE,	GRM12 - COMPOSITE,							
GRM13 - COMPOSITE,	GRM14 - COMPOSITE,							
GRM15 - COMPOSITE,	GRM16 - COMPOSITE,							
GRM17 - COMPOSITE,	GRM18 - COMPOSITE,							
GRM19 - COMPOSITE,	GRM20 - COMPOSITE,							
GRM21 - COMPOSITE,	GRM22 - COMPOSITE,							
GRM23 - COMPOSITE,	GRM24 - COMPOSITE,							
GRM25 - COMPOSITE,	GRM26 - COMPOSITE,							
GRM27 - COMPOSITE,	GRM28 - COMPOSITE,							
GRM29 - COMPOSITE,	GRM30 - COMPOSITE,							
GRM31 - COMPOSITE,	GRM32 - COMPOSITE,							
GRM33 - COMPOSITE,	GRM34 - COMPOSITE							
Pulp Bag								
GRM01 - COMPOSITE,	GRM02 - COMPOSITE	**16-JUN-2011**	**24-JUN-2011**	23-JUN-2011	✘	**24-JUN-2011**	25-JUN-2011	✓

Matrix: **SOIL**

Evaluation: ✗ = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA006: Sodium Adsorption Ratio (SAR)								
Pulp Bag								
GRM01 - COMPOSITE, GRM03 - COMPOSITE, GRM05 - COMPOSITE, GRM07 - COMPOSITE, GRM09 - COMPOSITE, GRM11 - COMPOSITE, GRM13 - COMPOSITE, GRM15 - COMPOSITE, GRM17 - COMPOSITE, GRM19 - COMPOSITE, GRM21 - COMPOSITE, GRM23 - COMPOSITE, GRM25 - COMPOSITE, GRM27 - COMPOSITE, GRM29 - COMPOSITE, GRM31 - COMPOSITE, GRM33 - COMPOSITE,	GRM02 - COMPOSITE, GRM04 - COMPOSITE, GRM06 - COMPOSITE, GRM08 - COMPOSITE, GRM10 - COMPOSITE, GRM12 - COMPOSITE, GRM14 - COMPOSITE, GRM16 - COMPOSITE, GRM18 - COMPOSITE, GRM20 - COMPOSITE, GRM22 - COMPOSITE, GRM24 - COMPOSITE, GRM26 - COMPOSITE, GRM28 - COMPOSITE, GRM30 - COMPOSITE, GRM32 - COMPOSITE, GRM34 - COMPOSITE	**16-JUN-2011**	**24-JUN-2011**	13-DEC-2011	✓	**27-JUN-2011**	13-DEC-2011	✓
EA010: Conductivity								
Pulp Bag								
GRM03 - COMPOSITE, GRM05 - COMPOSITE, GRM07 - COMPOSITE, GRM09 - COMPOSITE, GRM11 - COMPOSITE, GRM13 - COMPOSITE, GRM15 - COMPOSITE, GRM17 - COMPOSITE, GRM19 - COMPOSITE, GRM21 - COMPOSITE, GRM23 - COMPOSITE, GRM25 - COMPOSITE, GRM27 - COMPOSITE, GRM29 - COMPOSITE, GRM31 - COMPOSITE, GRM33 - COMPOSITE,	GRM04 - COMPOSITE, GRM06 - COMPOSITE, GRM08 - COMPOSITE, GRM10 - COMPOSITE, GRM12 - COMPOSITE, GRM14 - COMPOSITE, GRM16 - COMPOSITE, GRM18 - COMPOSITE, GRM20 - COMPOSITE, GRM22 - COMPOSITE, GRM24 - COMPOSITE, GRM26 - COMPOSITE, GRM28 - COMPOSITE, GRM30 - COMPOSITE, GRM32 - COMPOSITE, GRM34 - COMPOSITE	**16-JUN-2011**	**23-JUN-2011**	23-JUN-2011	✓	**27-JUN-2011**	21-JUL-2011	✓
Pulp Bag								
GRM01 - COMPOSITE,	GRM02 - COMPOSITE	**16-JUN-2011**	**24-JUN-2011**	23-JUN-2011	✗	**24-JUN-2011**	22-JUL-2011	✓

Matrix: **SOIL**

Evaluation: ✗ = Holding time breach ; ✓ = Within holding time.

Method *Container / Client Sample ID(s)*	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EA011: Net Acid Generation							
Pulp Bag 43733_133.5m-134m_Floor, 43893_186.96m-187.37m_Roof, 43893_336m-336.38m_Floor	**11-MAY-2011**	**17-JUN-2011**	10-MAY-2012	✓	**22-JUN-2011**	14-DEC-2011	✓
Pulp Bag 43723_209.5m-210m_OB, 43723_213.12m-213.98m_OB, 43723_217.92m-218.3m_Roof, 43723_260.57m-261.14m_IB, 43723_264.65m-265.15m_Floor, 43723_372m-372.5m_IB, 43723_375m-375.48m_IB, 43723_377m-377.5m_IB, 43723_384m-384.5m_IB, 43723_400.2m-400.7m_Floor, 43733_74m-74.5m_OB, 43733_121.1m-121.4m_OB, 43733_124.35m-124.71m_OB, 43733_127.02m-127.5m_OB, 43733_128.79m-129.29m_Roof, 43733_135m-135.38m_IB, 43733_214.5m-215m_IB, 43733_219.5m-220.04m_IB, 43733_222.83m-223.38m_Roof, 43733_235m-235.43m_IB, 43733_239.12m-239.5m_IB, 43733_241.5m-241.98m_IB, 43733_245.5m-246m_IB, 43733_256m-256.36m_IB, 43733_267.2m-267.75m_IB, 43733_279.66m-280m_Floor, 43750_264.51m-265m_OB, 43750_273m-273.5m_OB, 43750_282.2m-282.5m_Floor, 43750_284.5m-285m_IB, 43750_361m-361.5m_IB, 43750_364.9m-365.24m_IB, 43750_366.5m-366.95m_IB, 43750_368.69m-369.08m_Roof, 43750_378.5m-379m_Floor, 43750_383m-383.5m_IB, 43750_400m-400.5m_IB, 43750_404m-404.5m_IB, 43750_408m-408.43_IB, 43750_414.14m-414.47m_IB, 43750_417m-417.34m_Roof, 43765_228m-228.5m_OB, 43765_241.5m-242m_IB, 43765_322.5m-323m_IB, 43765_324.6m-325.1m_IB, 43765_337.6m-338.1m_IB, 43765_385m-385.5m_IB, 43765_389.5m-390m_IB, 43765_390.8m-391.36m_IB, 43765_392.3m-392.63m_Roof, 43893_177.5m-178m_OB, 43893_182m-182.5m_OB, 43893_192.12m-192.62m_Floor, 43893_194m-194.5m_IB, 43893_299.46m-299.94m_Roof, 43893_307.57m-308.07m_Floor, 43893_312m-312.5m_IB, 43893_315.8m-316.3m_IB, 43893_322.8m-323.3m_IB, 43893_324.46m-324.88m_IB, 438.93_357.09m-357.59m_Roof, 43893_363.61m-364.11_Floor	**11-MAY-2011**	**24-JUN-2011**	10-MAY-2012	✓	**28-JUN-2011**	21-DEC-2011	✓
EA011-A: pH Ox							
Pulp Bag 43733_133.5m-134m_Floor, 43893_186.96m-187.37m_Roof, 43893_336m-336.38m_Floor	**11-MAY-2011**	**17-JUN-2011**	11-MAY-2011	✗	**22-JUN-2011**	11-MAY-2011	✗
EA011-B: Dissolved Major Anions							
Pulp Bag 43733_133.5m-134m_Floor, 43893_186.96m-187.37m_Roof, 43893_336m-336.38m_Floor	**11-MAY-2011**	**17-JUN-2011**	11-MAY-2011	✗	**22-JUN-2011**	11-MAY-2011	✗

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA011-C: Dissolved Major Cations								
Pulp Bag 43733_133.5m-134m_Floor, 43893_336m-336.38m_Floor	43893_186.96m-187.37m_Roof,	**11-MAY-2011**	**17-JUN-2011**	11-MAY-2011	×	**22-JUN-2011**	11-MAY-2011	×
EA011-D: Calculated Components								
Pulp Bag 43733_133.5m-134m_Floor, 43893_336m-336.38m_Floor	43893_186.96m-187.37m_Roof,	**11-MAY-2011**	**17-JUN-2011**	11-MAY-2011	×	**22-JUN-2011**	11-MAY-2011	×
EA046 Acid Buffering Characterisation Curves								
Pulp Bag 43723_260.57m-261.14m_IB, 43723_400.2m-400.7m_Floor, 43733_222.83m-223.38m_Roof, 43750_361m-361.5m_IB, 43750_378.5m-379m_Floor, 43750_408m-408.43_IB, 43765_228m-228.5m_OB, 43765_390.8m-391.36m_IB, 43893_324.46m-324.88m_IB,	43723_264.65m-265.15m_Floor, 43733_127.02m-127.5m_OB, 43750_273m-273.5m_OB, 43750_364.9m-365.24m_IB, 43750_404m-404.5m_IB, 43750_417m-417.34m_Roof, 43765_389.5m-390m_IB, 43893_315.8m-316.3m_IB, 43893_336m-336.38m_Floor	**11-MAY-2011**	**----**	----	----	**30-JUN-2011**	10-MAY-2012	✓
ED007: Exchangeable Cations								
Pulp Bag GRM01 - COMPOSITE, GRM03 - COMPOSITE, GRM05 - COMPOSITE, GRM07 - COMPOSITE, GRM09 - COMPOSITE, GRM11 - COMPOSITE, GRM13 - COMPOSITE, GRM15 - COMPOSITE, GRM17 - COMPOSITE, GRM19 - COMPOSITE,	GRM02 - COMPOSITE, GRM04 - COMPOSITE, GRM06 - COMPOSITE, GRM08 - COMPOSITE, GRM10 - COMPOSITE, GRM12 - COMPOSITE, GRM14 - COMPOSITE, GRM16 - COMPOSITE, GRM18 - COMPOSITE, GRM20 - COMPOSITE	**16-JUN-2011**	**24-JUN-2011**	13-DEC-2011	✓	**27-JUN-2011**	13-DEC-2011	✓
Pulp Bag GRM21 - COMPOSITE, GRM23 - COMPOSITE, GRM25 - COMPOSITE, GRM27 - COMPOSITE, GRM29 - COMPOSITE, GRM31 - COMPOSITE, GRM33 - COMPOSITE,	GRM22 - COMPOSITE, GRM24 - COMPOSITE, GRM26 - COMPOSITE, GRM28 - COMPOSITE, GRM30 - COMPOSITE, GRM32 - COMPOSITE, GRM34 - COMPOSITE	**16-JUN-2011**	**27-JUN-2011**	13-DEC-2011	✓	**27-JUN-2011**	13-DEC-2011	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED037: Alkalinity								
Pulp Bag								
GRM03 - COMPOSITE, GRM05 - COMPOSITE, GRM07 - COMPOSITE, GRM09 - COMPOSITE, GRM11 - COMPOSITE, GRM13 - COMPOSITE, GRM15 - COMPOSITE, GRM17 - COMPOSITE, GRM19 - COMPOSITE, GRM21 - COMPOSITE, GRM23 - COMPOSITE, GRM25 - COMPOSITE, GRM27 - COMPOSITE, GRM29 - COMPOSITE, GRM31 - COMPOSITE, GRM33 - COMPOSITE,	GRM04 - COMPOSITE, GRM06 - COMPOSITE, GRM08 - COMPOSITE, GRM10 - COMPOSITE, GRM12 - COMPOSITE, GRM14 - COMPOSITE, GRM16 - COMPOSITE, GRM18 - COMPOSITE, GRM20 - COMPOSITE, GRM22 - COMPOSITE, GRM24 - COMPOSITE, GRM26 - COMPOSITE, GRM28 - COMPOSITE, GRM30 - COMPOSITE, GRM32 - COMPOSITE, GRM34 - COMPOSITE	**16-JUN-2011**	**23-JUN-2011**	13-DEC-2011	✓	**27-JUN-2011**	13-DEC-2011	✓
Pulp Bag								
GRM01 - COMPOSITE,	GRM02 - COMPOSITE	**16-JUN-2011**	**24-JUN-2011**	13-DEC-2011	✓	**24-JUN-2011**	13-DEC-2011	✓
ED040S : Soluble Sulfate by ICPAES								
Pulp Bag								
GRM03 - COMPOSITE, GRM05 - COMPOSITE, GRM07 - COMPOSITE, GRM09 - COMPOSITE, GRM11 - COMPOSITE, GRM13 - COMPOSITE, GRM15 - COMPOSITE, GRM17 - COMPOSITE, GRM19 - COMPOSITE, GRM21 - COMPOSITE, GRM23 - COMPOSITE, GRM25 - COMPOSITE, GRM27 - COMPOSITE, GRM29 - COMPOSITE, GRM31 - COMPOSITE, GRM33 - COMPOSITE,	GRM04 - COMPOSITE, GRM06 - COMPOSITE, GRM08 - COMPOSITE, GRM10 - COMPOSITE, GRM12 - COMPOSITE, GRM14 - COMPOSITE, GRM16 - COMPOSITE, GRM18 - COMPOSITE, GRM20 - COMPOSITE, GRM22 - COMPOSITE, GRM24 - COMPOSITE, GRM26 - COMPOSITE, GRM28 - COMPOSITE, GRM30 - COMPOSITE, GRM32 - COMPOSITE, GRM34 - COMPOSITE	**16-JUN-2011**	**23-JUN-2011**	23-JUN-2011	✓	**27-JUN-2011**	21-JUL-2011	✓
Pulp Bag								
GRM01 - COMPOSITE,	GRM02 - COMPOSITE	**16-JUN-2011**	**24-JUN-2011**	23-JUN-2011	×	**27-JUN-2011**	22-JUL-2011	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED045G: Chloride Discrete analyser								
Pulp Bag								
GRM03 - COMPOSITE,	GRM04 - COMPOSITE,	**16-JUN-2011**	**23-JUN-2011**	23-JUN-2011	✓	**27-JUN-2011**	21-JUL-2011	✓
GRM05 - COMPOSITE,	GRM06 - COMPOSITE,							
GRM07 - COMPOSITE,	GRM08 - COMPOSITE,							
GRM09 - COMPOSITE,	GRM10 - COMPOSITE,							
GRM11 - COMPOSITE,	GRM12 - COMPOSITE,							
GRM13 - COMPOSITE,	GRM14 - COMPOSITE,							
GRM15 - COMPOSITE,	GRM16 - COMPOSITE,							
GRM17 - COMPOSITE,	GRM18 - COMPOSITE,							
GRM19 - COMPOSITE,	GRM20 - COMPOSITE,							
GRM21 - COMPOSITE,	GRM22 - COMPOSITE,							
GRM23 - COMPOSITE,	GRM24 - COMPOSITE,							
GRM25 - COMPOSITE,	GRM26 - COMPOSITE,							
GRM27 - COMPOSITE,	GRM28 - COMPOSITE,							
GRM29 - COMPOSITE,	GRM30 - COMPOSITE,							
GRM31 - COMPOSITE,	GRM32 - COMPOSITE,							
GRM33 - COMPOSITE,	GRM34 - COMPOSITE							
Pulp Bag								
GRM01 - COMPOSITE,	GRM02 - COMPOSITE	**16-JUN-2011**	**24-JUN-2011**	23-JUN-2011	×	**27-JUN-2011**	22-JUL-2011	✓
ED093S: Soluble Major Cations								
Pulp Bag								
GRM03 - COMPOSITE,	GRM04 - COMPOSITE,	**16-JUN-2011**	**23-JUN-2011**	13-DEC-2011	✓	**27-JUN-2011**	13-DEC-2011	✓
GRM05 - COMPOSITE,	GRM06 - COMPOSITE,							
GRM07 - COMPOSITE,	GRM08 - COMPOSITE,							
GRM09 - COMPOSITE,	GRM10 - COMPOSITE,							
GRM11 - COMPOSITE,	GRM12 - COMPOSITE,							
GRM13 - COMPOSITE,	GRM14 - COMPOSITE,							
GRM15 - COMPOSITE,	GRM16 - COMPOSITE,							
GRM17 - COMPOSITE,	GRM18 - COMPOSITE,							
GRM19 - COMPOSITE,	GRM20 - COMPOSITE,							
GRM21 - COMPOSITE,	GRM22 - COMPOSITE,							
GRM23 - COMPOSITE,	GRM24 - COMPOSITE,							
GRM25 - COMPOSITE,	GRM26 - COMPOSITE,							
GRM27 - COMPOSITE,	GRM28 - COMPOSITE,							
GRM29 - COMPOSITE,	GRM30 - COMPOSITE,							
GRM31 - COMPOSITE,	GRM32 - COMPOSITE,							
GRM33 - COMPOSITE,	GRM34 - COMPOSITE							
Pulp Bag								
GRM01 - COMPOSITE,	GRM02 - COMPOSITE	**16-JUN-2011**	**24-JUN-2011**	13-DEC-2011	✓	**27-JUN-2011**	13-DEC-2011	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG005S : Soluble Metals by ICPAES								
Pulp Bag								
GRM03 - COMPOSITE,	GRM04 - COMPOSITE,	**16-JUN-2011**	**23-JUN-2011**	13-DEC-2011	✓	**27-JUN-2011**	13-DEC-2011	✓
GRM05 - COMPOSITE,	GRM06 - COMPOSITE,							
GRM07 - COMPOSITE,	GRM08 - COMPOSITE,							
GRM09 - COMPOSITE,	GRM10 - COMPOSITE,							
GRM11 - COMPOSITE,	GRM12 - COMPOSITE,							
GRM13 - COMPOSITE,	GRM14 - COMPOSITE,							
GRM15 - COMPOSITE,	GRM16 - COMPOSITE,							
GRM17 - COMPOSITE,	GRM18 - COMPOSITE,							
GRM19 - COMPOSITE,	GRM20 - COMPOSITE,							
GRM21 - COMPOSITE,	GRM22 - COMPOSITE,							
GRM23 - COMPOSITE,	GRM24 - COMPOSITE,							
GRM25 - COMPOSITE,	GRM26 - COMPOSITE,							
GRM27 - COMPOSITE,	GRM28 - COMPOSITE,							
GRM29 - COMPOSITE,	GRM30 - COMPOSITE,							
GRM31 - COMPOSITE,	GRM32 - COMPOSITE,							
GRM33 - COMPOSITE,	GRM34 - COMPOSITE							
Pulp Bag								
GRM01 - COMPOSITE,	GRM02 - COMPOSITE	**16-JUN-2011**	**24-JUN-2011**	13-DEC-2011	✓	**27-JUN-2011**	13-DEC-2011	✓
EG020S: Soluble Metals by ICPMS								
Pulp Bag								
GRM03 - COMPOSITE,	GRM04 - COMPOSITE,	**16-JUN-2011**	**23-JUN-2011**	13-DEC-2011	✓	**27-JUN-2011**	13-DEC-2011	✓
GRM05 - COMPOSITE,	GRM06 - COMPOSITE,							
GRM07 - COMPOSITE,	GRM08 - COMPOSITE,							
GRM09 - COMPOSITE,	GRM10 - COMPOSITE,							
GRM11 - COMPOSITE,	GRM12 - COMPOSITE,							
GRM13 - COMPOSITE,	GRM14 - COMPOSITE,							
GRM15 - COMPOSITE,	GRM16 - COMPOSITE,							
GRM17 - COMPOSITE,	GRM18 - COMPOSITE,							
GRM19 - COMPOSITE,	GRM20 - COMPOSITE,							
GRM21 - COMPOSITE,	GRM22 - COMPOSITE,							
GRM23 - COMPOSITE,	GRM24 - COMPOSITE,							
GRM25 - COMPOSITE,	GRM26 - COMPOSITE,							
GRM27 - COMPOSITE,	GRM28 - COMPOSITE,							
GRM29 - COMPOSITE,	GRM30 - COMPOSITE,							
GRM31 - COMPOSITE,	GRM32 - COMPOSITE,							
GRM33 - COMPOSITE,	GRM34 - COMPOSITE							
Pulp Bag								
GRM01 - COMPOSITE,	GRM02 - COMPOSITE	**16-JUN-2011**	**24-JUN-2011**	13-DEC-2011	✓	**27-JUN-2011**	13-DEC-2011	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG035S: Soluble Mercury by FIMS								
Pulp Bag								
GRM03 - COMPOSITE, GRM05 - COMPOSITE, GRM07 - COMPOSITE, GRM09 - COMPOSITE, GRM11 - COMPOSITE, GRM13 - COMPOSITE, GRM15 - COMPOSITE, GRM17 - COMPOSITE, GRM19 - COMPOSITE, GRM21 - COMPOSITE, GRM23 - COMPOSITE, GRM25 - COMPOSITE, GRM27 - COMPOSITE, GRM29 - COMPOSITE, GRM31 - COMPOSITE, GRM33 - COMPOSITE,	GRM04 - COMPOSITE, GRM06 - COMPOSITE, GRM08 - COMPOSITE, GRM10 - COMPOSITE, GRM12 - COMPOSITE, GRM14 - COMPOSITE, GRM16 - COMPOSITE, GRM18 - COMPOSITE, GRM20 - COMPOSITE, GRM22 - COMPOSITE, GRM24 - COMPOSITE, GRM26 - COMPOSITE, GRM28 - COMPOSITE, GRM30 - COMPOSITE, GRM32 - COMPOSITE, GRM34 - COMPOSITE	**16-JUN-2011**	**23-JUN-2011**	14-JUL-2011	✓	**27-JUN-2011**	14-JUL-2011	✓
Pulp Bag								
GRM01 - COMPOSITE,	GRM02 - COMPOSITE	**16-JUN-2011**	**24-JUN-2011**	14-JUL-2011	✓	**27-JUN-2011**	14-JUL-2011	✓
EP003: Total Organic Carbon (TOC) in Soil								
Pulp Bag								
43733_133.5m-134m_Floor, 43893_336m-336.38m_Floor	43893_186.96m-187.37m_Roof,	**11-MAY-2011**	**17-JUN-2011**	08-JUN-2011	×	**17-JUN-2011**	08-JUN-2011	×
EP003TC: Total Carbon (TC) in Soil								
Pulp Bag								
43733_133.5m-134m_Floor, 43893_336m-336.38m_Floor	43893_186.96m-187.37m_Roof,	**11-MAY-2011**	**17-JUN-2011**	07-NOV-2011	✓	**17-JUN-2011**	07-NOV-2011	✓
Pulp Bag								
GRM01 - COMPOSITE, GRM03 - COMPOSITE, GRM05 - COMPOSITE, GRM07 - COMPOSITE, GRM09 - COMPOSITE, GRM11 - COMPOSITE, GRM13 - COMPOSITE, GRM15 - COMPOSITE, GRM17 - COMPOSITE, GRM19 - COMPOSITE, GRM21 - COMPOSITE, GRM23 - COMPOSITE, GRM25 - COMPOSITE, GRM27 - COMPOSITE, GRM29 - COMPOSITE, GRM31 - COMPOSITE, GRM33 - COMPOSITE,	GRM02 - COMPOSITE, GRM04 - COMPOSITE, GRM06 - COMPOSITE, GRM08 - COMPOSITE, GRM10 - COMPOSITE, GRM12 - COMPOSITE, GRM14 - COMPOSITE, GRM16 - COMPOSITE, GRM18 - COMPOSITE, GRM20 - COMPOSITE, GRM22 - COMPOSITE, GRM24 - COMPOSITE, GRM26 - COMPOSITE, GRM28 - COMPOSITE, GRM30 - COMPOSITE, GRM32 - COMPOSITE, GRM34 - COMPOSITE	**16-JUN-2011**	**17-JUN-2011**	13-DEC-2011	✓	**17-JUN-2011**	13-DEC-2011	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity in Soil	ED037	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Cations - soluble by ICP-AES	ED093S	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride Soluble By Discrete Analyser	ED045G	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Exchangeable Cations	ED007	4	34	**11.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Net Acid Generation	EA011	8	65	**12.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Mercury by FIMS	EG035S	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICPAES	EG005S	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite X	EG020X-S	3	30	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite Y	EG020Y-S	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite Z	EG020Z-S	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Carbon	EP003TC	4	37	**10.8**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	1	3	**33.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Alkalinity in Soil	ED037	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride Soluble By Discrete Analyser	ED045G	6	42	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Exchangeable Cations	ED007	2	34	**5.9**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Net Acid Generation	EA011	5	65	**7.7**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Net Acid Generation (Extended Boil)	EA011E	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Mercury by FIMS	EG035S	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICPAES	EG005S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite X	EG020X-S	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite Y	EG020Y-S	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite Z	EG020Z-S	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Carbon	EP003TC	2	37	**5.4**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Alkalinity in Soil	ED037	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Cations - soluble by ICP-AES	ED093S	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride Soluble By Discrete Analyser	ED045G	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Exchangeable Cations	ED007	2	34	**5.9**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sodium Absorption Ratio (SAR)	EA006	2	34	**5.9**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Soluble Mercury by FIMS	EG035S	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICPAES	EG005S	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite X	EG020X-S	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite Y	EG020Y-S	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite Z	EG020Z-S	3	42	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Carbon	EP003TC	2	37	**5.4**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	1	3	**33.3**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Soluble Mercury by FIMS	EG035S	3	42	**7.1**	**5.0**	✓	ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	(APHA 21st ed., 4500H+) pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 103)
Sodium Absorption Ratio (SAR)	EA006	SOIL	USEPA 600/2 - 78 - 54. The concentration as meq of Ca, Mg and Na are determined on saturated soil by water leach. Results are used to calculate SAR.
Electrical Conductivity (1:5)	EA010	SOIL	(APHA 21st ed., 2510) Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 104)
Net Acid Generation	EA011	SOIL	Miller (1998) Titremetric procedure determines net acidity in a soil following peroxide oxidation. Titrations to both pH 4.5 and pH 7 are reported.
Net Acid Generation (Extended Boil)	EA011E	SOIL	Environmental Geochemistry International:Appendix F ¿Extended Boil Calculated Net Acid Generation (calculated NAG) Test Procedure for Coal Washery Wastes¿ ICP and Discrete Analyser procedure determines net acidity in a soil following peroxide oxidation.
Acid Buffering Characterisation Curves (ABCC's)	EA046	SOIL	Miller and Jeffery (1995) Determine the portion of an ANC value of a particular sample is readily available for acid neutralisation.
Exchangeable Cations	ED007	SOIL	Rayment & Higginson (1992) Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (1999) Schedule B(3) (Method 301)
Alkalinity in Soil	ED037	SOIL	APHA 21st ed., 2320 B Alkalinity is determined and reported on a 1:5 soil/water leach.
Major Anions - Soluble	ED040S	SOIL	In-house. Soluble Anions are determined off a 1:5 soil / water extract by ICPAES.
Chloride Soluble By Discrete Analyser	ED045G	SOIL	The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition 4500-Cl- E.
Cations - soluble by ICP-AES	ED093S	SOIL	APHA 21st ed., 3120; USEPA SW 846 - 6010 (ICPAES) Water extracts of the soil are analyzed for major cations by ICPAES. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (1999) Schedule B(3)
Soluble Metals by ICPAES	EG005S	SOIL	(APHA 21st ed., 3120; USEPA SW 846 - 6010) (ICPAES) Soluble metals are determined following an appropriate soil / water extraction of the soil. The ICPAES technique ionises samples in a plasma, emitting characteristic spectrums based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards.
Soluble Metals by ICP-MS - Suite X	EG020X-S	SOIL	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Soluble Metals by ICP-MS - Suite Y	EG020Y-S	SOIL	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
Soluble Metals by ICP-MS - Suite Z	EG020Z-S	SOIL	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Soluble Mercury by FIMS	EG035S	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the extract. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.
Total Organic Carbon	EP003	SOIL	In-house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automaticaly measured by infra-red detector.
Total Carbon	EP003TC	SOIL	In-house C-IR07. Dried and pulverised sample is combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved Carbon (as CO2) is measured by infra-red detector
Total Inorganic Carbon	EP003TIC	SOIL	In-house C-CAL15. Determined as the difference between Total Carbon and Organic Carbon.

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
SAR Prep	EA006PR	SOIL	USEPA 600/2. Soil is bought to saturation with distilled water by capiliary action.
Exchangeable Cations Preparation Method	ED007PR	SOIL	Rayment & Higginson (1992) method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
Sample Compositing	EN020	SOIL	Equal weights of each original soil are taken, then mixed and homogenised. The combined mixture is labelled as a new sample.
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Sample splitting	GEO31	SOIL	Sample aliquots are split for use in other departments, eg Minerals

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Duplicate (DUP) RPDs							
ED045G: Chloride Discrete analyser	EB1111539-001	Anonymous	**Chloride**	16887-00-6	21.5 %	----	**RPD exceeds DQO**
Laboratory Control Spike (LCS) Recoveries							
EA011-B: Dissolved Major Anions	2161183-004	----	**Chloride**	16887-00-6	Not Determined	----	**Standard recovery not determined, result less than LOR**
EA011-C: Dissolved Major Cations	2161183-004	----	**Calcium**	7440-70-2	Not Determined	----	**Standard recovery not determined, result less than LOR**
EA011-C: Dissolved Major Cations	2161183-004	----	**Magnesium**	7439-95-4	Not Determined	----	**Standard recovery not determined, result less than LOR**
EA011-C: Dissolved Major Cations	2161183-004	----	**Potassium**	7440-09-7	Not Determined	----	**Standard recovery not determined, result less than LOR**

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **SOIL**

Method	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)	*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EA002 : pH (Soils)						

Matrix: **SOIL**

Method		*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)		*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EA002 : pH (Soils) - Analysis Holding Time Compliance							
Pulp Bag							
GRM03 - COMPOSITE,	GRM04 - COMPOSITE,	----	----	----	27-JUN-2011	23-JUN-2011	**4**
GRM05 - COMPOSITE,	GRM06 - COMPOSITE,						
GRM07 - COMPOSITE,	GRM08 - COMPOSITE,						
GRM09 - COMPOSITE,	GRM10 - COMPOSITE,						
GRM11 - COMPOSITE,	GRM12 - COMPOSITE,						
GRM13 - COMPOSITE,	GRM14 - COMPOSITE,						
GRM15 - COMPOSITE,	GRM16 - COMPOSITE,						
GRM17 - COMPOSITE,	GRM18 - COMPOSITE,						
GRM19 - COMPOSITE,	GRM20 - COMPOSITE,						
GRM21 - COMPOSITE,	GRM22 - COMPOSITE,						
GRM23 - COMPOSITE,	GRM24 - COMPOSITE,						
GRM25 - COMPOSITE,	GRM26 - COMPOSITE,						
GRM27 - COMPOSITE,	GRM28 - COMPOSITE,						
GRM29 - COMPOSITE,	GRM30 - COMPOSITE,						
GRM31 - COMPOSITE,	GRM32 - COMPOSITE,						
GRM33 - COMPOSITE,	GRM34 - COMPOSITE						
Pulp Bag							
GRM01 - COMPOSITE,	GRM02 - COMPOSITE	24-JUN-2011	23-JUN-2011	**1**	----	----	----
EA010: Conductivity							
Pulp Bag							
GRM01 - COMPOSITE,	GRM02 - COMPOSITE	24-JUN-2011	23-JUN-2011	**1**	----	----	----
EA011-A: pH Ox							
Pulp Bag							
43733_133.5m-134m_Floor,	43893_186.96m-187.37m_Roof,	17-JUN-2011	11-MAY-2011	**37**	22-JUN-2011	11-MAY-2011	**42**
43893_336m-336.38m_Floor							
EA011-B: Dissolved Major Anions							
Pulp Bag							
43733_133.5m-134m_Floor,	43893_186.96m-187.37m_Roof,	17-JUN-2011	11-MAY-2011	**37**	22-JUN-2011	11-MAY-2011	**42**
43893_336m-336.38m_Floor							
EA011-C: Dissolved Major Cations							
Pulp Bag							
43733_133.5m-134m_Floor,	43893_186.96m-187.37m_Roof,	17-JUN-2011	11-MAY-2011	**37**	22-JUN-2011	11-MAY-2011	**42**
43893_336m-336.38m_Floor							
EA011-D: Calculated Components							
Pulp Bag							
43733_133.5m-134m_Floor,	43893_186.96m-187.37m_Roof,	17-JUN-2011	11-MAY-2011	**37**	22-JUN-2011	11-MAY-2011	**42**
43893_336m-336.38m_Floor							
ED040S : Soluble Sulfate by ICPAES							
Pulp Bag							
GRM01 - COMPOSITE,	GRM02 - COMPOSITE	24-JUN-2011	23-JUN-2011	**1**	----	----	----
ED045G: Chloride Discrete analyser							

Matrix: **SOIL**

Method Container / Client Sample ID(s)		Extraction / Preparation Date extracted	Due for extraction	Days overdue	Analysis Date analysed	Due for analysis	Days overdue
ED045G: Chloride Discrete analyser - Analysis Holding Time Compliance							
Pulp Bag GRM01 - COMPOSITE,	GRM02 - COMPOSITE	24-JUN-2011	23-JUN-2011	**1**	----	----	----
EP003: Total Organic Carbon (TOC) in Soil							
Pulp Bag 43733_133.5m-134m_Floor, 43893_336m-336.38m_Floor	43893_186.96m-187.37m_Roof,	17-JUN-2011	08-JUN-2011	**9**	17-JUN-2011	08-JUN-2011	**9**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **EB1111587**		
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	Page	: 1 of 6
Order number	: ----		
C-O-C number	: ----	Quote number	: EB2011URSQLD0327 (BN/060/11)
Site	: ----		
Sampler	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 14-JUN-2011	Issue Date	: 16-JUN-2011 14:06
Client Requested Due Date	: 28-JUN-2011	Scheduled Reporting Date	: **28-JUN-2011**

Delivery Details

Mode of Delivery	: Samples on hand	Temperature	: AMBIENT
No. of coolers/boxes	: REBATCH	No. of samples received	: 99
Security Seal	: Intact.	No. of samples analysed	: 99

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Requested Deliverables
- **Sample containers do not comply to pretreatment / preservation standards (AS, APHA, USEPA). Please refer to the Sample Container(s)/Preservation Non-Compliance Log at the end of this report for details.**
- **Sample(s) have been received within recommended holding times.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

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

Method *Client sample ID*	**Sample Container Received**	**Preferred Sample Container for Analysis**
EA006 : Sodium Absorption Ratio (SAR)		
GRM01 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM02 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM03 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM04 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM05 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM06 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM07 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM08 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM09 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM10 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM11 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM12 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM13 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM14 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM15 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM16 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM17 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM18 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM19 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM20 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM21 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM22 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM23 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM24 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM25 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM26 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM27 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM28 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM29 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM30 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM31 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM32 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM33 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRM34 COMPOSITE	- Pulp Bag	- Soil Glass Jar - Unpreserved

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
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.

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - EA002 pH (1:5)	SOIL - EA006 (solids) Sodium Absorption Ratio	SOIL - EA010 (solids): Electrical Conductivity (1:5) Electrical Conductivity (1:5)	SOIL - EA011 Net Acid Generation (NAG)	SOIL - EA011E Net Acid Generation (Extended Boil)	SOIL - EA046 Acid Buffering Characterisation Curve	SOIL - ED007 CEC / Exchangeable Cations (ED007)	SOIL - ED037 Alkalinity in Soil
EB1111587-001	11-MAY-2011 15:00	43723_209.5m-210m_OB				✓				
EB1111587-002	11-MAY-2011 15:00	43723_213.12m-213.98.				✓				
EB1111587-003	11-MAY-2011 15:00	43723_217.92m-218.3m.				✓				
EB1111587-004	11-MAY-2011 15:00	43723_260.57m-261.14.				✓		✓		
EB1111587-005	11-MAY-2011 15:00	43723_264.65m-265.15.				✓		✓		
EB1111587-006	11-MAY-2011 15:00	43723_372m-372.5m_IB				✓				
EB1111587-007	11-MAY-2011 15:00	43723_375m-375.48m_IB				✓				

			SOIL - EA002 pH (1:5)	SOIL - EA006 (solids) Sodium Absorption Ratio	SOIL - EA010 (solids): Electrical Conductivity (1:5) Electrical Conductivity (1:5)	SOIL - EA011 Net Acid Generation (NAG)	SOIL - EA011E Net Acid Generation (Extended Boil)	SOIL - EA046 Acid Buffering Characterisation Curve	SOIL - ED007 CEC / Exchangeable Cations (ED007)	SOIL - ED037 Alkalinity in Soil
EB1111587-008	11-MAY-2011 15:00	43723_377m-377.5m_IB				✓				
EB1111587-009	11-MAY-2011 15:00	43723_384m-384.5m_IB				✓				
EB1111587-010	11-MAY-2011 15:00	43723_400.2m-400.7m_.				✓		✓		
EB1111587-011	11-MAY-2011 15:00	43733_74m-74.5m_OB				✓				
EB1111587-012	11-MAY-2011 15:00	43733_121.1m-121.4m_.				✓				
EB1111587-013	11-MAY-2011 15:00	43733_124.35m-124.71.				✓				
EB1111587-014	11-MAY-2011 15:00	43733_127.02m-127.5m.				✓		✓		
EB1111587-015	11-MAY-2011 15:00	43733_128.79m-129.29.				✓				
EB1111587-016	11-MAY-2011 15:00	43733_133.5m-134m_Fl.				✓	✓			
EB1111587-017	11-MAY-2011 15:00	43733_135m-135.38m_IB				✓				
EB1111587-018	11-MAY-2011 15:00	43733_214.5m-215m_IB				✓				
EB1111587-019	11-MAY-2011 15:00	43733_219.5m-220.04m.				✓				
EB1111587-020	11-MAY-2011 15:00	43733_222.83m-223.38.				✓		✓		
EB1111587-021	11-MAY-2011 15:00	43733_235m-235.43m_IB				✓				
EB1111587-022	11-MAY-2011 15:00	43733_239.12m-239.5m.				✓				
EB1111587-023	11-MAY-2011 15:00	43733_241.5m-241.98m.				✓				
EB1111587-024	11-MAY-2011 15:00	43733_245.5m-246m_IB				✓				
EB1111587-025	11-MAY-2011 15:00	43733_256m-256.36m_IB				✓				
EB1111587-026	11-MAY-2011 15:00	43733_267.2m-267.75m.				✓				
EB1111587-027	11-MAY-2011 15:00	43733_279.66m-280m_F				✓				
EB1111587-028	11-MAY-2011 15:00	43750_264.51m-265m_O				✓				
EB1111587-029	11-MAY-2011 15:00	43750_273m-273.5m_OB				✓		✓		
EB1111587-030	11-MAY-2011 15:00	43750_282.2m-282.5m_.				✓				
EB1111587-031	11-MAY-2011 15:00	43750_284.5m-285m_IB				✓				
EB1111587-032	11-MAY-2011 15:00	43750_361m-361.5m_IB				✓		✓		
EB1111587-033	11-MAY-2011 15:00	43750_364.9m-365.24m.				✓		✓		
EB1111587-034	11-MAY-2011 15:00	43750_366.5m-366.95m.				✓				
EB1111587-035	11-MAY-2011 15:00	43750_368.69m-369.08.				✓				
EB1111587-036	11-MAY-2011 15:00	43750_378.5m-379m_Fl.				✓		✓		
EB1111587-037	11-MAY-2011 15:00	43750_383m-383.5m_IB				✓				
EB1111587-038	11-MAY-2011 15:00	43750_400m-400.5m_IB				✓				
EB1111587-039	11-MAY-2011 15:00	43750_404m-404.5m_IB				✓		✓		
EB1111587-040	11-MAY-2011 15:00	43750_408m-408.43_IB				✓		✓		
EB1111587-041	11-MAY-2011 15:00	43750_414.14m-414.47.				✓				
EB1111587-042	11-MAY-2011 15:00	43750_417m-417.34m_R				✓		✓		
EB1111587-043	11-MAY-2011 15:00	43765_228m-228.5m_OB				✓		✓		
EB1111587-044	11-MAY-2011 15:00	43765_241.5m-242m_IB				✓				
EB1111587-045	11-MAY-2011 15:00	43765_322.5m-323m_IB				✓				
EB1111587-046	11-MAY-2011 15:00	43765_324.6m-325.1m_.				✓				
EB1111587-047	11-MAY-2011 15:00	43765_337.6m-338.1m_.				✓				
EB1111587-048	11-MAY-2011 15:00	43765_385m-385.5m_IB				✓				

			SOIL - EA002 pH (1:5)	SOIL - EA006 (solids) Sodium Absorption Ratio	SOIL - EA010 (solids): Electrical Conductivity (1:5) Electrical Conductivity (1:5)	SOIL - EA011 Net Acid Generation (NAG)	SOIL - EA011E Net Acid Generation (Extended Boil)	SOIL - EA046 Acid Buffering Characterisation Curve	SOIL - ED007 CEC / Exchangeable Cations (ED007)	SOIL - ED037 Alkalinity in Soil
EB1111587-049	11-MAY-2011 15:00	43765_389.5m-390m_IB				✓		✓		
EB1111587-050	11-MAY-2011 15:00	43765_390.8m-391.36m.				✓		✓		
EB1111587-051	11-MAY-2011 15:00	43765_392.3m-392.63m.				✓				
EB1111587-052	11-MAY-2011 15:00	43893_177.5m-178m_OB				✓				
EB1111587-053	11-MAY-2011 15:00	43893_182m-182.5m_OB				✓				
EB1111587-054	11-MAY-2011 15:00	43893_186.96m-187.37.				✓	✓			
EB1111587-055	11-MAY-2011 15:00	43893_192.12m-192.62.				✓				
EB1111587-056	11-MAY-2011 15:00	43893_194m-194.5m_IB				✓				
EB1111587-057	11-MAY-2011 15:00	43893_299.46m-299.94.				✓				
EB1111587-058	11-MAY-2011 15:00	43893_307.57m-308.07.				✓				
EB1111587-059	11-MAY-2011 15:00	43893_312m-312.5m_IB				✓				
EB1111587-060	11-MAY-2011 15:00	43893_315.8m-316.3m_.				✓		✓		
EB1111587-061	11-MAY-2011 15:00	43893_322.8m-323.3m_.				✓				
EB1111587-062	11-MAY-2011 15:00	43893_324.46m-324.88.				✓		✓		
EB1111587-063	11-MAY-2011 15:00	43893_336m-336.38m_F				✓	✓	✓		
EB1111587-064	11-MAY-2011 15:00	438.93_357.09m-357.5..				✓				
EB1111587-065	11-MAY-2011 15:00	43893_363.61m-364.11.				✓				
EB1111587-066	16-JUN-2011 15:00	GRM01 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-067	16-JUN-2011 15:00	GRM02 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-068	16-JUN-2011 15:00	GRM03 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-069	16-JUN-2011 15:00	GRM04 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-070	16-JUN-2011 15:00	GRM05 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-071	16-JUN-2011 15:00	GRM06 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-072	16-JUN-2011 15:00	GRM07 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-073	16-JUN-2011 15:00	GRM08 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-074	16-JUN-2011 15:00	GRM09 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-075	16-JUN-2011 15:00	GRM10 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-076	16-JUN-2011 15:00	GRM11 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-077	16-JUN-2011 15:00	GRM12 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-078	16-JUN-2011 15:00	GRM13 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-079	16-JUN-2011 15:00	GRM14 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-080	16-JUN-2011 15:00	GRM15 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-081	16-JUN-2011 15:00	GRM16 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-082	16-JUN-2011 15:00	GRM17 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-083	16-JUN-2011 15:00	GRM18 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-084	16-JUN-2011 15:00	GRM19 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-085	16-JUN-2011 15:00	GRM20 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-086	16-JUN-2011 15:00	GRM21 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-087	16-JUN-2011 15:00	GRM22 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-088	16-JUN-2011 15:00	GRM23 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-089	16-JUN-2011 15:00	GRM24 COMPOSITE	✓	✓	✓				✓	✓

			SOIL - EA002 pH (1:5)	SOIL - EA006 (solids) Sodium Absorption Ratio	SOIL - EA010 (solids): Electrical Conductivity (1:5) Electrical Conductivity (1:5)	SOIL - EA011 Net Acid Generation (NAG)	SOIL - EA011E Net Acid Generation (Extended Boil)	SOIL - EA046 Acid Buffering Characterisation Curve	SOIL - ED007 CEC / Exchangeable Cations (ED007)	SOIL - ED037 Alkalinity in Soil
EB1111587-090	16-JUN-2011 15:00	GRM25 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-091	16-JUN-2011 15:00	GRM26 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-092	16-JUN-2011 15:00	GRM27 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-093	16-JUN-2011 15:00	GRM28 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-094	16-JUN-2011 15:00	GRM29 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-095	16-JUN-2011 15:00	GRM30 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-096	16-JUN-2011 15:00	GRM31 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-097	16-JUN-2011 15:00	GRM32 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-098	16-JUN-2011 15:00	GRM33 COMPOSITE	✓	✓	✓				✓	✓
EB1111587-099	16-JUN-2011 15:00	GRM34 COMPOSITE	✓	✓	✓				✓	✓

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - ED040S Soluble Major Anions	SOIL - ED045G (solids) Chloride Soluble by Discrete Analyser	SOIL - ED093S Cations - Soluble	SOIL - EG005S Soluble Metals by ICPAES	SOIL - EG020S Soluble Metals by ICPMS	SOIL - EG035S Soluble Mercury by FIMS	SOIL - EP003TC Total Carbon in Soil	SOIL - EP003TIC Total Inorganic Carbon in Soil
EB1111587-016	11-MAY-2011 15:00	43733_133.5m-134m_Fl.								✓
EB1111587-054	11-MAY-2011 15:00	43893_186.96m-187.37.								✓
EB1111587-063	11-MAY-2011 15:00	43893_336m-336.38m_F								✓
EB1111587-066	16-JUN-2011 15:00	GRM01 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-067	16-JUN-2011 15:00	GRM02 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-068	16-JUN-2011 15:00	GRM03 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-069	16-JUN-2011 15:00	GRM04 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-070	16-JUN-2011 15:00	GRM05 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-071	16-JUN-2011 15:00	GRM06 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-072	16-JUN-2011 15:00	GRM07 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-073	16-JUN-2011 15:00	GRM08 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-074	16-JUN-2011 15:00	GRM09 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-075	16-JUN-2011 15:00	GRM10 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-076	16-JUN-2011 15:00	GRM11 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-077	16-JUN-2011 15:00	GRM12 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-078	16-JUN-2011 15:00	GRM13 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-079	16-JUN-2011 15:00	GRM14 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-080	16-JUN-2011 15:00	GRM15 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-081	16-JUN-2011 15:00	GRM16 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-082	16-JUN-2011 15:00	GRM17 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	

			SOIL - ED040S Soluble Major Anions	SOIL - ED045G (solids) Chloride Soluble by Discrete Analyser	SOIL - ED093S Cations - Soluble	SOIL - EG005S Soluble Metals by ICPAES	SOIL - EG020S Soluble Metals by ICPMS	SOIL - EG035S Soluble Mercury by FIMS	SOIL - EP003TC Total Carbon in Soil	SOIL - EP003TIC Total Inorganic Carbon in Soil
EB1111587-083	16-JUN-2011 15:00	GRM18 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-084	16-JUN-2011 15:00	GRM19 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-085	16-JUN-2011 15:00	GRM20 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-086	16-JUN-2011 15:00	GRM21 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-087	16-JUN-2011 15:00	GRM22 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-088	16-JUN-2011 15:00	GRM23 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-089	16-JUN-2011 15:00	GRM24 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-090	16-JUN-2011 15:00	GRM25 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-091	16-JUN-2011 15:00	GRM26 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-092	16-JUN-2011 15:00	GRM27 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-093	16-JUN-2011 15:00	GRM28 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-094	16-JUN-2011 15:00	GRM29 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-095	16-JUN-2011 15:00	GRM30 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-096	16-JUN-2011 15:00	GRM31 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-097	16-JUN-2011 15:00	GRM32 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-098	16-JUN-2011 15:00	GRM33 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	
EB1111587-099	16-JUN-2011 15:00	GRM34 COMPOSITE	✓	✓	✓	✓	✓	✓	✓	

Requested Deliverables

DR TONY JONG

- *AU Certificate of Analysis - NATA (COA)	Email	tony_jong@urscorp.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	tony_jong@urscorp.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	tony_jong@urscorp.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	tony_jong@urscorp.com
- Attachment - Report (SUBCO)	Email	tony_jong@urscorp.com
- Chain of Custody (CoC) (COC)	Email	tony_jong@urscorp.com
- EDI Format - MRED (MRED)	Email	tony_jong@urscorp.com
- EDI Format - XTab (XTAB)	Email	tony_jong@urscorp.com

MR LAWRIE DUCK

- *AU Certificate of Analysis - NATA (COA)	Email	lawrie_duck@urscorp.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	lawrie_duck@urscorp.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	lawrie_duck@urscorp.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	lawrie_duck@urscorp.com
- Attachment - Report (SUBCO)	Email	lawrie_duck@urscorp.com
- Chain of Custody (CoC) (COC)	Email	lawrie_duck@urscorp.com
- EDI Format - MRED (MRED)	Email	lawrie_duck@urscorp.com
- EDI Format - XTab (XTAB)	Email	lawrie_duck@urscorp.com

THE ACCOUNTS BRISBANE

- A4 - AU Tax Invoice (INV)	Email	brisbane_accounts@urscorp.com

Appendix C ALS Laboratory Reports—Coarse Rejects

Australian Laboratory Services Pty. Ltd.
32 Shand Street
Stafford
Brisbane QLD 4053
Phone: +61 (7) 3243 7222 Fax: +61 (7) 3243 7218
www.alsglobal.com

Finalized Date: 15-JUL-2011
Account: URSAUS

CERTIFICATE BR11128235

Project: ME-MS61
P.O. No.: EN/001/10
This report is for 8 Pulp samples submitted to our lab in Brisbane, QLD, Australia on 11-JUL-2011.
The following have access to data associated with this certificate:

LAWRIE DUCK	TONY JONG	

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
LEV-01	Waste Disposal Levy
LOG-22	Sample login - Rcd w/o BarCode
ASH-01	Ashing of carbons/soils

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
C-IR07	Total Carbon (Leco)	LECO
ME-MS42	Up to 34 elements by ICP-MS	ICP-MS
ME-MS61	48 element four acid ICP-MS	

To: **URS AUSTRALIA PTY LTD**
ATTN: LAWRIE DUCK
LEVEL 14
240 QUEEN STREET
BRISBANE QLD 4000

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Signature:

Shaun Kenny, Brisbane Laboratory Manager

ALS Minerals

Australian Laboratory Services Pty. Ltd.
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Phone: +61 (7) 3243 7222 Fax: +61 (7) 3243 7218
www.alsglobal.com

Finalized Date: 15-JUL-2011
Account: URSAUS

Project: ME-MS61

CERTIFICATE OF ANALYSIS BR11128235

Sample Description	Method / Analyte / Units / LOR	ME-MS42 Hg ppm 0.005	ME-MS61 Ag ppm 0.01	ME-MS61 Al % 0.01	ME-MS61 As ppm 0.2	ME-MS61 Ba ppm 10	ME-MS61 Be ppm 0.05	ME-MS61 Bi ppm 0.01	ME-MS61 Ca % 0.01	ME-MS61 Cd ppm 0.02	ME-MS61 Ce ppm 0.01	ME-MS61 Co ppm 0.1	ME-MS61 Cr ppm 1	ME-MS61 Cs ppm 0.05	ME-MS61 Cu ppm 0.2	ME-MS61 Fe % 0.01
GRM_CR_01 Rejects May 2011		0.091	0.08	5.88	3.7	560	1.49	0.34	0.10	0.14	10.40	4.6	28	1.96	41.8	1.91
GRM_CR_02 Rejects Dec 2009		0.100	0.08	5.81	4.1	830	1.65	0.37	0.07	0.15	13.75	3.7	15	3.54	41.6	1.32
GRM_CR_03 Rejects May 2009		0.102	0.09	5.16	5.2	450	1.50	0.27	0.17	0.14	8.97	3.9	17	2.61	37.7	4.43
GRM_CR_04 Rejects 2003		0.075	0.06	4.50	2.2	160	1.41	0.29	0.03	0.11	10.50	6.9	9	2.78	31.2	0.53
GS001R_GY Rejects 2008		0.163	0.09	7.48	4.5	330	1.75	0.47	0.08	0.11	10.10	3.2	16	2.87	40.4	1.26
GS002R_GY Rejects May 2011		0.078	0.07	7.40	2.6	2130	1.28	0.39	0.42	0.07	20.8	4.5	26	2.30	25.2	2.73
GS003R_GY Rejects Mid 2010		0.136	0.12	6.64	4.0	1410	1.96	0.27	0.26	0.34	8.33	2.6	13	3.29	145.0	1.29
GS004R_GY Rejects Mid 2006		0.153	0.09	6.93	5.2	1080	1.69	0.45	0.09	0.18	11.20	4.4	18	3.10	38.5	1.22

***** See Appendix Page for comments regarding this certificate *****

ALS Minerals

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www.alsglobal.com

Project: ME-MS61

Finalized Date: 15-JUL-2011
Account: URSAUS

CERTIFICATE OF ANALYSIS BR11128235

Sample Description	Method / Analyte / Units / LOR	ME-MS61 Ga ppm 0.05	ME-MS61 Ge ppm 0.05	ME-MS61 Hf ppm 0.1	ME-MS61 In ppm 0.005	ME-MS61 K % 0.01	ME-MS61 La ppm 0.5	ME-MS61 Li ppm 0.2	ME-MS61 Mg % 0.01	ME-MS61 Mn ppm 5	ME-MS61 Mo ppm 0.05	ME-MS61 Na % 0.01	ME-MS61 Nb ppm 0.1	ME-MS61 Ni ppm 0.2	ME-MS61 P ppm 10	ME-MS61 Pb ppm 0.5
GRM_CR_01 Rejects May 2011		21.5	0.11	2.5	0.079	0.54	3.8	74.0	0.11	267	2.64	0.08	8.0	12.9	280	16.7
GRM_CR_02 Rejects Dec 2009		20.3	0.09	2.7	0.080	0.72	5.5	61.6	0.13	227	2.01	0.12	8.1	9.7	220	17.6
GRM_CR_03 Rejects May 2009		20.2	0.29	2.3	0.064	0.67	3.5	60.1	0.20	1015	1.92	0.08	6.0	13.8	340	13.5
GRM_CR_04 Rejects 2003		16.55	0.10	2.8	0.070	0.55	4.1	50.5	0.07	79	1.52	0.06	6.2	10.7	100	15.2
GS001R_GY Rejects 2008		27.5	0.08	2.7	0.068	0.66	3.7	74.1	0.11	187	2.67	0.06	9.2	8.4	190	17.2
GS002R_GY Rejects May 2011		19.95	0.13	2.2	0.062	0.65	8.2	66.8	0.38	452	1.32	0.35	6.0	12.0	1230	15.0
GS003R_GY Rejects Mid 2010		27.2	0.19	2.4	0.081	0.83	3.1	84.0	0.13	240	2.95	0.06	6.8	7.2	910	16.2
GS004R_GY Rejects Mid 2006		22.8	0.09	2.9	0.091	0.73	4.1	81.9	0.13	183	3.07	0.08	7.3	13.2	220	25.3

***** See Appendix Page for comments regarding this certificate *****

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www.alsglobal.com

Project: ME-MS61

Finalized Date: 15-JUL-2011
Account: URSAUS

CERTIFICATE OF ANALYSIS BR11128235

Sample Description	Method / Analyte / Units / LOR	ME-MS61 Rb ppm 0.1	ME-MS61 Re ppm 0.002	ME-MS61 S % 0.01	ME-MS61 Sb ppm 0.05	ME-MS61 Sc ppm 0.1	ME-MS61 Se ppm 1	ME-MS61 Sn ppm 0.2	ME-MS61 Sr ppm 0.2	ME-MS61 Ta ppm 0.05	ME-MS61 Te ppm 0.05	ME-MS61 Th ppm 0.2	ME-MS61 Ti % 0.005	ME-MS61 Tl ppm 0.02	ME-MS61 U ppm 0.1	ME-MS61 V ppm 1
GRM_CR_01 Rejects May 2011		16.6	0.002	0.10	0.58	7.0	1	2.2	77.9	0.60	0.12	3.1	0.477	0.32	2.4	71
GRM_CR_02 Rejects Dec 2009		26.3	<0.002	0.08	0.56	6.9	1	2.7	87.5	0.77	0.14	3.5	0.451	0.41	2.7	67
GRM_CR_03 Rejects May 2009		17.2	<0.002	0.28	0.50	5.5	1	2.0	95.6	0.53	0.14	2.4	0.352	0.37	2.2	67
GRM_CR_04 Rejects 2003		20.9	<0.002	0.02	0.47	5.4	1	2.2	41.7	0.55	0.10	3.3	0.334	0.31	2.2	66
GS001R_GY Rejects 2008		20.0	<0.002	0.04	0.71	7.1	1	3.2	87.8	0.87	0.12	5.1	0.501	0.41	3.2	69
GS002R_GY Rejects May 2011		20.5	<0.002	0.43	0.37	9.8	1	1.8	147.0	0.52	0.13	4.3	0.356	0.32	2.1	76
GS003R_GY Rejects Mid 2010		22.8	<0.002	0.11	0.89	7.2	1	2.1	104.5	0.54	0.19	2.3	0.636	0.60	2.3	77
GS004R_GY Rejects Mid 2006		25.9	<0.002	0.09	0.58	7.2	1	3.1	106.5	0.67	0.16	4.7	0.370	0.43	2.5	66

***** See Appendix Page for comments regarding this certificate *****

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www.alsglobal.com

ALS Minerals

Finalized Date: 15-JUL-2011
Account: URSAUS

Project: ME-MS61

CERTIFICATE OF ANALYSIS BR11128235

Sample Description	Method	ME-MS61	ME-MS61	ME-MS61	ME-MS61	C-IR07
	Analyte	W	Y	Zn	Zr	C
	Units	ppm	ppm	ppm	ppm	%
	LOR	0.1	0.1	2	0.5	0.01
GRM_CR_01 Rejects May 2011		1.4	5.5	50	84.5	27.2
GRM_CR_02 Rejects Dec 2009		1.5	7.6	52	88.1	25.7
GRM_CR_03 Rejects May 2009		1.1	5.2	48	69.7	21.8
GRM_CR_04 Rejects 2003		1.3	6.0	34	86.4	33.9
GS001R_GY Rejects 2008		1.6	4.7	40	70.5	16.40
GS002R_GY Rejects May 2011		1.2	14.8	34	74.7	16.50
GS003R_GY Rejects Mid 2010		1.7	6.3	68	68.3	12.00
GS004R_GY Rejects Mid 2006		1.3	6.7	52	86.9	24.6

***** See Appendix Page for comments regarding this certificate *****

Australian Laboratory Services Pty. Ltd.
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Finalized Date: 15-JUL-2011
Account: URSAUS

Project: ME-MS61

CERTIFICATE OF ANALYSIS BR11128235

Method	CERTIFICATE COMMENTS
ME-MS61	REE's may not be totally soluble in this method.

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Finalized Date: 15-JUL-2011
Account: URSAUS

QC CERTIFICATE BR11128235

Project: ME-MS61
P.O. No.: EN/001/10
This report is for 8 Pulp samples submitted to our lab in Brisbane, QLD, Australia on 11-JUL-2011.
The following have access to data associated with this certificate:

LAWRIE DUCK	TONY JONG	

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
LEV-01	Waste Disposal Levy
LOG-22	Sample login - Rcd w/o BarCode
ASH-01	Ashing of carbons/soils

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
C-IR07	Total Carbon (Leco)	LECO
ME-MS42	Up to 34 elements by ICP-MS	ICP-MS
ME-MS61	48 element four acid ICP-MS	

To: **URS AUSTRALIA PTY LTD**
ATTN: LAWRIE DUCK
LEVEL 14
240 QUEEN STREET
BRISBANE QLD 4000

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Signature:

Shaun Kenny, Brisbane Laboratory Manager

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Finalized Date: 15-JUL-2011
Account: URSAUS

Project: ME-MS61

QC CERTIFICATE OF ANALYSIS BR11128235

Sample Description / Method / Analyte / Units / LOR	ME-MS42 / Hg / ppm / 0.005
STANDARDS	
GBM908-10	0.020
Target Range - Lower Bound	0.009
Upper Bound	0.025
MRGeo08	0.069
Target Range - Lower Bound	0.055
Upper Bound	0.086
BLANKS	
BLANK	<0.005
Target Range - Lower Bound	<0.005
Upper Bound	0.010
DUPLICATES	
GS004R_GY Rejects Mid 2006	0.153
DUP	0.157
Target Range - Lower Bound	0.138
Upper Bound	0.172

***** See Appendix Page for comments regarding this certificate *****

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www.alsglobal.com

Finalized Date: 15-JUL-2011
Account: URSAUS

Project: ME-MS61

QC CERTIFICATE OF ANALYSIS BR11128235

Method	CERTIFICATE COMMENTS
ME-MS61	REE's may not be totally soluble in this method.

Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY			
Job Code:			
Due Date:			
Comments:			
Custody seal intact?	YES	NO	N/A
Sample cold?	YES	NO	N/A

FROM: Tony Jong
Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED:
Rapid turn-around

Project Name:	GRM_EIS
Project No:	42626689
Project Manager:	Kim Bidle
Agreement No.:	EN/001/10
Quote No.:	BN/060/11

Sampler Name:
Samples at ALS - previously analysed as EB1110488
Sampler Contact:

Released by:
Lawrie Duck
Date: 14/06/2011 **Time:** 17:00

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

	Container Identification											NOTES
Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	
Preservative Code	none	none	none	none	none	none	none	none	none	none	none	
Analytes	EA011 - Nett Acid Generation (NAG)	EA011E - Modified NAG with Extended Boil	Carbon (EP005, EP006, EP007)	EA046 - Acid Buffering Characteristic Curves (ABCC)	CEC (ED007)	Exchangeable (Ca, Mg, Na, K) (ED007)	ESP (ED007)	Four Acid 'Near Total' Digest with ICPAES/ICPMS finish (ME-MS61)	Mercury (ME-MS42)	1:5 Leach (EN34)	Analysis of 1:5 Leach (as per Page 2_1:5 Leach)	

Analysis as per ALS Quotation BN/060/11 - Phase 2: Part A and Part B (1) - Solids Analysis (NO COMPOSITES)

Laboratory ID	ALS Code ID	Northing (m)	Easting (m))	Sample ID	Matrix	Type	Lithology	No of bags		EA011	EA011E	Carbon	EA046	CEC	Exchangeable	ESP	Four Acid	Mercury	1:5 Leach	Analysis of 1:5 Leach	NOTES
	EB1110488-001	7594997.00	596847.00	GRM_CR_01_RV Rejects May 2011	Solid	Coal reject	Coal			X	X	X		X	X	X	X	X	X	X	
	EB1110488-002	7594382.00	597485.00	GRM_CR_02_RV Rejects Dec 2009	Solid	Coal reject	Coal			X	X	X		X	X	X	X	X	X	X	
	EB1110488-003	7593948.00	597075.00	GRM_CR_03_RV Rejects May 2009	Solid	Coal reject	Coal			X	X	X	X	X	X	X	X	X	X	X	
	EB1110488-004	7594108.00	596969.00	GRM_CR_04_RV Rejects 2003	Solid	Coal reject	Coal			X	X	X		X	X	X	X	X	X	X	
	EB1110488-005	7589920.00	599597.00	GS001R_GY Rejects 2008	Solid	Coal reject	Coal			X	X	X		X	X	X	X	X	X	X	
	EB1110488-006	7589479.00	599902.00	GS002R_GY Rejects May 2011	Solid	Coal reject	Coal			X	X	X	X	X	X	X	X	X	X	X	
	EB1110488-007	7589970.00	599875.00	GS003R_GY Rejects Mid 2010	Solid	Coal reject	Coal			X	X	X		X	X	X	X	X	X	X	
	EB1110488-008	7589755.00	599963.00	GS004R_GY Rejects Mid 2006	Solid	Coal reject	Coal			X	X	X		X	X	X	X	X	X	X	
Remarks to Lab:	**Analysis as per ALS Quotation BN/060/11 - Phase 2: Part A and Part B (1) - Solids Analysis (NO COMPOSITES)**						**TOTAL number of bags**	0	**TOTAL number of each analyte**	8	8	8	2	8	8	8	8	8	8	8	

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

Email Results to: tony_jong@urscorp.com lawrie_duck@urscorp.com

NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES. GLOVES SHOULD BE WORN WHILST HANDLING SAMPLES.

Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY	
Job Code:	
Due Date:	
Comments:	
Custody seal intact?	YES NO N/A
Sample cold?	YES NO N/A

FROM: Tony Jong
Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED:
Rapid turn-around

Project Name: GRM_EIS
Project No: 42626689
Project Manager: Kim Bidle
Agreement No.: EN/001/10
Quote No.: BN/060/11

Sampler Name:
Samples to be produced as per Page 1 of this COC
Sampler Contact:

Released by:
Date: **Time:**

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

Container Identification

	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11
Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB
Preservative Code	none	none	none	none	none	none	none	none	none	none	none
Analytes	Soluble Metals by ICP-MS (Ag, Al, As, Cd, Co, Cr, Cu, Pb, Ni, Mn, Mo, Sb, Se, U, V, Zn) (EG020S)	Soluble Metals by ICP-AES (B, Fe) (EG005S)	Soluble Mercury (Hg) by FIMS (EG035S)	pH (1:5) (EA002)	EC (1:5) (EA010)	Soluble Cations by ICP-AES (Ca, Mg, Na, K) (ED093S)	Soluble Chloride (ED045G)	Soluble Sulfate (ED040S)	Alkalinity (ED037)	Sodium Adsorption Ratio (SAR) (EA006)	

NOTES

Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B (2) - Analysis of 1:5 Leach

Laboratory ID	ALS Code ID	Northing (m)	Easting (m))	Sample ID	Matrix	Type	Lithology	No of bottles	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	NOTES
	EB1110488-001	7594997.00	596847.00	GRM_CR_01_RV Rejects May 2011	Liquid (1:5 Leach)	Coal reject	Coal		X	X	X	X	X	X	X	X	X	X		
	EB1110488-002	7594382.00	597485.00	GRM_CR_02_RV Rejects Dec 2009	Liquid (1:5 Leach)	Coal reject	Coal		X	X	X	X	X	X	X	X	X	X		
	EB1110488-003	7593948.00	597075.00	GRM_CR_03_RV Rejects May 2009	Liquid (1:5 Leach)	Coal reject	Coal		X	X	X	X	X	X	X	X	X	X		
	EB1110488-004	7594108.00	596969.00	GRM_CR_04_RV Rejects 2003	Liquid (1:5 Leach)	Coal reject	Coal		X	X	X	X	X	X	X	X	X	X		
	EB1110488-005	7589920.00	599597.00	GS001R_GY Rejects 2008	Liquid (1:5 Leach)	Coal reject	Coal		X	X	X	X	X	X	X	X	X	X		
	EB1110488-006	7589479.00	599902.00	GS002R_GY Rejects May 2011	Liquid (1:5 Leach)	Coal reject	Coal		X	X	X	X	X	X	X	X	X	X		
	EB1110488-007	7589970.00	599875.00	GS003R_GY Rejects Mid 2010	Liquid (1:5 Leach)	Coal reject	Coal		X	X	X	X	X	X	X	X	X	X		
	EB1110488-008	7589755.00	599963.00	GS004R_GY Rejects Mid 2006	Liquid (1:5 Leach)	Coal reject	Coal		X	X	X	X	X	X	X	X	X	X		
Remarks to Lab:	Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B (2) - Analysis of 1:5 Leach						TOTAL number of bottles	0	8	8	8	8	8	8	8	8	8	8		

(TOTAL number of each analyte: 8 in each of the first ten analyte columns)

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

Email Results to: tony_jong@urscorp.com lawrie_duck@urscorp.com

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Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY	
Job Code:	
Due Date:	
Comments:	
Custody seal intact?	YES NO N/A
Sample cold?	YES NO N/A

FROM: Tony Jong
URS Australia: Level 16, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED: Turn-around-time = 2 weeks

Project Name:	GRM_EIS
Project No:	42626689
Project Manager:	Kim Bidle
Agreement No.:	EN/001/10
Quote No.:	BN/060/11

Sampler Name:
Sampler Contact:

Released by:
Date: **Time:**

Received for Laboratory by: J. PALLAZZI ALS
Date: 26/5/11 **Time:** 16:00

Container Type, Preservative and Analysis

Container Identification							
Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB
Preservative Code	none	none	none	none	none	none	none
Analytes	Sample Preparation - refer attached Sample Split & Preparation Spreadsheet	pH and EC (1:5)	NAPP	Chromium Reducible Sulfur (CRS)			

Laboratory ID	ALS Code	Sample ID	Northing (m)	Easting (m)	Description (estimated deposition time/period, etc)	Matrix	Coal Reject Location/Name (Bin/Dump/etc)	# Bags		Sample Preparation	pH and EC (1:5)	NAPP	CRS				NOTES
	1	GRM_CR_01	7594997.00	596847.00	RV Rejects May 2011	Solid				X	X	X	X				
	2	GRM_CR_02	7594382.00	597485.00	RV Rejects Dec 2009	Solid				X	X	X	X				
	3	GRM_CR_03	7593948.00	597075.00	RV Rejects May 2009	Solid				X	X	X	X				
	4	GRM_CR_04	7594108.00	596969.00	RV Rejects 2003	Solid				X	X	X	X				
						Solid											
	5	GS001R	7589920.00	599597.00	GY Rejects 2008	Solid	R21 Reject Dump	1									
	6	GS002R	7589479.00	599902.00	GY Rejects May 2011	Solid	R21 Reject Dump	1									
	7	GS003R	7589970.00	599875.00	GY Rejects Mid 2010	Solid	R21 Reject Dump	1									
	8	GS004R	7589755.00	599963.00	GY Rejects Mid 2006	Solid	R21 Reject Dump	1									
						Solid											
						Solid											
						Solid											
						Solid											
						Solid											
						Solid											
						Solid											
						Solid											
Remarks to Lab:	Sample preparation as per attached Sample Split & Preparation Spreadsheet						TOTAL number of Samples	4	TOTAL number of each analyte	4	4	4	4	0	0	0	

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

Email Results to: tony_jong@urscorp.com lawrie_duck@urscorp.com

NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES. GLOVES SHOULD BE WORN WHILST HANDLING SAMPLES.

Environmental Division
Brisbane
Work Order
EB1110488
KC

Telephone : + 61-7-3243 7222

CERTIFICATE OF ANALYSIS

Work Order	: **EB1110488**	Page	: 1 of 4
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 26-MAY-2011
Sampler	: ----	Issue Date	: 09-JUN-2011
Site	: ----		
		No. of samples received	: 8
Quote number	: BN/060/11	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
WORLD RECOGNISED ACCREDITATION

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
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Inorganics
Myles.Clark	Acid Sulfate Soils Supervisor	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.**

Analytical Results

Sub-Matrix: SOLID			Client sample ID	GRM_CR_01 RV Rejects May 2011	GRM_CR_02 RV Rejects Dec 2009	GRM_CR_03 RV Rejects May 2009	GRM_CR_04 RV Rejects 2003	GS001R GY Rejects 2008
			Client sampling date / time	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00
Compound	CAS Number	LOR	Unit	EB1110488-001	EB1110488-002	EB1110488-003	EB1110488-004	EB1110488-005
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.9	8.5	8.5	6.7	8.6
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	8.5	5.6	-3.2	5.8	5.2
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	320	293	138	307	212
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	3.3	6.3	11.6	2.6	3.7
^ ANC as CaCO3	----	0.1	% CaCO3	0.3	0.6	1.2	0.3	0.4
Fizz Rating	----	0	Fizz Unit	0	0	0	0	0
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.167	0.189	0.129	0.070	0.130
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.39	0.39	0.28	0.27	0.29

Analytical Results

Sub-Matrix: SOLID		Client sample ID		GS002R GY Rejects May 2011	GS003R GY Rejects Mid 2010	GS004R GY Rejects Mid 2006	----	----
		Client sampling date / time		26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	----	----
Compound	CAS Number	LOR	Unit	EB1110488-006	EB1110488-007	EB1110488-008	----	----
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	9.4	7.6	7.2	----	----
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	-8.2	<0.5	14.0	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	145	288	173	----	----
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	15.6	9.1	4.5	----	----
^ ANC as CaCO3	----	0.1	% CaCO3	1.6	0.9	0.4	----	----
Fizz Rating	----	0	Fizz Unit	0	0	0	----	----
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.098	0.229	0.409	----	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.24	0.30	0.60	----	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **EB1110488**	Page	: 1 of 5
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 26-MAY-2011
Sampler	: ----	Issue Date	: 09-JUN-2011
Order number	: ----		
		No. of samples received	: 8
Quote number	: BN/060/11	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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA
WORLD RECOGNISED ACCREDITATION

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
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Inorganics
Myles.Clark	Acid Sulfate Soils Supervisor	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.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
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
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA002 : pH (Soils) (QC Lot: 1811417)									
EB1110488-001	GRM_CR_01 RV Rejects May 2011	EA002: pH Value	----	0.1	pH Unit	7.9	8.0	0.0	0% - 20%
EB1110489-007	Anonymous	EA002: pH Value	----	0.1	pH Unit	8.8	8.9	0.0	0% - 20%
EA002 : pH (Soils) (QC Lot: 1816231)									
EB1110488-007	GS003R GY Rejects Mid 2010	EA002: pH Value	----	0.1	pH Unit	7.6	7.8	1.8	0% - 20%
EA010: Conductivity (QC Lot: 1811418)									
EB1110488-001	GRM_CR_01 RV Rejects May 2011	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	320	331	3.4	0% - 20%
EB1110489-007	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	711	704	1.0	0% - 20%
EA010: Conductivity (QC Lot: 1816232)									
EB1110488-007	GS003R GY Rejects Mid 2010	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	288	274	5.0	0% - 20%
EA013: Acid Neutralising Capacity (QC Lot: 1812464)									
EB1110488-001	GRM_CR_01 RV Rejects May 2011	EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	3.3	3.1	7.4	No Limit
EB1110489-008	Anonymous	EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	10.2	10.7	4.5	0% - 20%
EA013: Acid Neutralising Capacity (QC Lot: 1823699)									
EB1110488-005	GS001R GY Rejects 2008	EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	3.7	3.4	10.5	No Limit
EA026 : Chromium Reducible Sulfur (QC Lot: 1812465)									
EB1110488-001	GRM_CR_01 RV Rejects May 2011	EA026: Chromium Reducible Sulphur	----	0.005	%	0.167	0.167	0.0	0% - 20%
EB1110489-008	Anonymous	EA026: Chromium Reducible Sulphur	----	0.005	%	0.083	0.083	0.0	0% - 50%
EA026 : Chromium Reducible Sulfur (QC Lot: 1823700)									
EB1110488-005	GS001R GY Rejects 2008	EA026: Chromium Reducible Sulphur	----	0.005	%	0.130	0.128	1.6	0% - 20%
ED042T: Total Sulfur by LECO (QC Lot: 1812586)									
EB1110488-001	GRM_CR_01 RV Rejects May 2011	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.39	0.35	9.3	0% - 20%
ED042T: Total Sulfur by LECO (QC Lot: 1819384)									
EB1110488-005	GS001R GY Rejects 2008	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	0.29	0.24	18.1	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002 : pH (Soils) (QCLot: 1811417)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	101	97	103
EA002 : pH (Soils) (QCLot: 1816231)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	102	97	103
EA010: Conductivity (QCLot: 1811418)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	91.8	85	115
EA010: Conductivity (QCLot: 1816232)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	91.8	85	115
EA013: Acid Neutralising Capacity (QCLot: 1812464)								
EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	----	9.9 kg H2SO4/t	98.3	75	127
EA013: Acid Neutralising Capacity (QCLot: 1823699)								
EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	----	9.9 kg H2SO4/t	105	75	127
EA026 : Chromium Reducible Sulfur (QCLot: 1812465)								
EA026: Chromium Reducible Sulphur	----	0.005	%	<0.005	.28 %	82.3	80	120
EA026 : Chromium Reducible Sulfur (QCLot: 1823700)								
EA026: Chromium Reducible Sulphur	----	0.005	%	<0.005	.28 %	83.2	80	120
ED042T: Total Sulfur by LECO (QCLot: 1812586)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	100 %	100	70	130
ED042T: Total Sulfur by LECO (QCLot: 1819384)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	100 %	99.3	70	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) Results are required to be reported.**

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1110488**	Page	: 1 of 6
Client	: URS AUSTRALIA PTY LTD (QLD)	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 26-MAY-2011
Sampler	: ----	Issue Date	: 09-JUN-2011
Order number	: ----		
		No. of samples received	: 8
Quote number	: BN/060/11	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 Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
EA002 : pH (Soils)								
Pulp Bag GS001R - GY Rejects 2008, GS003R - GY Rejects Mid 2010,	GS002R - GY Rejects May 2011, GS004R - GY Rejects Mid 2006	**26-MAY-2011**	**03-JUN-2011**	02-JUN-2011	×	**07-JUN-2011**	03-JUN-2011	×
Snap Lock Bag GRM_CR_01 - RV Rejects May 2011, GRM_CR_03 - RV Rejects May 2009,	GRM_CR_02 - RV Rejects Dec 2009, GRM_CR_04 - RV Rejects 2003	**26-MAY-2011**	**02-JUN-2011**	02-JUN-2011	✓	**07-JUN-2011**	02-JUN-2011	×
EA010: Conductivity								
Pulp Bag GS001R - GY Rejects 2008, GS003R - GY Rejects Mid 2010,	GS002R - GY Rejects May 2011, GS004R - GY Rejects Mid 2006	**26-MAY-2011**	**03-JUN-2011**	02-JUN-2011	×	**07-JUN-2011**	01-JUL-2011	✓
Snap Lock Bag GRM_CR_01 - RV Rejects May 2011, GRM_CR_03 - RV Rejects May 2009,	GRM_CR_02 - RV Rejects Dec 2009, GRM_CR_04 - RV Rejects 2003	**26-MAY-2011**	**02-JUN-2011**	02-JUN-2011	✓	**07-JUN-2011**	30-JUN-2011	✓
EA013: Acid Neutralising Capacity								
Pulp Bag GRM_CR_01 - RV Rejects May 2011, GRM_CR_03 - RV Rejects May 2009,	GRM_CR_02 - RV Rejects Dec 2009, GRM_CR_04 - RV Rejects 2003	**26-MAY-2011**	**01-JUN-2011**	25-MAY-2012	✓	**09-JUN-2011**	28-NOV-2011	✓
Pulp Bag GS001R - GY Rejects 2008, GS003R - GY Rejects Mid 2010,	GS002R - GY Rejects May 2011, GS004R - GY Rejects Mid 2006	**26-MAY-2011**	**09-JUN-2011**	25-MAY-2012	✓	**09-JUN-2011**	06-DEC-2011	✓
EA026 : Chromium Reducible Sulfur								
Snap Lock Bag GRM_CR_01 - RV Rejects May 2011, GRM_CR_03 - RV Rejects May 2009,	GRM_CR_02 - RV Rejects Dec 2009, GRM_CR_04 - RV Rejects 2003	**26-MAY-2011**	**01-JUN-2011**	27-MAY-2011	×	**09-JUN-2011**	30-AUG-2011	✓
Snap Lock Bag GS001R - GY Rejects 2008, GS003R - GY Rejects Mid 2010,	GS002R - GY Rejects May 2011, GS004R - GY Rejects Mid 2006	**26-MAY-2011**	**09-JUN-2011**	27-MAY-2011	×	**09-JUN-2011**	07-SEP-2011	✓
ED042T: Total Sulfur by LECO								
Pulp Bag GRM_CR_01 - RV Rejects May 2011, GRM_CR_03 - RV Rejects May 2009,	GRM_CR_02 - RV Rejects Dec 2009, GRM_CR_04 - RV Rejects 2003	**26-MAY-2011**	**01-JUN-2011**	22-NOV-2011	✓	**01-JUN-2011**	22-NOV-2011	✓
Pulp Bag GS001R - GY Rejects 2008, GS003R - GY Rejects Mid 2010,	GS002R - GY Rejects May 2011, GS004R - GY Rejects Mid 2006	**26-MAY-2011**	**07-JUN-2011**	22-NOV-2011	✓	**07-JUN-2011**	22-NOV-2011	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Acid Neutralising Capacity (ANC)	EA013	3	18	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chromium Reducible Sulphur	EA026	3	18	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	3	18	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	3	18	**16.7**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfur - Total as S (LECO)	ED042T	2	8	**25.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Acid Neutralising Capacity (ANC)	EA013	2	18	**11.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chromium Reducible Sulphur	EA026	2	18	**11.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	2	18	**11.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	2	18	**11.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfur - Total as S (LECO)	ED042T	2	8	**25.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chromium Reducible Sulphur	EA026	2	18	**11.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	2	18	**11.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfur - Total as S (LECO)	ED042T	2	8	**25.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	*Method*	*Matrix*	*Method Descriptions*
pH (1:5)	EA002	SOIL	(APHA 21st ed., 4500H+) pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 103)
Net Acid Production Potential	EA009	SOIL	Coastech Research (Canada)(Mod.). NAPP = Acid Production Potential (APP or MAP- Maximum Acid Potential) minus Neutralising Capacity (ANC). NAPP may be +ve, zero or -ve.
Electrical Conductivity (1:5)	EA010	SOIL	(APHA 21st ed., 2510) Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 104)
Acid Neutralising Capacity (ANC)	EA013	SOIL	USEPA 600/2-78-054, I. Miller (2000). A fizz test is done to semiquanititatively estimate the likely reactivity. The soil is then reacted with an known excess quanitity of an appropriate acid. Titration determines the acid remaining, and the ANC can be calculated from comparison with a blank titration.
Chromium Reducible Sulphur	EA026	SOIL	Sullivan et al (1998) The CRS method converts reduced inorganic sulfur to H_2S by $CrCl_2$ solution ; the evolved H_2S is trapped in a zinc acetate solution as ZnS which is quantified by iodometric titration.
Sulfur - Total as S (LECO)	ED042T	SOIL	In-house. Dried and pulverised sample is combusted in a LECO furnace at 1350C in the presence of strong oxidants / catalysts. The evolved S (as SO_2) is measured by infra-red detector

Preparation Methods	*Method*	*Matrix*	*Method Descriptions*
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002 : pH (Soils)						
Pulp Bag GS001R - GY Rejects 2008, GS002R - GY Rejects May 2011, GS003R - GY Rejects Mid 2010, GS004R - GY Rejects Mid 2006	03-JUN-2011	02-JUN-2011	**1**	07-JUN-2011	03-JUN-2011	**4**
Snap Lock Bag GRM_CR_01 - RV Rejects May 2011, GRM_CR_02 - RV Rejects Dec 2009, GRM_CR_03 - RV Rejects May 2009, GRM_CR_04 - RV Rejects 2003	----	----	----	07-JUN-2011	02-JUN-2011	**5**
EA010: Conductivity						
Pulp Bag GS001R - GY Rejects 2008, GS002R - GY Rejects May 2011, GS003R - GY Rejects Mid 2010, GS004R - GY Rejects Mid 2006	03-JUN-2011	02-JUN-2011	**1**	----	----	----
EA026 : Chromium Reducible Sulfur						
Snap Lock Bag GRM_CR_01 - RV Rejects May 2011, GRM_CR_02 - RV Rejects Dec 2009, GRM_CR_03 - RV Rejects May 2009, GRM_CR_04 - RV Rejects 2003	01-JUN-2011	27-MAY-2011	**5**	----	----	----
Snap Lock Bag GS001R - GY Rejects 2008, GS002R - GY Rejects May 2011, GS003R - GY Rejects Mid 2010, GS004R - GY Rejects Mid 2006	09-JUN-2011	27-MAY-2011	**13**	----	----	----

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order : **EB1110488**

Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	Page	: 1 of 2
Order number	: ----		
C-O-C number	: ----	Quote number	: EB2011URSQLD0327 (BN/060/11)
Site	: ----		
Sampler	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 26-MAY-2011	Issue Date	: 02-JUN-2011 15:16
Client Requested Due Date	: 09-JUN-2011	Scheduled Reporting Date	: **09-JUN-2011**

Delivery Details

Mode of Delivery	: Client Drop off	Temperature	: 18.3°C
No. of coolers/boxes	: 1 DRUM	No. of samples received	: 8
Security Seal	: Intact.	No. of samples analysed	: 8

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **Sample(s) have been received within recommended holding times.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

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

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

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.

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - ASS1 NAPP	SOIL - EA002 pH (1:5)	SOIL - EA010 (solids): Electrical Conductivity (1:5) Electrical Conductivity (1:5)	SOIL - EA026 Chromium Reducible Sulphur
EB1110488-001	26-MAY-2011 15:00	GRM_CR_01 RV Reject.	✓	✓	✓	✓
EB1110488-002	26-MAY-2011 15:00	GRM_CR_02 RV Reject.	✓	✓	✓	✓
EB1110488-003	26-MAY-2011 15:00	GRM_CR_03 RV Reject.	✓	✓	✓	✓
EB1110488-004	26-MAY-2011 15:00	GRM_CR_04 RV Reject.	✓	✓	✓	✓
EB1110488-005	26-MAY-2011 15:00	GS001R GY Rejects 2...	✓	✓	✓	✓
EB1110488-006	26-MAY-2011 15:00	GS002R GY Rejects M..	✓	✓	✓	✓
EB1110488-007	26-MAY-2011 15:00	GS003R GY Rejects M..	✓	✓	✓	✓
EB1110488-008	26-MAY-2011 15:00	GS004R GY Rejects M..	✓	✓	✓	✓

Requested Deliverables

DR TONY JONG

- *AU Certificate of Analysis - NATA (COA)	Email	tony_jong@urscorp.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	tony_jong@urscorp.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	tony_jong@urscorp.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	tony_jong@urscorp.com
- Chain of Custody (CoC) (COC)	Email	tony_jong@urscorp.com
- EDI Format - EQUIS V5 URS (EQUV5_URS)	Email	tony_jong@urscorp.com
- EDI Format - MRED (MRED)	Email	tony_jong@urscorp.com
- EDI Format - XTab (XTAB)	Email	tony_jong@urscorp.com

MR LAWRIE DUCK

- *AU Certificate of Analysis - NATA (COA)	Email	lawrie_duck@urscorp.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	lawrie_duck@urscorp.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	lawrie_duck@urscorp.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	lawrie_duck@urscorp.com
- Chain of Custody (CoC) (COC)	Email	lawrie_duck@urscorp.com
- EDI Format - EQUIS V5 URS (EQUV5_URS)	Email	lawrie_duck@urscorp.com
- EDI Format - MRED (MRED)	Email	lawrie_duck@urscorp.com
- EDI Format - XTab (XTAB)	Email	lawrie_duck@urscorp.com

RESULTS ADDRESS

- *AU Certificate of Analysis - NATA (COA)	Email	brisbane@urscorp.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	brisbane@urscorp.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	brisbane@urscorp.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	brisbane@urscorp.com
- Chain of Custody (CoC) (COC)	Email	brisbane@urscorp.com
- EDI Format - EQUIS V5 URS (EQUV5_URS)	Email	brisbane@urscorp.com
- EDI Format - MRED (MRED)	Email	brisbane@urscorp.com
- EDI Format - XTab (XTAB)	Email	brisbane@urscorp.com

THE ACCOUNTS BRISBANE

- A4 - AU Tax Invoice (INV)	Email	brisbane_accounts@urscorp.com

ALS Environmental

Acid Buffering Characteristic Curve (ABCC) REPORT

Batch: **EB1111539**

CONTACT:	EB1111539	**LABORATORY:**	Brisbane
CLIENT:	URS AUSTRALIA PTY LTD (QLD)	**DATE SAMPLED:**	26/05/2011
ADDRESS:	GPO BOX 302	**DATE RECEIVED:**	26/05/2011
	BRISBANE, QLD, AUSTRALIA 4001	**DATE COMPLETED:**	
		SAMPLE TYPE:	Soil
		No. of SAMPLES:	2

COMMENTS

ISSUING LABORATORY: ALS BRISBANE

Address:	32 Shand Street	**Telephone:**	07 3243 7222
	STAFFORD QLD 4053	**Facsimile:**	07 3243 7218
	AUSTRALIA	**E-mail:**	Myles.Clark@alsenviro.com

Signatory

Australian Laboratory Services Pty Ltd (ABN 84 009 936 029)

Work Order :	EB1111539	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			RV Rejects May 2009
	Client Sample Identification 2			
	Sample Date			26/05/2011
Method	Analyte	Units	LOR	3 EB1111539

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**11.6**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	7.87				
1	0.2	0.49	5.72				
2	0.4	0.98	5.05				
3	0.6	1.47	4.50				
4	0.8	1.96	4.05				
5	1	2.45	3.75				
6	1.2	2.94	3.55				
7	1.4	3.43	3.42				
8	1.6	3.92	3.32				
9	1.8	4.41	3.22				
10	2	4.9	3.13				
11	2.2	5.39	3.04				
12	2.4	5.88	2.97				
13	2.6	6.37	2.91				
14	2.8	6.86	2.86				
15	3	7.35	2.81				
16	3.2	7.84	2.76				
17	3.4	8.33	2.72				
18	3.6	8.82	2.69				
19	3.8	9.31	2.65				
20	4	9.8	2.62				
21	4.2	10.29	2.59				
22	4.4	10.78	2.57				
23	4.6	11.27	2.54				
24	4.8	11.76	2.51				
25	5	12.25	2.49				
26	5.2	12.74	2.47				
27	5.4	13.23	2.45				

Work Order :	EB1111539	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			RV Rejects May 2009
	Client Sample Identification 2			
	Sample Date			26/05/2011
Method	Analyte	Units	LOR	
				3 Check EB1111539

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.2**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**11.6**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	7.34				
1	0.2	0.49	5.64				
2	0.4	0.98	4.77				
3	0.6	1.47	4.03				
4	0.8	1.96	3.62				
5	1	2.45	3.39				
6	1.2	2.94	3.23				
7	1.4	3.43	3.10				
8	1.6	3.92	3.01				
9	1.8	4.41	2.93				
10	2	4.9	2.87				
11	2.2	5.39	2.82				
12	2.4	5.88	2.77				
13	2.6	6.37	2.73				
14	2.8	6.86	2.68				
15	3	7.35	2.65				
16	3.2	7.84	2.61				
17	3.4	8.33	2.59				
18	3.6	8.82	2.56				
19	3.8	9.31	2.54				
20	4	9.8	2.51				
21	4.2	10.29	2.49				
22	4.4	10.78	2.46				
23	4.6	11.27	2.45				
24	4.8	11.76	2.43				
25	5	12.25	2.41				
26	5.2	12.74	2.40				

Work Order :	EB1111539	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			GS002R GY Rejects May 2011
	Client Sample Identification 2			
	Sample Date			26/05/2011
Method	Analyte	Units	LOR	6 EB1111539

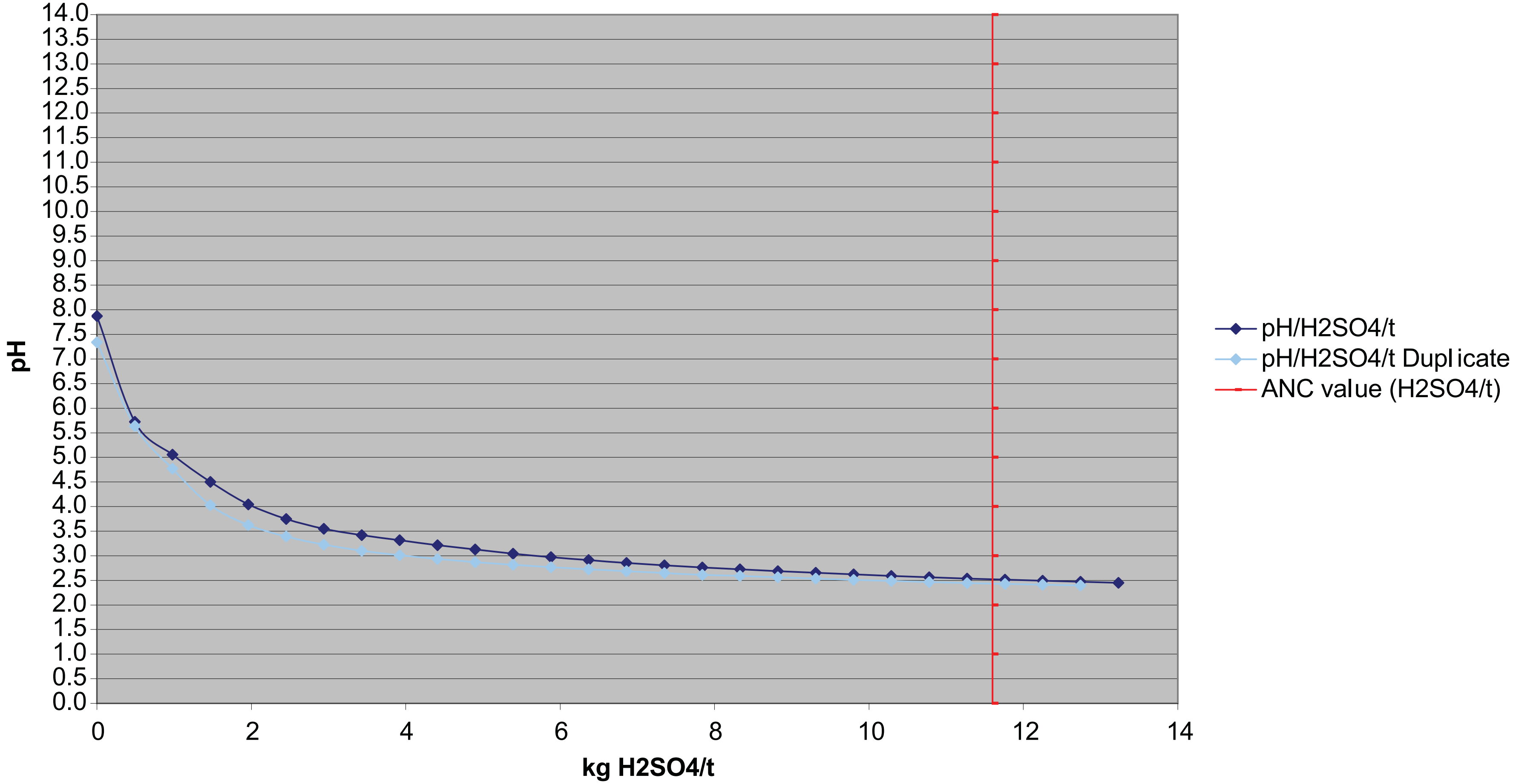
EA046 - A Titration information

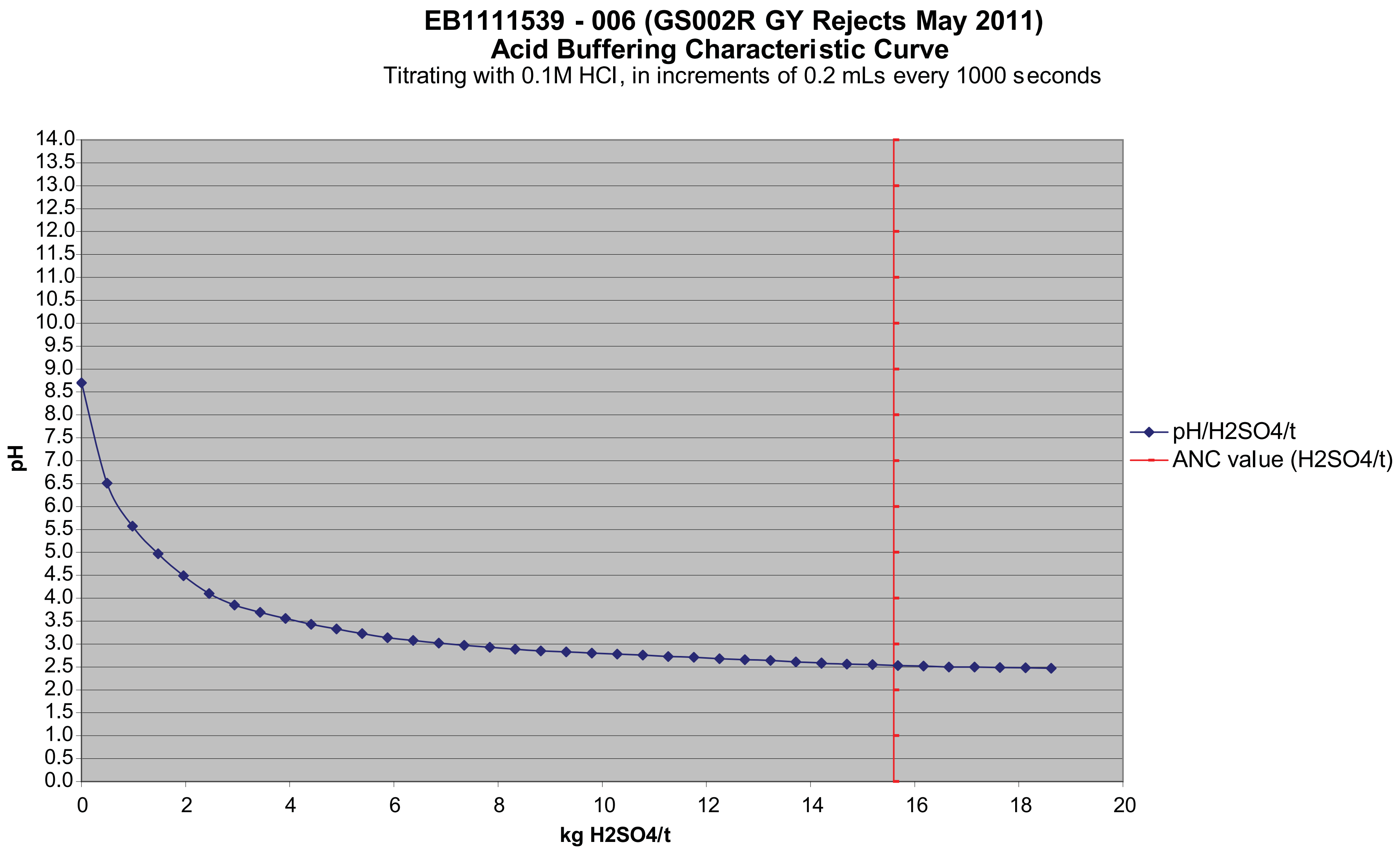
HCl Molarity:	M	0.1
Increments:	mL	0.2
Weight	(g)	2
ANC	kgH2SO4/t	15.6

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	8.7	36	7	17.15	2.5
1	0.2	0.49	6.51	37	7.2	17.64	2.49
2	0.4	0.98	5.57	38	7.4	18.13	2.48
3	0.6	1.47	4.97	39	7.6	18.62	2.47
4	0.8	1.96	4.49				
5	1	2.45	4.1				
6	1.2	2.94	3.85				
7	1.4	3.43	3.69				
8	1.6	3.92	3.56				
9	1.8	4.41	3.43				
10	2	4.9	3.33				
11	2.2	5.39	3.23				
12	2.4	5.88	3.14				
13	2.6	6.37	3.08				
14	2.8	6.86	3.02				
15	3	7.35	2.97				
16	3.2	7.84	2.93				
17	3.4	8.33	2.89				
18	3.6	8.82	2.85				
19	3.8	9.31	2.83				
20	4	9.8	2.8				
21	4.2	10.29	2.78				
22	4.4	10.78	2.76				
23	4.6	11.27	2.73				
24	4.8	11.76	2.71				
25	5	12.25	2.68				
26	5.2	12.74	2.66				
27	5.4	13.23	2.64				
28	5.6	13.72	2.61				
29	5.8	14.21	2.59				
30	5.8	14.21	2.58				
31	6	14.7	2.56				
32	6.2	15.19	2.55				
33	6.4	15.68	2.53				
34	6.6	16.17	2.52				
35	6.8	16.66	2.5				

EB1111539 - 003 (RV Rejects May 2009)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.2 mLs every 1000 seconds





EB1111539 - 006 (GS002R GY Rejects May 2011)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.2 mLs every 1000 seconds
pH
kg H2SO4/t
pH/H2SO4/t
ANC value (H2SO4/t)

URS Rebatch #1

Chain-of-Custody Form

ALS: 26 Shand St, Stafford QLD 4053 Ph: 3243 7222

Environmental Division
Brisbane
Work Order
EB1111539

JP

Telephone : + 61-7-3243 7222

Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222, 26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY

Job Code:

Due Date:

Comments:

Custody seal intact? YES NO N/A

Sample cold? YES NO N/A

FROM: Tony Jong
Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED: Rapid turn-around

Project Name: GRM_EIS
Project No: 42626689
Project Manager: Kim Bidle
Agreement No.: EN/001/10
Quote No.: BN/060/11

Sampler Name: Samples at ALS - previously analysed as EB1110488
Sampler Contact:

Released by: Lawrie Duck
Date: 14/06/2011 **Time:** 17:00

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

Container Identification

Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	NOTES
Preservative Code	none	none	none	none	none	none	none	none	none	none	none	
Analytes	EA011 - Nett Acid Generation (NAG)	EA011E - Modified NAG with Extended Boil	Carbon (EP005, EP006, EP007)	EA046 - Acid Buffering Characteristic Curves (ABCC)	CEC (ED007)	Exchangeable (Ca, Mg, Na, K) (ED007)	ESP (ED007)	Four Acid 'Near Total' Digest with ICPAES/ICPMS finish (ME-MS61)	Mercury (ME-MS42)	1:5 Leach (EN34)	Analysis of 1:5 Leach (as per Page 2_1:5 Leach)	

Analysis as per ALS Quotation BN/060/11 - Phase 2: Part A and Part B (1) - Solids Analysis (NO COMPOSITES)

Laboratory ID	ALS Code ID	Northing (m)	Easting (m))	Sample ID	Matrix	Type	Lithology	No of bags	EA011	EA011E	Carbon	EA046	CEC	Exchangeable	ESP	Four Acid	Mercury	1:5 Leach	Analysis of 1:5 Leach	NOTES
1	EB1110488-001	7594997.00	596847.00	GRM_CR_01_RV Rejects May 2011	Solid	Coal reject	Coal		X	X	X		X	X	X	X	X	X	X	
2	EB1110488-002	7594382.00	597485.00	GRM_CR_02_RV Rejects Dec 2009	Solid	Coal reject	Coal		X	X	X		X	X	X	X	X	X	X	
3	EB1110488-003	7593948.00	597075.00	GRM_CR_03_RV Rejects May 2009	Solid	Coal reject	Coal		X	X	X	X	X	X	X	X	X	X	X	
4	EB1110488-004	7594108.00	596969.00	GRM_CR_04_RV Rejects 2003	Solid	Coal reject	Coal		X	X	X		X	X	X	X	X	X	X	
5	EB1110488-005	7589920.00	599597.00	GS001R_GY Rejects 2008	Solid	Coal reject	Coal		X	X	X		X	X	X	X	X	X	X	
6	EB1110488-006	7589479.00	599902.00	GS002R_GY Rejects May 2011	Solid	Coal reject	Coal		X	X	X	X	X	X	X	X	X	X	X	
7	EB1110488-007	7589970.00	599875.00	GS003R_GY Rejects Mid 2010	Solid	Coal reject	Coal		X	X	X		X	X	X	X	X	X	X	
8	EB1110488-008	7589755.00	599963.00	GS004R_GY Rejects Mid 2006	Solid	Coal reject	Coal		X	X	X		X	X	X	X	X	X	X	
Remarks to Lab: Analysis as per ALS Quotation BN/060/11 - Phase 2: Part A and Part B (1) - Solids Analysis (NO COMPOSITES)							TOTAL number of bags	0	8	8	8	2	8	8	8	8	8	8	8	

(Last row: TOTAL number of each analyte)

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

Email Results to: tony_jong@urscorp.com lawrie_duck@urscorp.com

NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES. GLOVES SHOULD BE WORN WHILST HANDLING SAMPLES.

Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY			
Job Code:			
Due Date:			
Comments:			
Custody seal intact?	YES	NO	N/A
Sample cold?	YES	NO	N/A

FROM: Tony Jong
Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED:
Rapid turn-around

Project Name:	GRM_EIS
Project No:	42626689
Project Manager:	Kim Bidle
Agreement No.:	EN/001/10
Quote No.:	BN/060/11

Sampler Name:
Samples to be produced as per Page 1 of this COC
Sampler Contact:

Released by:
Date: **Time:**

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

Container Identification

Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB
Preservative Code	none	none	none	none	none	none	none	none	none	none	none
Analytes	Soluble Metals by ICP-MS (Ag, Al, As, Cd, Co, Cr, Cu, Pb, Ni, Mn, Mo, Sb, Se, U, V, Zn) (EG020S)	Soluble Metals by ICP-AES (B, Fe) (EG005S)	Soluble Mercury (Hg) by FIMS (EG035S)	pH (1:5) (EA002)	EC (1:5) (EA010)	Soluble Cations by ICP-AES (Ca, Mg, Na, K) (ED093S)	Soluble Chloride (ED045G)	Soluble Sulfate (ED040S)	Alkalinity (ED037)	Sodium Adsorption Ratio (SAR) (EA006)	

NOTES

Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B (2) - Analysis of 1:5 Leach

Laboratory ID	ALS Code ID	Northing (m)	Easting (m))	Sample ID	Matrix	Type	Lithology	No of bottles		EG020S	EG005S	EG035S	EA002	EA010	ED093S	ED045G	ED040S	ED037	EA006		NOTES
	EB1110488-001	7594997.00	596847.00	GRM_CR_01_RV Rejects May 2011	Liquid (1:5 Leach)	Coal reject	Coal			X	X	X	X	X	X	X	X	X	X		
	EB1110488-002	7594382.00	597485.00	GRM_CR_02_RV Rejects Dec 2009	Liquid (1:5 Leach)	Coal reject	Coal			X	X	X	X	X	X	X	X	X	X		
	EB1110488-003	7593948.00	597075.00	GRM_CR_03_RV Rejects May 2009	Liquid (1:5 Leach)	Coal reject	Coal			X	X	X	X	X	X	X	X	X	X		
	EB1110488-004	7594108.00	596969.00	GRM_CR_04_RV Rejects 2003	Liquid (1:5 Leach)	Coal reject	Coal			X	X	X	X	X	X	X	X	X	X		
	EB1110488-005	7589920.00	599597.00	GS001R_GY Rejects 2008	Liquid (1:5 Leach)	Coal reject	Coal			X	X	X	X	X	X	X	X	X	X		
	EB1110488-006	7589479.00	599902.00	GS002R_GY Rejects May 2011	Liquid (1:5 Leach)	Coal reject	Coal			X	X	X	X	X	X	X	X	X	X		
	EB1110488-007	7589970.00	599875.00	GS003R_GY Rejects Mid 2010	Liquid (1:5 Leach)	Coal reject	Coal			X	X	X	X	X	X	X	X	X	X		
	EB1110488-008	7589755.00	599963.00	GS004R_GY Rejects Mid 2006	Liquid (1:5 Leach)	Coal reject	Coal			X	X	X	X	X	X	X	X	X	X		
Remarks to Lab:		**Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B (2) - Analysis of 1:5 Leach**					TOTAL number of bottles	0	TOTAL number of each analyte	8	8	8	8	8	8	8	8	8	8		

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

Email Results to: tony_jong@urscorp.com lawrie_duck@urscorp.com

NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES. GLOVES SHOULD BE WORN WHILST HANDLING SAMPLES.

CERTIFICATE OF ANALYSIS

Work Order	: **EB1111539**	Page	: 1 of 8
Amendment	: **1**		
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: DR LAWRENCE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 26-MAY-2011
Sampler	: ----	Issue Date	: 01-JUL-2011
Site	: ----		
		No. of samples received	: 8
Quote number	: BN/060/11	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.

WORLD RECOGNISED ACCREDITATION

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
Kim McCabe	Senior Inorganic Chemist	Stafford Minerals - AY
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils
Myles.Clark	Acid Sulfate Soils Supervisor	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

- **ED045G - Chloride Soluble : SampleGRM_CR_0**
  1 RV Rejects May 2011 shows poor duplicate results due to matrix interference. Confirmed by re-extraction and re-analysis.
- **This report has been amended and re-released to allow the reporting of additional analytical data.**

Analytical Results

Sub-Matrix: SOIL		Client sample ID		GRM_CR_01 RV Rejects May 2011	GRM_CR_02RV Rejects Dec 2009	RV Rejects May 2009	GRM_CR_04 RV Rejects 2003	GS001R GY Rejects 2008
		Client sampling date / time		26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00
Compound	CAS Number	LOR	Unit	EB1111539-001	EB1111539-002	EB1111539-003	EB1111539-004	EB1111539-005
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.6	8.8	8.9	7.4	7.7
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Absorption Ratio	----	0.01	-	23.0	28.3	11.9	8.39	0.11
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	273	238	105	538	111
EA011: Net Acid Generation								
pH (OX)	----	0.1	pH Unit	3.5	3.4	6.6	2.5	3.3
NAG (pH 4.5)	----	0.1	kg H2SO4/t	2.4	4.8	<0.1	49.4	4.4
NAG (pH 7.0)	----	0.1	kg H2SO4/t	11.0	13.1	0.2	83.8	13.4
EA011-A: pH Ox								
pH (OX)	----	0.1	pH Unit	4.0	3.6	6.5	2.5	3.3
pH -2 (ext)	----	0.1	pH Unit	6.1	6.2	----	5.4	5.7
EA011-B: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	22	27	----	20	23
Chloride	16887-00-6	1	mg/L	<1	3	----	11	<1
EA011-C: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	8	8	----	3	8
Magnesium	7439-95-4	1	mg/L	6	6	----	3	5
Sodium	7440-23-5	1	mg/L	7	8	----	6	2
Potassium	7440-09-7	1	mg/L	7	2	----	2	2
EA011-D: Calculated Components								
Calculated Acid Component	----	0.1	kg H2SO4/t	6.7	8.2	----	6.3	7.2
Calculated Neutralisng Component	----	0.1	kg H2SO4/t	7.0	6.1	----	1.8	4.4
Calculated NAG Acidity	----	0.1	kg H2SO4/t	<0.1	2.1	----	4.5	2.8
EA046 Acid Buffering Characterisation Curves								
Dummy Analyte	----	-	-	----	----	----	----	----
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	4.0	3.0	4.0	2.1	5.0
^ Exchangeable Magnesium	----	0.1	meq/100g	3.5	3.7	4.5	3.9	4.8
^ Exchangeable Potassium	----	0.1	meq/100g	0.2	0.3	0.3	0.2	0.4
^ Exchangeable Sodium	----	0.1	meq/100g	2.0	2.6	1.2	1.6	<0.1
^ Cation Exchange Capacity	----	0.1	meq/100g	9.7	9.7	10.0	7.8	10.3
^ Exchangeable Sodium Percent	----	0.1	%	20.5	27.2	12.4	20.8	0.8
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	652	195	261	65	195

Analytical Results

Sub-Matrix: SOIL			Client sample ID	GRM_CR_01 RV Rejects May 2011	GRM_CR_02RV Rejects Dec 2009	RV Rejects May 2009	GRM_CR_04 RV Rejects 2003	GS001R GY Rejects 2008
			Client sampling date / time	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00
Compound	CAS Number	LOR	Unit	EB1111539-001	EB1111539-002	EB1111539-003	EB1111539-004	EB1111539-005
ED037: Alkalinity - Continued								
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	522	65	131	65	195
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	130	130	130	<1	<1
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	360	380	110	1040	80
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	70	50	<10	20	<10
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	<10	<10	<10	10	30
Magnesium	7439-95-4	10	mg/kg	<10	<10	<10	20	30
Sodium	7440-23-5	10	mg/kg	260	260	100	440	10
Potassium	7440-09-7	10	mg/kg	<10	<10	50	20	20
EG005S : Soluble Metals by ICPAES								
Boron	7440-42-8	1	mg/kg	<1	<1	<1	<1	<1
Iron	7439-89-6	1	mg/kg	<1	<1	2	<1	<1
EG020S: Soluble Metals by ICPMS								
Arsenic	7440-38-2	0.01	mg/kg	<0.01	<0.01	0.06	<0.01	<0.01
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Silver	7440-22-4	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	7440-43-9	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	7440-48-4	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	7440-47-3	0.01	mg/kg	0.01	0.01	0.02	<0.01	<0.01
Copper	7440-50-8	0.01	mg/kg	<0.01	<0.01	0.02	<0.01	<0.01
Manganese	7439-96-5	0.01	mg/kg	0.02	<0.01	0.01	0.69	0.21
Molybdenum	7439-98-7	0.01	mg/kg	0.04	0.02	0.15	<0.01	0.02
Nickel	7440-02-0	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Lead	7439-92-1	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.01	mg/kg	<0.01	<0.01	0.02	<0.01	<0.01
Uranium	7440-61-1	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	7440-62-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aluminium	7429-90-5	0.1	mg/kg	0.4	0.2	24.5	0.1	0.1
EG035S: Soluble Mercury by FIMS								
Mercury	7439-97-6	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	26.6	24.3	20.5	31.7	16.3
EP003TC: Total Carbon (TC) in Soil								

Analytical Results

Sub-Matrix: **SOIL**			Client sample ID	GRM_CR_01 RV Rejects May 2011	GRM_CR_02RV Rejects Dec 2009	RV Rejects May 2009	GRM_CR_04 RV Rejects 2003	GS001R GY Rejects 2008
			Client sampling date / time	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111539-001**	**EB1111539-002**	**EB1111539-003**	**EB1111539-004**	**EB1111539-005**
EP003TC: Total Carbon (TC) in Soil - Continued								
Total Carbon	----	0.02	%	**27.2**	**25.7**	**21.8**	**33.9**	**16.4**
EP003TIC: Total inorganic Carbon (TIC) in Soil								
^ Total Inorganic Carbon	----	0.02	%	**0.51**	**1.39**	**1.38**	**2.17**	**0.06**

Analytical Results

Sub-Matrix: **SOIL**			Client sample ID	GS002R GY Rejects May 2011	GS003R GY Rejects Mid 2010	GS004R GY Rejects Mid 2006	----	----
			Client sampling date / time	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111539-006**	**EB1111539-007**	**EB1111539-008**	**----**	**----**
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**9.1**	**7.7**	**8.6**	----	----
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Absorption Ratio	----	0.01	-	**9.39**	**0.62**	**6.16**	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**345**	**389**	**382**	----	----
EA011: Net Acid Generation								
pH (OX)	----	0.1	pH Unit	**8.0**	**5.5**	**2.8**	----	----
NAG (pH 4.5)	----	0.1	kg H2SO4/t	<0.1	<0.1	**10.4**	----	----
NAG (pH 7.0)	----	0.1	kg H2SO4/t	<0.1	**0.5**	**22.9**	----	----
EA011-A: pH Ox								
pH (OX)	----	0.1	pH Unit	**8.0**	**5.5**	**3.0**	----	----
pH -2 (ext)	----	0.1	pH Unit	----	----	**3.0**	----	----
EA011-B: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	----	----	**54**	----	----
Chloride	16887-00-6	1	mg/L	----	----	**2**	----	----
EA011-C: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	----	----	**13**	----	----
Magnesium	7439-95-4	1	mg/L	----	----	**7**	----	----
Sodium	7440-23-5	1	mg/L	----	----	**7**	----	----
Potassium	7440-09-7	1	mg/L	----	----	**3**	----	----
EA011-D: Calculated Components								
Calculated Acid Component	----	0.1	kg H2SO4/t	----	----	**16.6**	----	----
Calculated Neutralisng Component	----	0.1	kg H2SO4/t	----	----	**7.4**	----	----
Calculated NAG Acidity	----	0.1	kg H2SO4/t	----	----	**9.2**	----	----
EA046 Acid Buffering Characterisation Curves								
Dummy Analyte	----	-	-	----	----	----	----	----
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	**4.0**	**10.8**	**5.5**	----	----
^ Exchangeable Magnesium	----	0.1	meq/100g	**3.6**	**5.3**	**3.8**	----	----
^ Exchangeable Potassium	----	0.1	meq/100g	**0.3**	**0.4**	**0.4**	----	----
^ Exchangeable Sodium	----	0.1	meq/100g	**2.3**	**0.6**	**2.1**	----	----
^ Cation Exchange Capacity	----	0.1	meq/100g	**10.2**	**17.0**	**11.9**	----	----
^ Exchangeable Sodium Percent	----	0.1	%	**22.5**	**3.2**	**17.8**	----	----
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	**1240**	**130**	**65**	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	**1110**	**130**	**65**	----	----

Analytical Results

Sub-Matrix: SOIL			Client sample ID	GS002R GY Rejects May 2011	GS003R GY Rejects Mid 2010	GS004R GY Rejects Mid 2006	----	----
			Client sampling date / time	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	----	----
Compound	CAS Number	LOR	Unit	EB1111539-006	EB1111539-007	EB1111539-008	----	----
ED037: Alkalinity - Continued								
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	**130**	<1	<1	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**170**	**700**	**600**	----	----
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	**40**	<10	**20**	----	----
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	**10**	**140**	**20**	----	----
Magnesium	7439-95-4	10	mg/kg	**10**	**80**	**20**	----	----
Sodium	7440-23-5	10	mg/kg	**340**	**90**	**300**	----	----
Potassium	7440-09-7	10	mg/kg	**20**	**20**	**10**	----	----
EG005S : Soluble Metals by ICPAES								
Boron	7440-42-8	1	mg/kg	<1	<1	<1	----	----
Iron	7439-89-6	1	mg/kg	<1	<1	<1	----	----
EG020S: Soluble Metals by ICPMS								
Arsenic	7440-38-2	0.01	mg/kg	**0.02**	<0.01	<0.01	----	----
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
Silver	7440-22-4	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Cadmium	7440-43-9	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Cobalt	7440-48-4	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Chromium	7440-47-3	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Copper	7440-50-8	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Manganese	7439-96-5	0.01	mg/kg	**0.01**	**0.34**	**0.04**	----	----
Molybdenum	7439-98-7	0.01	mg/kg	**0.62**	**0.01**	**0.04**	----	----
Nickel	7440-02-0	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Lead	7439-92-1	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Antimony	7440-36-0	0.01	mg/kg	**0.03**	<0.01	<0.01	----	----
Uranium	7440-61-1	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Zinc	7440-66-6	0.01	mg/kg	<0.01	<0.01	<0.01	----	----
Vanadium	7440-62-2	0.1	mg/kg	<0.1	<0.1	<0.1	----	----
Aluminium	7429-90-5	0.1	mg/kg	**0.5**	<0.1	<0.1	----	----
EG035S: Soluble Mercury by FIMS								
Mercury	7439-97-6	0.0005	mg/kg	<0.0005	<0.0005	<0.0005	----	----
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**15.7**	**11.9**	**23.6**	----	----
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	----	0.02	%	**16.5**	**12.0**	**24.6**	----	----

Analytical Results

Sub-Matrix: **SOIL**			Client sample ID	**GS002R GY Rejects May 2011**	**GS003R GY Rejects Mid 2010**	**GS004R GY Rejects Mid 2006**	----	----
			Client sampling date / time	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111539-006**	**EB1111539-007**	**EB1111539-008**	**----**	**----**
EP003TIC: Total inorganic Carbon (TIC) in Soil								
^ Total Inorganic Carbon	----	0.02	%	**0.79**	**0.11**	**1.03**	----	----

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **EB1111539**	Page	: 1 of 9
Amendment	: **1**		
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: DR LAWRENCE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 26-MAY-2011
Sampler	: ----	Issue Date	: 01-JUL-2011
Order number	: ----		
		No. of samples received	: 8
Quote number	: BN/060/11	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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

WORLD RECOGNISED ACCREDITATION

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
Kim McCabe	Senior Inorganic Chemist	Stafford Minerals - AY
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils
Myles.Clark	Acid Sulfate Soils Supervisor	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.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
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
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA002 : pH (Soils) (QC Lot: 1842535)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	EA002: pH Value	----	0.1	pH Unit	8.6	8.6	0.0	0% - 20%
EB1111539-007	GS003R GY Rejects Mid 2010	EA002: pH Value	----	0.1	pH Unit	7.7	7.8	0.0	0% - 20%
EA010: Conductivity (QC Lot: 1842537)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	273	280	2.5	0% - 20%
EB1111539-007	GS003R GY Rejects Mid 2010	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	389	371	4.7	0% - 20%
EA011: Net Acid Generation (QC Lot: 1834318)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	2.4	2.3	0.0	0% - 20%
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	11.0	10.9	0.0	0% - 20%
		EA011: pH (OX)	----	0.1	pH Unit	3.5	3.5	0.0	0% - 20%
EA011-A: pH Ox (QC Lot: 1834319)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	EA011E: pH -2 (ext)	----	0.1	pH Unit	6.1	6.1	0.0	0% - 20%
EA011-B: Dissolved Major Anions (QC Lot: 1834319)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	EA011E: Sulfur as S	63705-05-5	1	mg/L	22	22	0.0	0% - 20%
		EA011E: Chloride	16887-00-6	1	mg/L	<1	<1	0.0	No Limit
EA011-C: Dissolved Major Cations (QC Lot: 1834319)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	EA011E: Calcium	7440-70-2	1	mg/L	8	8	0.0	No Limit
		EA011E: Magnesium	7439-95-4	1	mg/L	6	6	0.0	No Limit
		EA011E: Sodium	7440-23-5	1	mg/L	7	7	0.0	No Limit
		EA011E: Potassium	7440-09-7	1	mg/L	7	8	0.0	No Limit
EA011-D: Calculated Components (QC Lot: 1834319)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	EA011E: Calculated Acid Component	----	0.1	kg H2SO4/t	6.7	6.8	0.0	0% - 20%
		EA011E: Calculated Neutralisng Component	----	0.1	kg H2SO4/t	7.0	7.0	0.0	0% - 20%
		EA011E: Calculated NAG Acidity	----	0.1	kg H2SO4/t	<0.1	<0.1	0.0	No Limit
EA046 Acid Buffering Characterisation Curves (QC Lot: 1840646)									
EB1111539-003	RV Rejects May 2009	EA046: Dummy Analyte	----	----	-	----	----	# Not Determined	0% - 20%

Sub-Matrix: **SOIL**

Laboratory Duplicate (DUP) Report

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
ED007: Exchangeable Cations (QC Lot: 1834278)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	ED007: Exchangeable Calcium	----	0.1	meq/100g	4.0	3.9	0.0	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	3.5	3.5	0.0	0% - 20%
		ED007: Exchangeable Potassium	----	0.1	meq/100g	0.2	0.2	0.0	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	2.0	2.0	0.0	0% - 20%
ED037: Alkalinity (QC Lot: 1842540)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	ED037: Total Alkalinity as CaCO3	----	1	meq/kg	652	586	10.7	0% - 20%
EB1111539-007	GS003R GY Rejects Mid 2010	ED037: Total Alkalinity as CaCO3	----	1	meq/kg	130	130	0.0	0% - 20%
ED040S: Soluble Major Anions (QC Lot: 1842536)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	360	340	5.0	0% - 20%
EB1111539-007	GS003R GY Rejects Mid 2010	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	700	670	4.7	0% - 20%
ED045G: Chloride Discrete analyser (QC Lot: 1842544)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	ED045G: Chloride	16887-00-6	10	mg/kg	70	50	# 21.5	No Limit
EB1111539-007	GS003R GY Rejects Mid 2010	ED045G: Chloride	16887-00-6	10	mg/kg	<10	<10	0.0	No Limit
ED093S: Soluble Major Cations (QC Lot: 1842539)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	ED093S: Calcium	7440-70-2	10	mg/kg	<10	<10	0.0	No Limit
		ED093S: Magnesium	7439-95-4	10	mg/kg	<10	<10	0.0	No Limit
		ED093S: Sodium	7440-23-5	10	mg/kg	260	250	0.0	0% - 20%
		ED093S: Potassium	7440-09-7	10	mg/kg	<10	<10	0.0	No Limit
EB1111539-007	GS003R GY Rejects Mid 2010	ED093S: Calcium	7440-70-2	10	mg/kg	140	130	0.0	0% - 50%
		ED093S: Magnesium	7439-95-4	10	mg/kg	80	80	0.0	No Limit
		ED093S: Sodium	7440-23-5	10	mg/kg	90	80	0.0	No Limit
		ED093S: Potassium	7440-09-7	10	mg/kg	20	20	0.0	No Limit
EG005S : Soluble Metals by ICPAES (QC Lot: 1842538)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	EG005S: Boron	7440-42-8	1	mg/kg	<1	<1	0.0	No Limit
		EG005S: Iron	7439-89-6	1	mg/kg	<1	<1	0.0	No Limit
EB1111539-007	GS003R GY Rejects Mid 2010	EG005S: Boron	7440-42-8	1	mg/kg	<1	<1	0.0	No Limit
		EG005S: Iron	7439-89-6	1	mg/kg	<1	<1	0.0	No Limit
EG020S: Soluble Metals by ICPMS (QC Lot: 1842541)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020S: Soluble Metals by ICPMS (QC Lot: 1842541) - continued									
EB1111539-007	GS003R GY Rejects Mid 2010	EG020X-S: Arsenic	7440-38-2	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Cobalt	7440-48-4	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Chromium	7440-47-3	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Copper	7440-50-8	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Manganese	7439-96-5	0.01	mg/kg	0.34	0.36	5.5	0% - 20%
		EG020X-S: Molybdenum	7439-98-7	0.01	mg/kg	0.01	<0.01	0.0	No Limit
		EG020X-S: Nickel	7440-02-0	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Lead	7439-92-1	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Antimony	7440-36-0	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Uranium	7440-61-1	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Zinc	7440-66-6	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Vanadium	7440-62-2	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020X-S: Aluminium	7429-90-5	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EB1111587-067	Anonymous	EG020X-S: Arsenic	7440-38-2	0.01	mg/kg	0.27	0.31	13.8	0% - 20%
		EG020X-S: Cobalt	7440-48-4	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Chromium	7440-47-3	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Copper	7440-50-8	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Manganese	7439-96-5	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Molybdenum	7439-98-7	0.01	mg/kg	0.16	0.15	0.0	0% - 50%
		EG020X-S: Nickel	7440-02-0	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Lead	7439-92-1	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Antimony	7440-36-0	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Uranium	7440-61-1	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Zinc	7440-66-6	0.01	mg/kg	<0.10	<0.10	0.0	No Limit
		EG020X-S: Vanadium	7440-62-2	0.1	mg/kg	<1.0	<1.0	0.0	No Limit
		EG020X-S: Aluminium	7429-90-5	0.1	mg/kg	<1.0	<1.0	0.0	No Limit
EG020S: Soluble Metals by ICPMS (QC Lot: 1842542)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	EG020Y-S: Cadmium	7440-43-9	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020Y-S: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EB1111539-007	GS003R GY Rejects Mid 2010	EG020Y-S: Cadmium	7440-43-9	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020Y-S: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EG020S: Soluble Metals by ICPMS (QC Lot: 1842543)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	EG020Z-S: Silver	7440-22-4	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
EB1111539-007	GS003R GY Rejects Mid 2010	EG020Z-S: Silver	7440-22-4	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
EG035S: Soluble Mercury by FIMS (QC Lot: 1842545)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG035S: Soluble Mercury by FIMS (QC Lot: 1842545) - continued									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	EG035S: Mercury	7439-97-6	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EB1111539-007	GS003R GY Rejects Mid 2010	EG035S: Mercury	7439-97-6	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 1833756)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	EP003: Total Organic Carbon	----	0.02	%	26.6	27.1	1.7	0% - 20%
EP003TC: Total Carbon (TC) in Soil (QC Lot: 1833757)									
EB1111539-001	GRM_CR_01 RV Rejects May 2011	EP003TC: Total Carbon	----	0.02	%	27.2	27.1	0.07	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002 : pH (Soils) (QCLot: 1842535)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	100	97	103
EA006: Sodium Adsorption Ratio (SAR) (QCLot: 1834290)								
EA006: Sodium Absorption Ratio	----	0.01		<0.01	----	----	----	----
EA010: Conductivity (QCLot: 1842537)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	97.4	85	115
EA011: Net Acid Generation (QCLot: 1834318)								
EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	----	12 kg H2SO4/t	96.4	84	114
EA011-A: pH Ox (QCLot: 1834319)								
EA011E: pH (OX)	----	0.1	pH Unit	----	2.7 pH Unit	100	80	120
EA011E: pH -2 (ext)	----	0.1	pH Unit	----	2.6 pH Unit	96.2	80	120
EA011-B: Dissolved Major Anions (QCLot: 1834319)								
EA011E: Sulfur as S	63705-05-5	1	mg/L	----	53 mg/L	93.0	80	120
EA011E: Chloride	16887-00-6	1	mg/L	----	.7 mg/L	# Not Determined	80	120
EA011-C: Dissolved Major Cations (QCLot: 1834319)								
EA011E: Calcium	7440-70-2	1	mg/L	----	.8 mg/L	# Not Determined	80	120
EA011E: Magnesium	7439-95-4	1	mg/L	----	.16 mg/L	# Not Determined	80	120
EA011E: Sodium	7440-23-5	1	mg/L	----	2 mg/L	85.5	80	120
EA011E: Potassium	7440-09-7	1	mg/L	----	.4 mg/L	# Not Determined	80	120
EA011-D: Calculated Components (QCLot: 1834319)								
EA011E: Calculated Acid Component	----	0.1	kg H2SO4/t	----	16.2 kg H2SO4/t	93.1	80	120
EA011E: Calculated Neutralisng Component	----	0.1	kg H2SO4/t	----	.6 kg H2SO4/t	96.8	80	120
EA011E: Calculated NAG Acidity	----	0.1	kg H2SO4/t	----	16.2 kg H2SO4/t	89.5	80	120
ED007: Exchangeable Cations (QCLot: 1834278)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	1.2 meq/100g	108	70	130
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	0.65 meq/100g	107	70	130
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	0.20 meq/100g	73.9	70	130
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.4 meq/100g	89.8	70	130
ED007: Cation Exchange Capacity	----	0.1	meq/100g	----	2.46 meq/100g	102	70	130
ED037: Alkalinity (QCLot: 1842540)								
ED037: Total Alkalinity as CaCO3	----	1	meq/kg	<1	200 meq/kg	97.5	85	115
ED040S: Soluble Major Anions (QCLot: 1842536)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	238 mg/kg	103	77	125
ED045G: Chloride Discrete analyser (QCLot: 1842544)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
ED045G: Chloride Discrete analyser (QCLot: 1842544) - continued								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	5000 mg/kg	91.9	73	129
ED093S: Soluble Major Cations (QCLot: 1842539)								
ED093S: Calcium	7440-70-2	10	mg/kg	<10	----	----	----	----
ED093S: Magnesium	7439-95-4	10	mg/kg	<10	----	----	----	----
ED093S: Sodium	7440-23-5	10	mg/kg	<10	----	----	----	----
ED093S: Potassium	7440-09-7	10	mg/kg	<10	----	----	----	----
EG005S : Soluble Metals by ICPAES (QCLot: 1842538)								
EG005S: Boron	7440-42-8	1.00	mg/kg	<1	----	----	----	----
EG005S: Iron	7439-89-6	1.00	mg/kg	<1	----	----	----	----
EG020S: Soluble Metals by ICPMS (QCLot: 1842541)								
EG020X-S: Arsenic	7440-38-2	0.01	mg/kg	<0.01	0.5 mg/kg	105	84.7	124
EG020X-S: Cobalt	7440-48-4	0.01	mg/kg	<0.01	0.5 mg/kg	103	72	130
EG020X-S: Chromium	7440-47-3	0.01	mg/kg	<0.01	0.5 mg/kg	109	70	125
EG020X-S: Copper	7440-50-8	0.01	mg/kg	<0.01	1.0 mg/kg	101	70	130
EG020X-S: Manganese	7439-96-5	0.01	mg/kg	<0.01	0.5 mg/kg	105	77.6	130
EG020X-S: Molybdenum	7439-98-7	0.01	mg/kg	<0.01	0.5 mg/kg	98.8	83	117
EG020X-S: Nickel	7440-02-0	0.01	mg/kg	<0.01	0.5 mg/kg	102	78	124
EG020X-S: Lead	7439-92-1	0.01	mg/kg	<0.01	0.5 mg/kg	104	70	117
EG020X-S: Antimony	7440-36-0	0.01	mg/kg	<0.01	0.5 mg/kg	99.9	77	117
EG020X-S: Uranium	7440-61-1	0.01	mg/kg	<0.01	----	----	----	----
EG020X-S: Zinc	7440-66-6	0.01	mg/kg	<0.01	1.0 mg/kg	104	70	125
EG020X-S: Vanadium	7440-62-2	0.1	mg/kg	<0.1	0.5 mg/kg	103	83	125
EG020X-S: Aluminium	7429-90-5	0.1	mg/kg	<0.1	2.5 mg/kg	106	70	121
EG020S: Soluble Metals by ICPMS (QCLot: 1842542)								
EG020Y-S: Selenium	7782-49-2	0.1	mg/kg	<0.1	0.5 mg/kg	94.1	77	116
EG020Y-S: Cadmium	7440-43-9	0.01	mg/kg	<0.01	0.5 mg/kg	100	79	116
EG020S: Soluble Metals by ICPMS (QCLot: 1842543)								
EG020Z-S: Silver	7440-22-4	0.01	mg/kg	<0.01	0.5 mg/kg	100	75	130
EG035S: Soluble Mercury by FIMS (QCLot: 1842545)								
EG035S: Mercury	7439-97-6	0.0005	mg/kg	<0.0005	0.05 mg/kg	98.2	74	116
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 1833756)								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	100	70	130
EP003TC: Total Carbon (TC) in Soil (QCLot: 1833757)								
EP003TC: Total Carbon	----	0.02	%	<0.02	100 %	100	70	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	Spike Recovery (%)	Recovery Limits (%)	
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*Concentration*	*MS*	*Low*	*High*
EG035S: Soluble Mercury by FIMS (QCLot: 1842545)							
EB1111539-002	GRM_CR_02RV Rejects Dec 2009	EG035S: Mercury	7439-97-6	0.05 mg/kg	111	70	130

Appendix D ALS Laboratory Reports—Tailings

ALS Minerals

Australian Laboratory Services Pty. Ltd.
32 Shand Street
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Phone: +61 (7) 3243 7222 Fax: +61 (7) 3243 7218
www.alsglobal.com

CERTIFICATE BR11127136

Project: GRM_EIS
P.O. No.: EN/001/10
This report is for 10 Pulp samples submitted to our lab in Brisbane, QLD, Australia on 8-JUL-2011.
The following have access to data associated with this certificate:

LAWRIE DUCK	TONY JONG	

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
LEV-01	Waste Disposal Levy
LOG-22	Sample login - Rcd w/o BarCode
ASH-01	Ashing of carbons/soils

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
ME-MS42	Up to 34 elements by ICP-MS	ICP-MS
C-IR07	Total Carbon (Leco)	LECO
ME-MS61	48 element four acid ICP-MS	

To: **URS AUSTRALIA PTY LTD**
ATTN: LAWRIE DUCK
LEVEL 14
240 QUEEN STREET
BRISBANE QLD 4000

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61. ME-MS61:REEs may not be totally soluble in this method.

Signature:

Shaun Kenny, Brisbane Laboratory Manager

ALS Minerals

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www.alsglobal.com

Finalized Date: 15-JUL-2011
Account: URSAUS

Project: GRM_EIS

CERTIFICATE OF ANALYSIS BR11127136

Sample Description	Method	ME-MS42	C-IR07	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61	ME-MS61
	Analyte	Hg	C	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu
	Units	ppm	%	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
	LOR	0.005	0.01	0.01	0.01	0.2	10	0.05	0.01	0.01	0.02	0.01	0.1	1	0.05	0.2
GS1_01_12 Mths Goonyella tailings		0.248	7.25	0.09	6.78	21.9	2780	1.55	0.32	0.24	0.17	11.20	6.6	37	2.59	39.3
GS1_02_6 Mths Goonyella tailings		0.188	12.50	0.08	6.29	8.1	2040	1.31	0.32	0.53	0.18	12.35	3.9	31	1.37	33.1
GS1_03_Recent Goonyella tailings		0.227	31.6	0.09	4.73	7.1	1240	1.19	0.36	0.38	0.18	14.05	5.2	20	1.65	38.6
GS1_04_2.5 Yrs Goonyella tailings		0.412	12.20	0.12	6.38	31.8	1940	1.47	0.34	0.30	0.21	14.65	26.4	31	3.15	38.2
GS1_05_5 Yrs Goonyella tailings		0.460	14.60	0.13	6.73	44.1	3020	1.30	0.35	1.00	0.26	14.50	155.5	23	1.46	40.9
GRT_01_March 2011 Riverside tailings		0.168	21.0	0.32	6.39	3.3	3870	1.50	0.40	0.20	0.21	15.70	4.0	17	2.23	37.6
GRT_02_End 2010 Riverside tailings		0.072	42.2	0.48	4.32	2.8	580	1.32	0.36	0.10	0.12	14.85	5.2	15	2.59	34.3
GRT_03_2008 Riverside tailings		0.074	48.7	0.06	3.36	2.2	310	1.19	0.37	0.16	0.11	13.65	4.9	14	1.74	32.2
GRT_04_6 Mths Riverside tailings		0.084	37.7	0.06	4.01	5.4	1060	1.28	0.37	0.20	0.12	15.70	6.5	21	3.18	33.4
GRT_05_4 Mths Riverside tailings		0.113	37.4	0.45	3.69	5.2	820	1.28	0.35	0.25	0.14	14.40	6.5	36	2.58	37.0

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61. ME-MS61:REEs may not be totally soluble in this method.

***** See Appendix Page for comments regarding this certificate *****

ALS Minerals

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www.alsglobal.com

Finalized Date: 15-JUL-2011
Account: URSAUS

Project: GRM_EIS

CERTIFICATE OF ANALYSIS BR11127136

Sample Description / Method / Analyte / Units / LOR	ME-MS61 Fe % 0.01	ME-MS61 Ga ppm 0.05	ME-MS61 Ge ppm 0.05	ME-MS61 Hf ppm 0.1	ME-MS61 In ppm 0.005	ME-MS61 K % 0.01	ME-MS61 La ppm 0.5	ME-MS61 Li ppm 0.2	ME-MS61 Mg % 0.01	ME-MS61 Mn ppm 5	ME-MS61 Mo ppm 0.05	ME-MS61 Na % 0.01	ME-MS61 Nb ppm 0.1	ME-MS61 Ni ppm 0.2	ME-MS61 P ppm 10
GS1_01_12 Mths Goonyella tailings	4.37	21.3	0.22	2.4	0.081	0.92	4.2	57.2	0.30	650	3.75	0.17	7.6	25.6	300
GS1_02_6 Mths Goonyella tailings	5.78	19.85	0.22	2.3	0.094	0.56	4.8	71.7	0.28	1060	3.57	0.16	6.8	18.4	290
GS1_03_Recent Goonyella tailings	3.12	16.00	0.21	2.4	0.078	0.60	5.4	62.4	0.16	544	2.59	0.14	6.5	13.3	490
GS1_04_2.5 Yrs Goonyella tailings	3.35	20.7	0.16	2.7	0.089	0.94	5.8	63.4	0.19	367	3.42	0.18	8.2	56.5	300
GS1_05_5 Yrs Goonyella tailings	3.77	21.2	0.17	2.5	0.095	0.62	5.4	60.7	0.19	336	4.33	0.13	7.8	279	520
GRT_01_March 2011 Riverside tailings	4.13	19.55	0.19	3.0	0.087	0.58	6.2	57.0	0.20	816	3.90	0.14	6.7	10.0	410
GRT_02_End 2010 Riverside tailings	1.04	15.20	0.18	2.8	0.059	0.63	5.7	42.2	0.13	164	2.61	0.13	5.6	12.6	330
GRT_03_2008 Riverside tailings	1.15	12.10	0.22	2.4	0.054	0.45	5.4	38.0	0.13	150	1.39	0.13	5.0	11.6	290
GRT_04_6 Mths Riverside tailings	1.00	14.50	0.17	2.5	0.055	0.83	6.2	38.1	0.18	112	1.86	0.17	5.7	20.4	580
GRT_05_4 Mths Riverside tailings	1.69	15.05	0.27	2.3	0.064	0.73	5.7	45.1	0.14	224	2.07	0.09	6.5	25.7	300

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61. ME-MS61:REEs may not be totally soluble in this method.

***** See Appendix Page for comments regarding this certificate *****

ALS Minerals

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www.alsglobal.com

Finalized Date: 15-JUL-2011
Account: URSAUS

Project: GRM_EIS

CERTIFICATE OF ANALYSIS BR11127136

Sample Description	Method / Analyte / Units / LOR	ME-MS61 Pb ppm 0.5	ME-MS61 Rb ppm 0.1	ME-MS61 Re ppm 0.002	ME-MS61 S % 0.01	ME-MS61 Sb ppm 0.05	ME-MS61 Sc ppm 0.1	ME-MS61 Se ppm 1	ME-MS61 Sn ppm 0.2	ME-MS61 Sr ppm 0.2	ME-MS61 Ta ppm 0.05	ME-MS61 Te ppm 0.05	ME-MS61 Th ppm 0.2	ME-MS61 Ti % 0.005	ME-MS61 Tl ppm 0.02	ME-MS61 U ppm 0.1
GS1_01_12 Mths Goonyella tailings		20.3	22.9	0.002	0.49	0.85	9.1	1	2.2	138.0	0.65	0.14	3.2	0.407	0.72	2.6
GS1_02_6 Mths Goonyella tailings		20.1	12.6	0.002	0.60	0.88	8.0	1	2.1	124.0	0.60	0.13	3.5	0.360	0.58	2.4
GS1_03_Recent Goonyella tailings		17.5	15.9	0.002	0.22	0.80	6.5	1	2.1	111.5	0.54	0.12	3.8	0.313	0.45	2.2
GS1_04_2.5 Yrs Goonyella tailings		24.1	32.1	0.002	0.48	1.19	8.4	1	2.6	139.0	0.69	0.18	4.1	0.408	0.97	2.6
GS1_05_5 Yrs Goonyella tailings		21.6	12.8	0.003	0.62	1.19	7.9	2	2.3	214	0.60	0.21	3.7	0.418	1.18	2.4
GRT_01_March 2011 Riverside tailings		21.7	17.3	0.002	0.38	0.75	7.7	1	2.5	108.5	0.60	0.12	4.6	0.374	0.36	2.7
GRT_02_End 2010 Riverside tailings		17.1	23.8	<0.002	0.11	0.56	5.7	<1	2.2	129.5	0.48	0.13	4.3	0.284	0.32	2.2
GRT_03_2008 Riverside tailings		15.1	14.8	<0.002	0.14	0.52	5.1	1	1.8	95.3	0.41	0.11	3.5	0.241	0.25	1.8
GRT_04_6 Mths Riverside tailings		14.7	29.4	0.002	0.16	0.57	6.5	1	2.2	103.0	0.47	0.12	3.7	0.278	0.41	1.9
GRT_05_4 Mths Riverside tailings		16.8	24.3	<0.002	0.19	0.52	5.5	1	2.2	128.5	0.51	0.15	3.5	0.329	0.38	2.0

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61. ME-MS61:REEs may not be totally soluble in this method.

***** See Appendix Page for comments regarding this certificate *****

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Finalized Date: 15-JUL-2011
Account: URSAUS

Project: GRM_EIS

CERTIFICATE OF ANALYSIS BR11127136

Sample Description	Method / Analyte / Units / LOR	ME-MS61 V ppm 1	ME-MS61 W ppm 0.1	ME-MS61 Y ppm 0.1	ME-MS61 Zn ppm 2	ME-MS61 Zr ppm 0.5
GS1_01_12 Mths Goonyella tailings		77	1.4	7.0	61	75.3
GS1_02_6 Mths Goonyella tailings		62	1.4	7.2	71	75.0
GS1_03_Recent Goonyella tailings		58	1.2	8.3	70	83.3
GS1_04_2.5 Yrs Goonyella tailings		75	1.5	8.3	81	81.5
GS1_05_5 Yrs Goonyella tailings		93	1.4	9.2	97	92.0
GRT_01_March 2011 Riverside tailings		62	1.9	8.9	73	86.0
GRT_02_End 2010 Riverside tailings		63	1.1	9.2	43	91.1
GRT_03_2008 Riverside tailings		58	0.9	8.2	42	80.1
GRT_04_6 Mths Riverside tailings		66	1.2	9.0	50	83.4
GRT_05_4 Mths Riverside tailings		68	1.3	7.9	57	76.1

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61. ME-MS61:REEs may not be totally soluble in this method.

***** See Appendix Page for comments regarding this certificate *****

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Project: GRM_EIS

CERTIFICATE OF ANALYSIS BR11127136

Method	CERTIFICATE COMMENTS
ME-MS61	REE's may not be totally soluble in this method.

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Phone: +61 (7) 3243 7222 Fax: +61 (7) 3243 7218
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QC CERTIFICATE BR11127136

Project: GRM_EIS
P.O. No.: EN/001/10
This report is for 10 Pulp samples submitted to our lab in Brisbane, QLD, Australia on 8-JUL-2011.
The following have access to data associated with this certificate:

LAWRIE DUCK	TONY JONG	

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
LEV-01	Waste Disposal Levy
LOG-22	Sample login - Rcd w/o BarCode
ASH-01	Ashing of carbons/soils

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
ME-MS42	Up to 34 elements by ICP-MS	ICP-MS
C-IR07	Total Carbon (Leco)	LECO
ME-MS61	48 element four acid ICP-MS	

To: **URS AUSTRALIA PTY LTD**
ATTN: LAWRIE DUCK
LEVEL 14
240 QUEEN STREET
BRISBANE QLD 4000

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61. ME-MS61:REEs may not be totally soluble in this method.

Signature:

Shaun Kenny, Brisbane Laboratory Manager

ALS Minerals

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www.alsglobal.com

Finalized Date: 15-JUL-2011
Account: URSAUS

Project: GRM_EIS

QC CERTIFICATE OF ANALYSIS BR11127136

Sample Description	Method / Analyte / Units / LOR	ME-MS42 Hg ppm 0.005
	STANDARDS	
GBM908-10		0.018
Target Range - Lower Bound		0.009
Upper Bound		0.025
MRGeo08		0.066
Target Range - Lower Bound		0.055
Upper Bound		0.086
	BLANKS	
BLANK		<0.005
Target Range - Lower Bound		<0.005
Upper Bound		0.010
	DUPLICATES	
GRT_05_4 Mths Riverside tailings		0.113
DUP		0.115
Target Range - Lower Bound		0.100
Upper Bound		0.128

Comments: Samples >5% carbon were ashed prior to digestion for ME-MS61. ME-MS61:REEs may not be totally soluble in this method.

***** See Appendix Page for comments regarding this certificate *****

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Finalized Date: 15-JUL-2011
Account: URSAUS

Project: GRM_EIS

QC CERTIFICATE OF ANALYSIS BR11127136

Method	CERTIFICATE COMMENTS
ME-MS61	REE's may not be totally soluble in this method.

Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY

Job Code:

Due Date:

Comments:

Custody seal intact? YES NO N/A

Sample cold? YES NO N/A

FROM: Tony Jong
Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED:
Rapid turn-around

Project Name:	GRM_EIS
Project No:	42626689
Project Manager:	Kim Bidle
Agreement No.:	EN/001/10
Quote No.:	BN/060/11

Sampler Name:
Samples at ALS - previously analysed as EB1110489
Sampler Contact:

Released by:
Lawrie Duck
Date: 14/06/2011 **Time:** 17:00

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

Container Identification

	1	2	3	4	5	6	7	8	9	10	11
Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB
Preservative Code	none	none	none	none	none	none	none	none	none	none	none
Analytes	EA011 - Nett Acid Generation (NAG)	EA011E - Modified NAG with Extended Boil	Carbon (EP005, EP006, EP007)	EA046 - Acid Buffering Characteristic Curves (ABCC)	CEC (ED007)	Exchangeable (Ca, Mg, Na, K) (ED007)	ESP (ED007)	Four Acid 'Near Total' Digest with ICPAES/ICPMS finish (ME-MS61)	Mercury (ME-MS42)	1:5 Leach (EN34)	Analysis of 1:5 Leach (as per Page 2_1:5 Leach)

NOTES

Analysis as per ALS Quotation BN/060/11 - Phase 2: Part A and Part B (1) - Solids Analysis (NO COMPOSITES)

Laboratory ID	ALS Code ID	Northing (m)	Easting (m))	Sample ID	Matrix	Type	Lithology	No of bags	NAG	EA011E	Carbon	ABCC	CEC	Exchangeable	ESP	ME-MS61	Mercury	1:5 Leach	Analysis of 1:5 Leach	NOTES
	EB1110489-001	7588322.00	597856.00	GS1_01_12 Mths Goonyella tailings	Solid	Tailings	Coal Waste		X	X	X		X	X	X	X	X	X	X	
	EB1110489-002	7589035.00	59766.00	GS1_02_6 Mths Goonyella tailings	Solid	Tailings	Coal Waste		X	X	X	X	X	X	X	X	X	X	X	
	EB1110489-003	7588585.00	597292.00	GS1_03_Recent Goonyella tailings	Solid	Tailings	Coal Waste		X	X	X		X	X	X	X	X	X	X	
	EB1110489-004	7587459.00	597273.00	GS1_04_2.5 Yrs Goonyella tailings	Solid	Tailings	Coal Waste		X	X	X		X	X	X	X	X	X	X	
	EB1110489-005	7587469.00	598377.00	GS1_05_5 Yrs Goonyella tailings	Solid	Tailings	Coal Waste		X	X	X	X	X	X	X	X	X	X	X	
	EB1110489-006	7595270.00	598304.00	GRT_01_March 2011 Riverside Tailings	Solid	Tailings	Coal Waste		X	X	X	X	X	X	X	X	X	X	X	
	EB1110489-007	7594124.00	597637.00	GRT_02_End 2010 Riverside Tailings	Solid	Tailings	Coal Waste		X	X	X		X	X	X	X	X	X	X	
	EB1110489-008	7594196.00	597579.00	GRT_03_2008 Riverside Tailings	Solid	Tailings	Coal Waste		X	X	X		X	X	X	X	X	X	X	
	EB1110489-009	7594195.00	598286.00	GRT_04_6 Mths Riverside Tailings	Solid	Tailings	Coal Waste		X	X	X	X	X	X	X	X	X	X	X	
	EB1110489-010	7594845.00	598298.00	GRT_05_4 Mths Riverside Tailings	Solid	Tailings	Coal Waste		X	X	X		X	X	X	X	X	X	X	
Remarks to Lab:	Analysis as per ALS Quotation BN/060/11 - Phase 2: Part A and Part B (1) - Solids Analysis (NO COMPOSITES)						**TOTAL number of bags**	0	10	10	10	4	10	10	10	10	10	10	10	

TOTAL number of each analyte (final row above)

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

Email Results to: tony_jong@urscorp.com lawrie_duck@urscorp.com

NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES. GLOVES SHOULD BE WORN WHILST HANDLING SAMPLES.

Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY		
Job Code:		
Due Date:		
Comments:		
Custody seal intact?		
YES	NO	N/A
Sample cold?		
YES	NO	N/A

FROM: Tony Jong
Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED:
Rapid turn-around

Project Name:	GRM_EIS
Project No:	42626689
Project Manager:	Kim Bidle
Agreement No.:	EN/001/10
Quote No.:	BN/060/11

Sampler Name:
Samples to be produced as per Page 1 of this COC
Sampler Contact:

Released by:
Date: **Time:**

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

Container Identification

Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB
Preservative Code	none	none	none	none	none	none	none	none	none	none	none
Analytes	Soluble Metals by ICP-MS (Ag, Al, As, Cd, Co, Cr, Cu, Pb, Ni, Mn, Mo, Sb, Se, U, V, Zn) (EG020S)	Soluble Metals by ICP-AES (B, Fe) (EG005S)	Soluble Mercury (Hg) by FIMS (EG035S)	pH (1:5) (EA002)	EC (1:5) (EA010)	Soluble Cations by ICP-AES (Ca, Mg, Na, K) (ED093S)	Soluble Chloride (ED045G)	Soluble Sulfate (ED040S)	Alkalinity (ED037)	Sodium Adsorption Ratio (SAR) (EA006)	

NOTES

Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B (2) - Analysis of 1:5 Leach

Laboratory ID	ALS Code ID	Northing (m)	Easting (m))	Sample ID	Matrix	Type	Lithology	No of bottles		EG020S	EG005S	EG035S	EA002	EA010	ED093S	ED045G	ED040S	ED037	EA006		NOTES
	EB1110489-001	7588322.00	597856.00	GS1_01_12 Mths Goonyella tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-002	7589035.00	59766.00	GS1_02_6 Mths Goonyella tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-003	7588585.00	597292.00	GS1_03_Recent Goonyella tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-004	7587459.00	597273.00	GS1_04_2.5 Yrs Goonyella tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-005	7587469.00	598377.00	GS1_05_5 Yrs Goonyella tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-006	7595270.00	598304.00	GRT_01_March 2011 Riverside Tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-007	7594124.00	597637.00	GRT_02_End 2010 Riverside Tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-008	7594196.00	597579.00	GRT_03_2008 Riverside Tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-009	7594195.00	598286.00	GRT_04_6 Mths Riverside Tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-010	7594845.00	598298.00	GRT_05_4 Mths Riverside Tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
Remarks to Lab:	Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B (2) - Analysis of 1:5 Leach						**TOTAL number of bottles**	0	**TOTAL number of each analyte**	10	10	10	10	10	10	10	10	10	10		

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

Email Results to: tony_jong@urscorp.com lawrie_duck@urscorp.com

NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES. GLOVES SHOULD BE WORN WHILST HANDLING SAMPLES.

Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY
Job Code:
Due Date:
Comments:
Custody seal intact? YES NO N/A
Sample cold? YES NO N/A

FROM: Tony Jong
URS Australia: Level 16, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED: Turn-around-time = 2 weeks

Project Name: GRM_EIS
Project No: 42626689
Project Manager: Kim Bidle
Agreement No.: EN/001/10
Quote No.: BN/060/11

Sampler Name:
Sampler Contact:

Released by:
Date: **Time:**

Received for Laboratory by: J. PALAZZI ALS
Date: 26/5/11 **Time:** 16:00

Container Type, Preservative and Analysis

	Container Identification						
Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB
Preservative Code	none	none	none	none	none	none	none
Analytes	Sample Preparation - refer attached Sample Split & Preparation Spreadsheet	pH and EC (1:5)	NAPP	Chromium Reducible Sulfur (CRS)			

Laboratory ID	Sample ID	Depth (m)	Northing (m)	Easting (m)	Description (estimated deposition time/period, etc)	Matrix	Location	# Bags		Sample Preparation	pH and EC (1:5)	NAPP	CRS				NOTES
1	GS1_01		7588322.00	597856.00	12 Mths Goonyella tailings	Solid	Tailings dam GS1			X	X	X	X				
2	GS1_02		7589035.00	59766.00	6 Mths Goonyella tailings	Solid	Tailings dam GS1			X	X	X	X				
3	GS1_03		7588585.00	597292.00	Recent Goonyella tailings	Solid	Tailings dam GS1			X	X	X	X				
4	GS1_04		7587459.00	597273.00	2.5 Yrs Goonyella tailings	Solid	Tailings dam GS1			X	X	X	X				
5	GS1_05		7587469.00	598377.00	5 Yrs Goonyella tailings	Solid	Tailings dam GS1			X	X	X	X				
6	GRT_01		7595270.00	598304.00	March 2011 Riverside Tailings	Solid	Tailings Dam RS1			X	X	X	X				
7	GRT_02		7594124.00	597637.00	End 2010 Riverside Tailings	Solid	Tailings Dam RS1			X	X	X	X				
8	GRT_03		7594196.00	597579.00	2008 Riverside Tailings	Solid	Tailings Dam RS1			X	X	X	X				
9	GRT_04		7594195.00	598286.00	6 Mths Riverside Tailings	Solid	Tailings Dam RS1			X	X	X	X				
10	GRT_05		7594845.00	598298.00	4 Mths Riverside Tailings	Solid	Tailings Dam RS1			X	X	X	X				
Remarks to Lab:	Sample preparation as per attached Sample Split & Preparation Spreadsheet						TOTAL number of Samples	0	TOTAL number of each analyte	10	10	10	10	0	0	0	

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

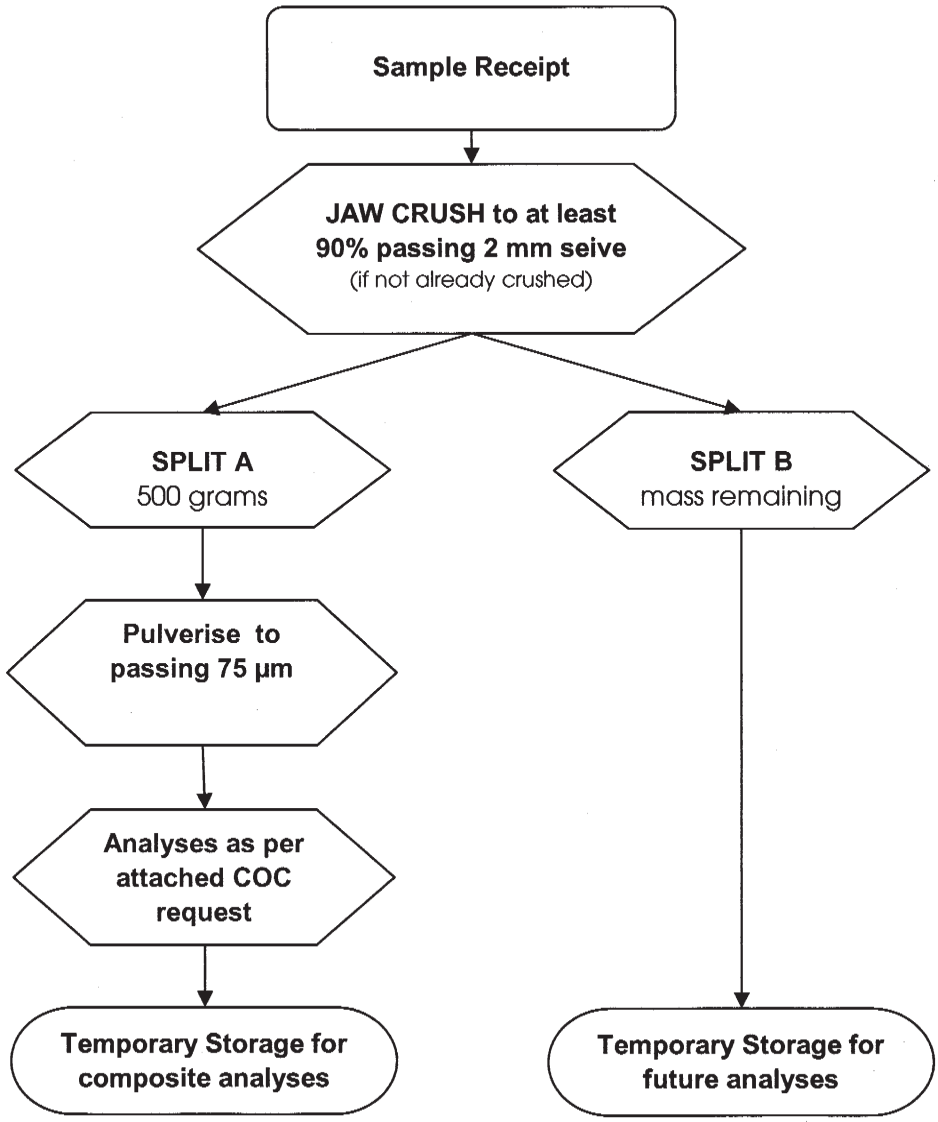
Email Results to: tony_jong@urscorp.com lawrie_duck@urscorp.com

NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES. GLOVES SHOULD BE WORN WHILST HANDLING SAMPLES.

Environmental Division
Brisbane
Work Order
EB1110489 VL.

Telephone : +61-7-3243 7222

URS Sample preparation request for: GRM_EIS



CERTIFICATE OF ANALYSIS

Work Order	: **EB1110489**	Page	: 1 of 4
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 26-MAY-2011
Sampler	: ----	Issue Date	: 09-JUN-2011
Site	: ----		
		No. of samples received	: 10
Quote number	: BN/060/11	No. of samples analysed	: 10

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

WORLD RECOGNISED ACCREDITATION

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.**

Analytical Results

Sub-Matrix: SOLID			Client sample ID	GS1_01 12 Mths Goonyella tailings	GS1_02 6 Mths Goonyella tailings	GS1_03 Recent Goonyella tailings	GS1_04 2.5 Yrs Goonyella tailings	GS1_05 5 Yrs Goonyella tailings
			Client sampling date / time	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00
Compound	CAS Number	LOR	Unit	EB1110489-001	EB1110489-002	EB1110489-003	EB1110489-004	EB1110489-005
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.0	7.9	9.2	7.7	7.6
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	29.3	11.9	17.2	55.4	60.4
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	556	1080	425	2230	2370
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	14.5	28.9	11.4	9.1	27.7
^ ANC as CaCO3	----	0.1	% CaCO3	1.5	2.9	1.2	0.9	2.8
Fizz Rating	----	0	Fizz Unit	0	2	0	0	2
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	1.35	1.31	0.708	1.83	2.30
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	1.43	1.33	0.93	2.11	2.88

Analytical Results

Sub-Matrix: SOLID			Client sample ID	GRT_01 March 2011 Riverside Tailings	GRT_02 End 2010 Riverside Tailings	GRT_03 2008 Riverside Tailings	GRT_04 6 Mths Riverside Tailings	GRT_05 4 Mths Riverside Tailings
			Client sampling date / time	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00	26-MAY-2011 15:00
Compound	CAS Number	LOR	Unit	EB1110489-006	EB1110489-007	EB1110489-008	EB1110489-009	EB1110489-010
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.8	8.8	8.7	8.4	8.2
EA009: Nett Acid Production Potential								
^ Net Acid Production Potential	----	0.5	kg H2SO4/t	20.7	4.3	3.6	5.6	23.7
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	609	711	619	1490	703
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	9.2	7.7	10.2	10.7	13.3
^ ANC as CaCO3	----	0.1	% CaCO3	0.9	0.8	1.0	1.1	1.4
Fizz Rating	----	0	Fizz Unit	0	0	0	0	0
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.668	0.097	0.083	0.145	1.03
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.98	0.39	0.45	0.53	1.21

QUALITY CONTROL REPORT

Work Order	: **EB1110489**	Page	: 1 of 5
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 26-MAY-2011
Sampler	: ----	Issue Date	: 09-JUN-2011
Order number	: ----		
		No. of samples received	: 10
Quote number	: BN/060/11	No. of samples analysed	: 10

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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED ACCREDITATION

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.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
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
RPD = Relative Percentage Difference
\# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA002 : pH (Soils) (QC Lot: 1811417)									
EB1110488-001	Anonymous	EA002: pH Value	----	0.1	pH Unit	7.9	8.0	0.0	0% - 20%
EB1110489-007	GRT_02 End 2010 Riverside Tailings	EA002: pH Value	----	0.1	pH Unit	8.8	8.9	0.0	0% - 20%
EA010: Conductivity (QC Lot: 1811418)									
EB1110488-001	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	320	331	3.4	0% - 20%
EB1110489-007	GRT_02 End 2010 Riverside Tailings	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	711	704	1.0	0% - 20%
EA013: Acid Neutralising Capacity (QC Lot: 1812464)									
EB1110488-001	Anonymous	EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	3.3	3.1	7.4	No Limit
EB1110489-008	GRT_03 2008 Riverside Tailings	EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	10.2	10.7	4.5	0% - 20%
EA026 : Chromium Reducible Sulfur (QC Lot: 1812465)									
EB1110488-001	Anonymous	EA026: Chromium Reducible Sulphur	----	0.005	%	0.167	0.167	0.0	0% - 20%
EB1110489-008	GRT_03 2008 Riverside Tailings	EA026: Chromium Reducible Sulphur	----	0.005	%	0.083	0.083	0.0	0% - 50%
ED042T: Total Sulfur by LECO (QC Lot: 1812587)									
EB1110489-001	GS1_01 12 Mths Goonyella tailings	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	1.43	1.26	12.2	0% - 20%
EB1110489-010	GRT_05 4 Mths Riverside Tailings	ED042T: Sulfur - Total as S (LECO)	----	0.01	%	1.21	1.24	2.6	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002 : pH (Soils) (QCLot: 1811417)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	101	97	103
EA010: Conductivity (QCLot: 1811418)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	91.8	85	115
EA013: Acid Neutralising Capacity (QCLot: 1812464)								
EA013: ANC as H2SO4	----	0.5	kg H2SO4/t	----	9.9 kg H2SO4/t	98.3	75	127
EA026 : Chromium Reducible Sulfur (QCLot: 1812465)								
EA026: Chromium Reducible Sulphur	----	0.005	%	<0.005	.28 %	82.3	80	120
ED042T: Total Sulfur by LECO (QCLot: 1812587)								
ED042T: Sulfur - Total as S (LECO)	----	0.01	%	<0.01	100 %	99.6	70	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) Results are required to be reported.**

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1110489**	Page	: 1 of 5
Client	: URS AUSTRALIA PTY LTD (QLD)	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 26-MAY-2011
Sampler	: ----	Issue Date	: 09-JUN-2011
Order number	: ----		
		No. of samples received	: 10
Quote number	: BN/060/11	No. of samples analysed	: 10

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 Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Work Order : EB1110489
Client : URS AUSTRALIA PTY LTD (QLD)
Project : 42626689 GRM_EIS

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non-volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **SOIL**

Evaluation: ✗ = Holding time breach ; ✓ = Within holding time.

Method / *Container / Client Sample ID(s)*	*Sample Date*	*Extraction / Preparation*			*Analysis*		
		Date extracted	*Due for extraction*	*Evaluation*	*Date analysed*	*Due for analysis*	*Evaluation*
EA002 : pH (Soils)							
Snap Lock Bag GS1_01 - 12 Mths Goonyella tailings, GS1_02 - 6 Mths Goonyella tailings, GS1_03 - Recent Goonyella tailings, GS1_04 - 2.5 Yrs Goonyella tailings, GS1_05 - 5 Yrs Goonyella tailings, GRT_01 - March 2011 Riverside Tailings, GRT_02 - End 2010 Riverside Tailings, GRT_03 - 2008 Riverside Tailings, GRT_04 - 6 Mths Riverside Tailings, GRT_05 - 4 Mths Riverside Tailings	**26-MAY-2011**	**02-JUN-2011**	02-JUN-2011	✓	**07-JUN-2011**	02-JUN-2011	✗
EA010: Conductivity							
Snap Lock Bag GS1_01 - 12 Mths Goonyella tailings, GS1_02 - 6 Mths Goonyella tailings, GS1_03 - Recent Goonyella tailings, GS1_04 - 2.5 Yrs Goonyella tailings, GS1_05 - 5 Yrs Goonyella tailings, GRT_01 - March 2011 Riverside Tailings, GRT_02 - End 2010 Riverside Tailings, GRT_03 - 2008 Riverside Tailings, GRT_04 - 6 Mths Riverside Tailings, GRT_05 - 4 Mths Riverside Tailings	**26-MAY-2011**	**02-JUN-2011**	02-JUN-2011	✓	**07-JUN-2011**	30-JUN-2011	✓
EA013: Acid Neutralising Capacity							
Pulp Bag GS1_01 - 12 Mths Goonyella tailings, GS1_02 - 6 Mths Goonyella tailings, GS1_03 - Recent Goonyella tailings, GS1_04 - 2.5 Yrs Goonyella tailings, GS1_05 - 5 Yrs Goonyella tailings, GRT_01 - March 2011 Riverside Tailings, GRT_02 - End 2010 Riverside Tailings, GRT_03 - 2008 Riverside Tailings, GRT_04 - 6 Mths Riverside Tailings, GRT_05 - 4 Mths Riverside Tailings	**26-MAY-2011**	**01-JUN-2011**	25-MAY-2012	✓	**09-JUN-2011**	28-NOV-2011	✓
EA026 : Chromium Reducible Sulfur							
Snap Lock Bag GS1_01 - 12 Mths Goonyella tailings, GS1_02 - 6 Mths Goonyella tailings, GS1_03 - Recent Goonyella tailings, GS1_04 - 2.5 Yrs Goonyella tailings, GS1_05 - 5 Yrs Goonyella tailings, GRT_01 - March 2011 Riverside Tailings, GRT_02 - End 2010 Riverside Tailings, GRT_03 - 2008 Riverside Tailings, GRT_04 - 6 Mths Riverside Tailings, GRT_05 - 4 Mths Riverside Tailings	**26-MAY-2011**	**01-JUN-2011**	27-MAY-2011	✗	**09-JUN-2011**	30-AUG-2011	✓
ED042T: Total Sulfur by LECO							
Pulp Bag GS1_01 - 12 Mths Goonyella tailings, GS1_02 - 6 Mths Goonyella tailings, GS1_03 - Recent Goonyella tailings, GS1_04 - 2.5 Yrs Goonyella tailings, GS1_05 - 5 Yrs Goonyella tailings, GRT_01 - March 2011 Riverside Tailings, GRT_02 - End 2010 Riverside Tailings, GRT_03 - 2008 Riverside Tailings, GRT_04 - 6 Mths Riverside Tailings, GRT_05 - 4 Mths Riverside Tailings	**26-MAY-2011**	**01-JUN-2011**	22-NOV-2011	✓	**01-JUN-2011**	22-NOV-2011	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Acid Neutralising Capacity (ANC)	EA013	2	14	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chromium Reducible Sulphur	EA026	2	14	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	2	14	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	2	14	**14.3**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfur - Total as S (LECO)	ED042T	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Acid Neutralising Capacity (ANC)	EA013	1	14	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chromium Reducible Sulphur	EA026	1	14	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	1	14	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	1	14	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfur - Total as S (LECO)	ED042T	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Chromium Reducible Sulphur	EA026	1	14	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	1	14	**7.1**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Sulfur - Total as S (LECO)	ED042T	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	(APHA 21st ed., 4500H+) pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 103)
Net Acid Production Potential	EA009	SOIL	Coastech Research (Canada)(Mod.). NAPP = Acid Production Potential (APP or MAP- Maximum Acid Potential) minus Neutralising Capacity (ANC). NAPP may be +ve, zero or -ve.
Electrical Conductivity (1:5)	EA010	SOIL	(APHA 21st ed., 2510) Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 104)
Acid Neutralising Capacity (ANC)	EA013	SOIL	USEPA 600/2-78-054, I. Miller (2000). A fizz test is done to semiquanititatively estimate the likely reactivity. The soil is then reacted with an known excess quanitity of an appropriate acid. Titration determines the acid remaining, and the ANC can be calculated from comparison with a blank titration.
Chromium Reducible Sulphur	EA026	SOIL	Sullivan et al (1998) The CRS method converts reduced inorganic sulfur to H_2S by $CrCl_2$ solution ; the evolved H_2S is trapped in a zinc acetate solution as ZnS which is quantified by iodometric titration.
Sulfur - Total as S (LECO)	ED042T	SOIL	In-house. Dried and pulverised sample is combusted in a LECO furnace at 1350C in the presence of strong oxidants / catalysts. The evolved S (as SO_2) is measured by infra-red detector

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**
- **For all matrices, no Laboratory Control outliers occur.**
- **For all matrices, no Matrix Spike outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002 : pH (Soils)						
Snap Lock Bag GS1_01 - 12 Mths Goonyella tailings, GS1_02 - 6 Mths Goonyella tailings, GS1_03 - Recent Goonyella tailings, GS1_04 - 2.5 Yrs Goonyella tailings, GS1_05 - 5 Yrs Goonyella tailings, GRT_01 - March 2011 Riverside Tailings, GRT_02 - End 2010 Riverside Tailings, GRT_03 - 2008 Riverside Tailings, GRT_04 - 6 Mths Riverside Tailings, GRT_05 - 4 Mths Riverside Tailings	----	----	----	07-JUN-2011	02-JUN-2011	**5**
EA026 : Chromium Reducible Sulfur						
Snap Lock Bag GS1_01 - 12 Mths Goonyella tailings, GS1_02 - 6 Mths Goonyella tailings, GS1_03 - Recent Goonyella tailings, GS1_04 - 2.5 Yrs Goonyella tailings, GS1_05 - 5 Yrs Goonyella tailings, GRT_01 - March 2011 Riverside Tailings, GRT_02 - End 2010 Riverside Tailings, GRT_03 - 2008 Riverside Tailings, GRT_04 - 6 Mths Riverside Tailings, GRT_05 - 4 Mths Riverside Tailings	01-JUN-2011	27-MAY-2011	**5**	----	----	----

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **EB1110489**		
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	Page	: 1 of 3
Order number	: ----		
C-O-C number	: ----	Quote number	: EB2011URSQLD0327 (BN/060/11)
Site	: ----		
Sampler	: ----	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 26-MAY-2011	Issue Date	: 31-MAY-2011 11:52
Client Requested Due Date	: 09-JUN-2011	Scheduled Reporting Date	: **09-JUN-2011**

Delivery Details

Mode of Delivery	: Client Drop off	Temperature	: 18.3°C
No. of coolers/boxes	: 1 DRUM	No. of samples received	: 10
Security Seal	: Intact.	No. of samples analysed	: 10

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Requested Deliverables
- **Samples received in appropriately pretreated and preserved containers.**
- **Sample(s) have been received within recommended holding times.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

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

- **No sample container / preservation non-compliance exist.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

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.

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - ASS1 NAPP	SOIL - EA002 pH (1:5)	SOIL - EA010 (solids): Electrical Conductivity (1:5) Electrical Conductivity (1:5)	SOIL - EA026 Chromium Reducible Sulphur
EB1110489-001	26-MAY-2011 15:00	GS1_01 12 Mths Goon..	✓	✓	✓	✓
EB1110489-002	26-MAY-2011 15:00	GS1_02 6 Mths Goony..	✓	✓	✓	✓
EB1110489-003	26-MAY-2011 15:00	GS1_03 Recent Goony.	✓	✓	✓	✓
EB1110489-004	26-MAY-2011 15:00	GS1_04 2.5 Yrs Goon...	✓	✓	✓	✓
EB1110489-005	26-MAY-2011 15:00	GS1_05 5 Yrs Goonye..	✓	✓	✓	✓
EB1110489-006	26-MAY-2011 15:00	GRT_01 March 2011 R..	✓	✓	✓	✓
EB1110489-007	26-MAY-2011 15:00	GRT_02 End 2010 Riv...	✓	✓	✓	✓
EB1110489-008	26-MAY-2011 15:00	GRT_03 2008 Riversi...	✓	✓	✓	✓
EB1110489-009	26-MAY-2011 15:00	GRT_04 6 Mths River...	✓	✓	✓	✓
EB1110489-010	26-MAY-2011 15:00	GRT_05 4 Mths River...	✓	✓	✓	✓

Requested Deliverables

DR TONY JONG		
- *AU Certificate of Analysis - NATA (COA)	Email	tony_jong@urscorp.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	tony_jong@urscorp.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	tony_jong@urscorp.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	tony_jong@urscorp.com
- Chain of Custody (CoC) (COC)	Email	tony_jong@urscorp.com
- EDI Format - EQUIS V5 URS (EQUV5_URS)	Email	tony_jong@urscorp.com
- EDI Format - MRED (MRED)	Email	tony_jong@urscorp.com
- EDI Format - XTab (XTAB)	Email	tony_jong@urscorp.com
MR LAWRIE DUCK		
- *AU Certificate of Analysis - NATA (COA)	Email	lawrie_duck@urscorp.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	lawrie_duck@urscorp.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	lawrie_duck@urscorp.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	lawrie_duck@urscorp.com
- Chain of Custody (CoC) (COC)	Email	lawrie_duck@urscorp.com
- EDI Format - EQUIS V5 URS (EQUV5_URS)	Email	lawrie_duck@urscorp.com
- EDI Format - MRED (MRED)	Email	lawrie_duck@urscorp.com
- EDI Format - XTab (XTAB)	Email	lawrie_duck@urscorp.com
RESULTS ADDRESS		
- *AU Certificate of Analysis - NATA (COA)	Email	brisbane@urscorp.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	brisbane@urscorp.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	brisbane@urscorp.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	brisbane@urscorp.com
- Chain of Custody (CoC) (COC)	Email	brisbane@urscorp.com
- EDI Format - EQUIS V5 URS (EQUV5_URS)	Email	brisbane@urscorp.com
- EDI Format - MRED (MRED)	Email	brisbane@urscorp.com
- EDI Format - XTab (XTAB)	Email	brisbane@urscorp.com
THE ACCOUNTS BRISBANE		
- A4 - AU Tax Invoice (INV)	Email	brisbane_accounts@urscorp.com

ALS Environmental

Acid Buffering Characteristic Curve (ABCC) REPORT

Batch: **EB1111542**

CONTACT:	TONY JONG	**LABORATORY:**	Brisbane
CLIENT:	URS AUSTRALIA PTY LTD (QLD)	**DATE SAMPLED:**	26/05/2011
ADDRESS:	GPO BOX 302	**DATE RECEIVED:**	14/06/2011
	BRISBANE, QLD, AUSTRALIA 4001	**DATE COMPLETED:**	5/06/2011
		SAMPLE TYPE:	Soil
		No. of SAMPLES:	4

COMMENTS

ISSUING LABORATORY: ALS BRISBANE

Address:	32 Shand Street	**Telephone:**	07 3243 7222
	STAFFORD QLD 4053	**Facsimile:**	07 3243 7218
	AUSTRALIA	**E-mail:**	Myles.Clark@alsenviro.com

Signatory

Australian Laboratory Services Pty Ltd (ABN 84 009 936 029)

Work Order :	EB1111542	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			GS1_01_12 Mths Goonyella
	Client Sample Identification 2			tailings
	Sample Date			26/05/2011
Method	Analyte	Units	LOR	
				2 EB1111542

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**28.9**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	8.53				
1	0.5	1.225	6.82				
2	1	2.45	6.30				
3	1.5	3.675	6.00				
4	2	4.9	5.79				
5	2.5	6.125	5.59				
6	3	7.35	5.45				
7	3.5	8.575	5.30				
8	4	9.8	5.14				
9	4.5	11.025	5.00				
10	5	12.25	4.87				
11	5.5	13.475	4.75				
12	6	14.7	4.64				
13	6.5	15.925	4.51				
14	7	17.15	4.36				
15	7.5	18.375	4.17				
16	8	19.6	3.96				
17	8.5	20.825	3.73				
18	9	22.05	3.53				
19	9.5	23.275	3.35				
20	10	24.5	3.19				
21	10.5	25.725	3.05				
22	11	26.95	2.94				
23	11.5	28.175	2.84				
24	12	29.4	2.76				
25	12.5	30.625	2.68				
26	13	31.85	2.62				
27	13.5	33.075	2.56				
28	14	34.3	2.51				
29	14.5	35.525	2.47				
30	15	36.75	2.43				
31	15.5	37.975	2.39				

Work Order : EB1111542 Client ID: URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			GS1_01_12 Mths Goonyella
	Client Sample Identification 2			tailings
	Sample Date			26/05/2011
Method	Analyte	Units	LOR	

2 Check
EB1111542

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**28.9**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	8.43				
1	0.5	1.225	6.62				
2	1	2.45	6.13				
3	1.5	3.675	5.9				
4	2	4.9	5.59				
5	2.5	6.125	5.39				
6	3	7.35	5.4				
7	3.5	8.575	5.23				
8	4	9.8	5.04				
9	4.5	11.025	5				
10	5	12.25	4.87				
11	5.5	13.475	4.75				
12	6	14.7	4.64				
13	6.5	15.925	4.51				
14	7	17.15	4.37				
15	7.5	18.375	4.14				
16	8	19.6	3.82				
17	8.5	20.825	3.72				
18	9	22.05	3.58				
19	9.5	23.275	3.23				
20	10	24.5	3.12				
21	10.5	25.725	3.00				
22	11	26.95	2.87				
23	11.5	28.175	2.67				
24	12	29.4	2.63				
25	12.5	30.625	2.59				
26	13	31.85	2.56				
27	13.5	33.075	2.52				
28	14	34.3	2.49				
29	14.5	35.525	2.46				
30	15	36.75	2.44				
31	15.5	37.975	2.41				
32	16	39.2	2.39				

Work Order :	EB1111542	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			GS1_05_5 Yrs Goonyella
	Client Sample Identification 2			tailings
	Sample Date			26/05/2011
Method	Analyte	Units	LOR	
				5 EB1111542

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.5**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**27.7**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	7.01				
1	0.5	1.225	5.19				
2	1	2.45	4.35				
3	1.5	3.675	3.85				
4	2	4.9	3.56				
5	2.5	6.125	3.38				
6	3	7.35	3.24				
7	3.5	8.575	3.13				
8	4	9.8	3.04				
9	4.5	11.025	2.96				
10	5	12.25	2.88				
11	5.5	13.475	2.82				
12	6	14.7	2.75				
13	6.5	15.925	2.70				
14	7	17.15	2.65				
15	7.5	18.375	2.61				
16	8	19.6	2.56				
17	8.5	20.825	2.52				
18	9	22.05	2.48				
19	9.5	23.275	2.44				
20	10	24.5	2.40				
21	10.5	25.725	2.37				

Work Order :	EB1111542	Client ID:	URS AUSTRALIA PTY LTD (QLD)

	Sub Matrix			Soil
	Client Sample Identification 1			GRT_01_March 2011 Riverside
	Client Sample Identification 2			tailings
	Sample Date			26/05/2011
Method	Analyte	Units	LOR	
				6 EB1111542

EA046 - A Titration information

HCl Molarity:	**M**	**0.1**
Increments:	**mL**	**0.1**
Weight	**(g)**	**2**
ANC	**kgH2SO4/t**	**9.2**

EA046 -B - Curve information

Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	6.92	36	3.6	8.82	2.82
1	0.1	0.245	5.79	37	3.7	9.065	2.80
2	0.2	0.49	5.32	38	3.8	9.31	2.78
3	0.3	0.735	5.02	39	3.9	9.555	2.76
4	0.4	0.98	4.79	40	4	9.8	2.74
5	0.5	1.225	4.54	41	4.1	10.045	2.73
6	0.6	1.47	4.36	42	4.2	10.29	2.71
7	0.7	1.715	4.19	43	4.3	10.535	2.69
8	0.8	1.96	4.05	44	4.4	10.78	2.68
9	0.9	2.205	3.95	45	4.5	11.025	2.66
10	1	2.45	3.84	46	4.6	11.27	2.64
11	1.1	2.695	3.75	47	4.7	11.515	2.63
12	1.2	2.94	3.66	48	4.8	11.76	2.62
13	1.3	3.185	3.59	49	4.9	12.005	2.60
14	1.4	3.43	3.53	50	5	12.25	2.59
15	1.5	3.675	3.48	51	5.1	12.495	2.57
16	1.6	3.92	3.43	52	5.2	12.74	2.56
17	1.7	4.165	3.38	53	5.3	12.985	2.55
18	1.8	4.41	3.33	54	5.4	13.23	2.54
19	1.9	4.655	3.29	55	5.5	13.475	2.52
20	2	4.9	3.24	56	5.6	13.72	2.51
21	2.1	5.145	3.21	57	5.7	13.965	2.50
22	2.2	5.39	3.18	58	5.8	14.21	2.49
23	2.3	5.635	3.14	59	5.9	14.455	2.48
24	2.4	5.88	3.11	60	6	14.7	2.47
25	2.5	6.125	3.08				
26	2.6	6.37	3.05				
27	2.7	6.615	3.02				
28	2.8	6.86	3.00				
29	2.9	7.105	2.97				
30	3	7.35	2.95				
31	3.1	7.595	2.93				
32	3.2	7.84	2.90				
33	3.3	8.085	2.88				
34	3.4	8.33	2.86				
35	3.5	8.575	2.84				

Work Order :	EB1111542	Client ID:	URS AUSTRALIA PTY LTD (QLD)

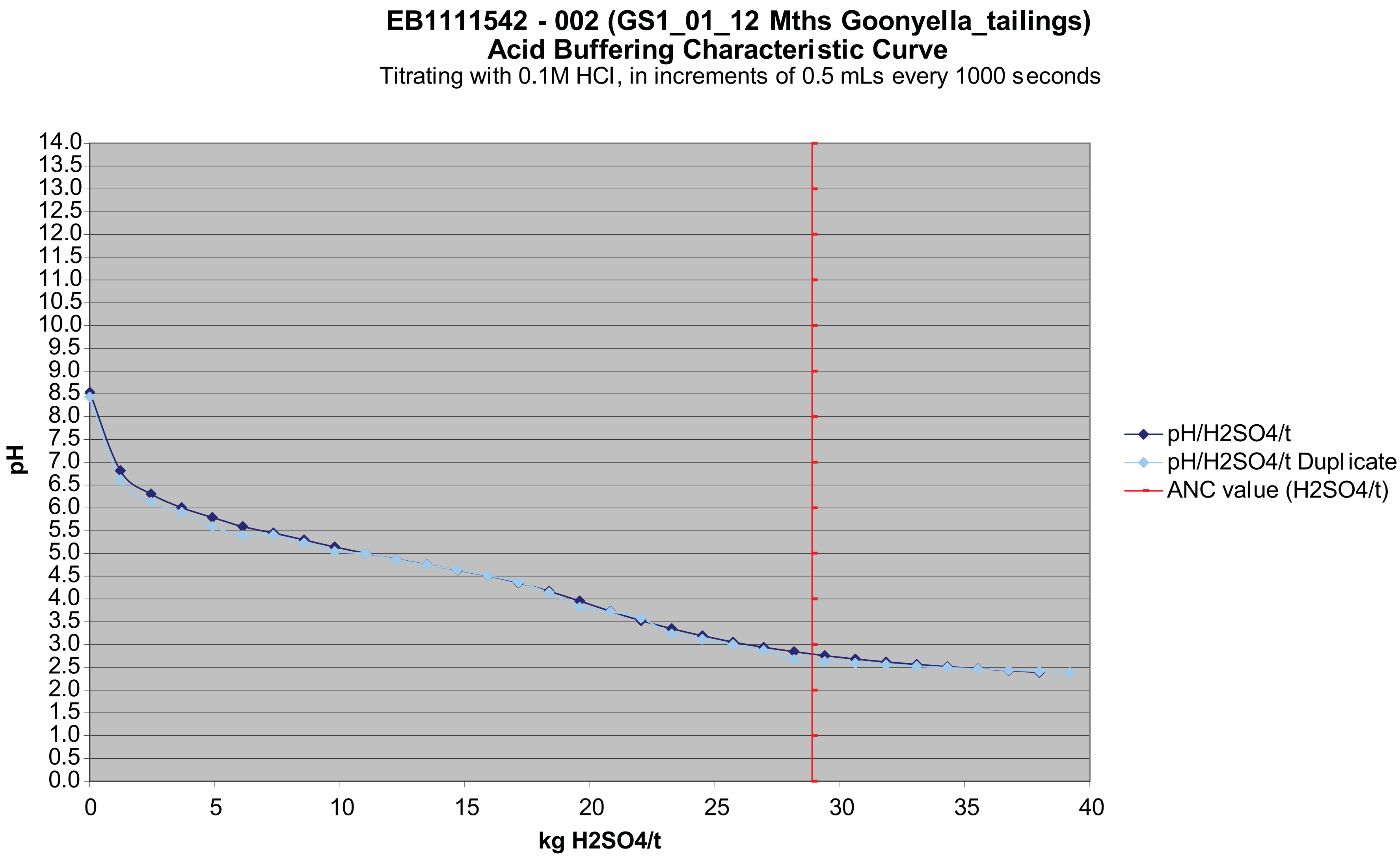
	Sub Matrix			Soil
	Client Sample Identification 1			GRT_04_6 Mths Riverside
	Client Sample Identification 2			tailings
	Sample Date			26/05/2011
Method	Analyte	Units	LOR	9 EB1111542

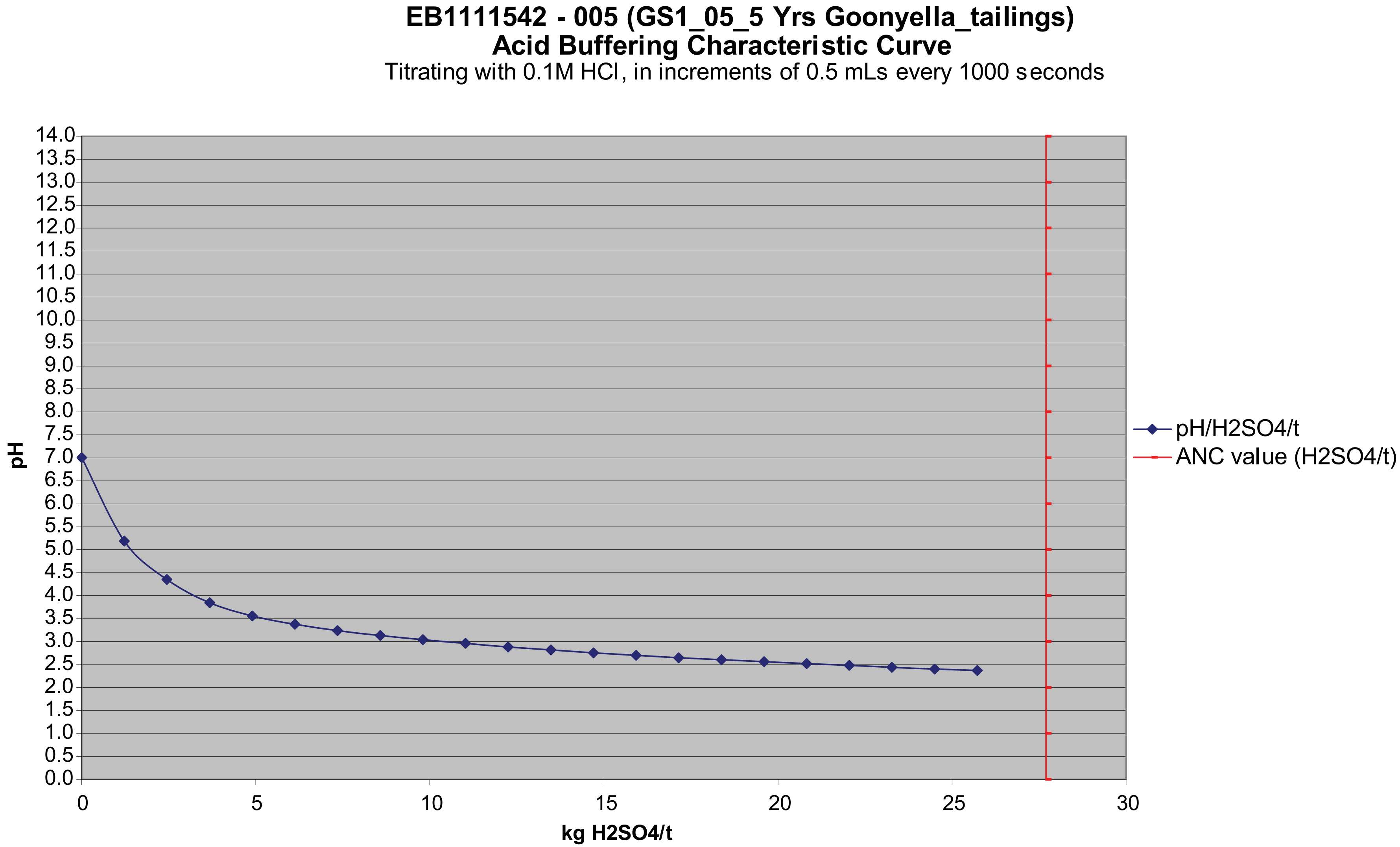
EA046 - A Titration information

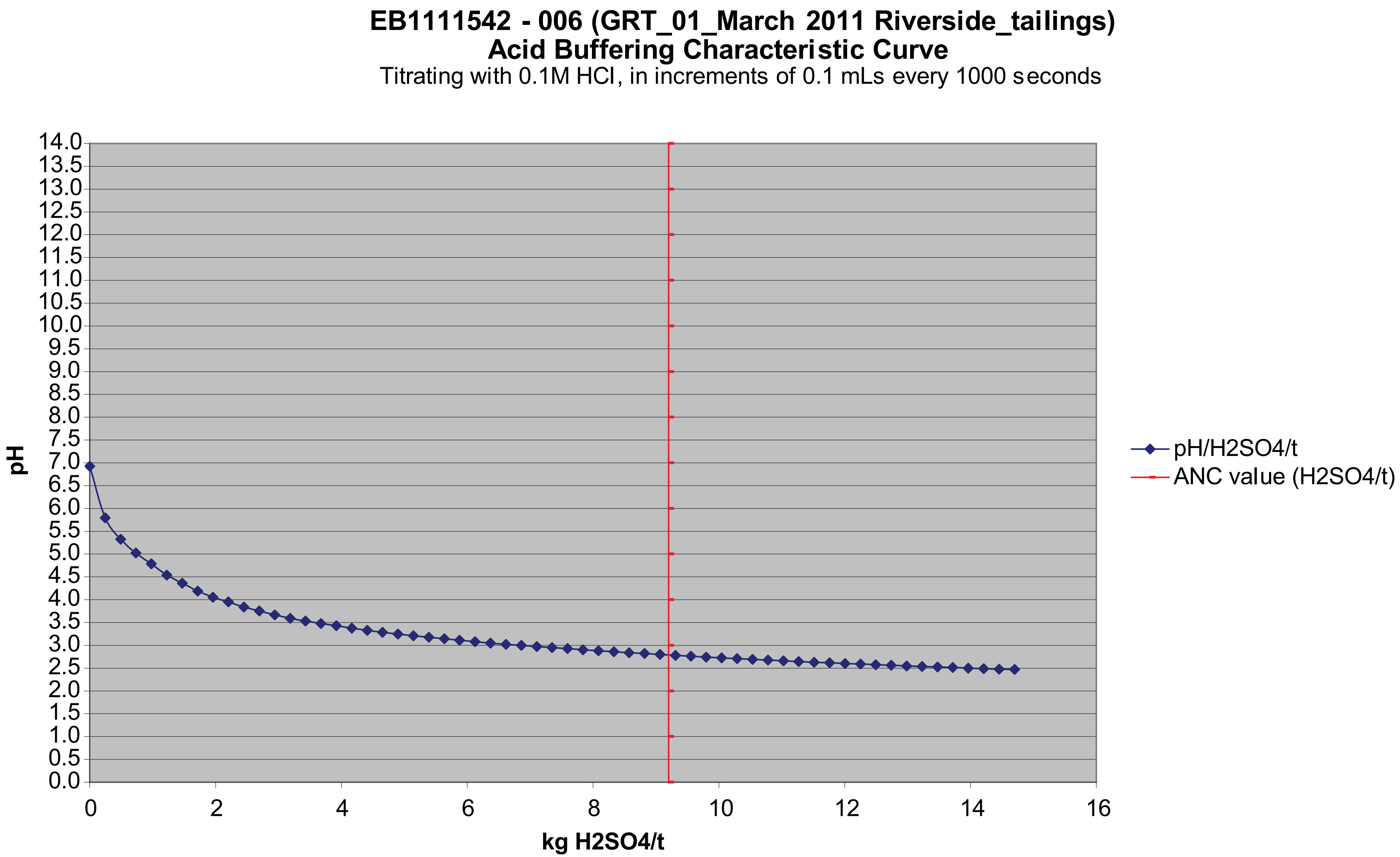
HCl Molarity:	M	0.1
Increments:	mL	0.2
Weight	(g)	2
ANC	kgH2SO4/t	10.7

EA046 -B - Curve information

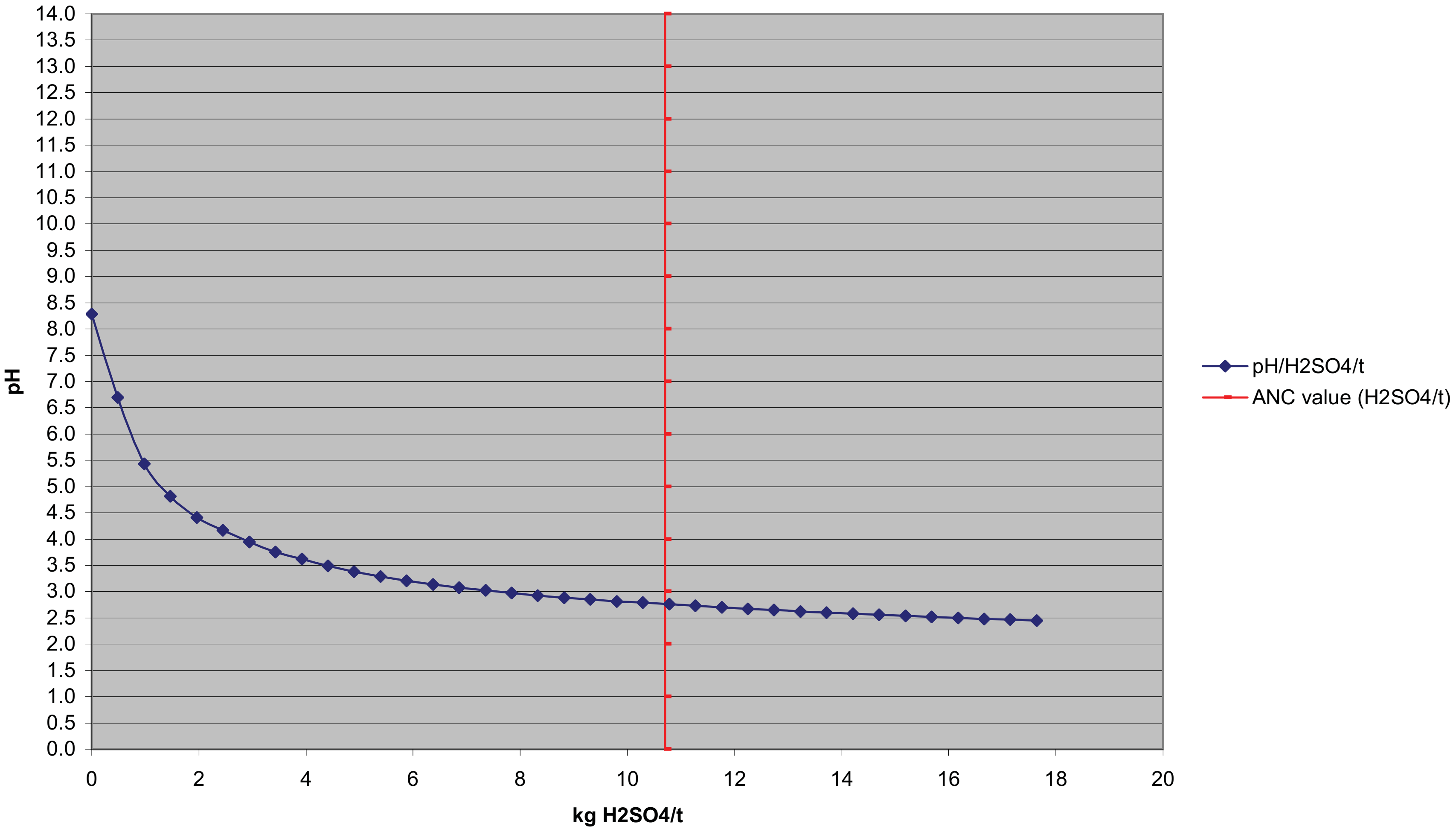
Addition	mLs adde (total)	kg H2SO4/t	pH	Addition	mLs adde (total)	kg H2SO4/t	pH
0	0	0	8.29	36	7.2	17.64	2.45
1	0.2	0.49	6.70				
2	0.4	0.98	5.43				
3	0.6	1.47	4.82				
4	0.8	1.96	4.41				
5	1	2.45	4.17				
6	1.2	2.94	3.94				
7	1.4	3.43	3.76				
8	1.6	3.92	3.63				
9	1.8	4.41	3.49				
10	2	4.9	3.38				
11	2.2	5.39	3.29				
12	2.4	5.88	3.20				
13	2.6	6.37	3.14				
14	2.8	6.86	3.08				
15	3	7.35	3.02				
16	3.2	7.84	2.97				
17	3.4	8.33	2.93				
18	3.6	8.82	2.89				
19	3.8	9.31	2.85				
20	4	9.8	2.82				
21	4.2	10.29	2.79				
22	4.4	10.78	2.76				
23	4.6	11.27	2.73				
24	4.8	11.76	2.70				
25	5	12.25	2.67				
26	5.2	12.74	2.65				
27	5.4	13.23	2.62				
28	5.6	13.72	2.60				
29	5.8	14.21	2.58				
30	6	14.7	2.56				
31	6.2	15.19	2.54				
32	6.4	15.68	2.52				
33	6.6	16.17	2.50				
34	6.8	16.66	2.48				
35	7	17.15	2.46				


EB1111542 - 002 (GS1_01_12 Mths Goonyella_tailings)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.5 mLs every 1000 seconds
pH
kg H2SO4/t
pH/H2SO4/t
pH/H2SO4/t Duplicate
ANC value (H2SO4/t)
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
5
10
15
20
25
30
35
40


EB1111542 - 005 (GS1_05_5 Yrs Goonyella_tailings)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.5 mLs every 1000 seconds
pH
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
5
10
15
20
25
30
kg H2SO4/t
pH/H2SO4/t
ANC value (H2SO4/t)


EB1111542 - 006 (GRT_01_March 2011 Riverside_tailings)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.1 mLs every 1000 seconds
pH
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
2
4
6
8
10
12
14
16
kg H2SO4/t
pH/H2SO4/t
ANC value (H2SO4/t)

EB1111542 - 009 (GRT_04_6 Mths Riverside_tailings)
Acid Buffering Characteristic Curve
Titrating with 0.1M HCl, in increments of 0.2 mLs every 1000 seconds



VRS Rebatch #2

Environmental Division
Brisbane
Work Order
EB1111542

JP KL

Telephone : +61-7-3243 7222

Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY		
Job Code:		
Due Date:		
Comments:		
Custody seal intact?		
YES	NO	N/A
Sample cold?		
YES	NO	N/A

FROM: Tony Jong
Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED:
Rapid turn-around

Project Name:	GRM_EIS
Project No:	42626689
Project Manager:	Kim Bidle
Agreement No.:	EN/001/10
Quote No.:	BN/060/11

Sampler Name:
Samples at ALS - previously analysed as EB1110489
Sampler Contact:

Released by:
Lawrie Duck
Date: 14/06/2011 **Time:** 17:00

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

Container Identification

	EA011 - Nett Acid Generation (NAG)	EA011E - Modified NAG with Extended Boil	Carbon (EP005, EP006, EP007)	EA046 - Acid Buffering Characteristic Curves (ABCC)	CEC (ED007)	Exchangeable (Ca, Mg, Na, K) (ED007)	ESP (ED007)	Four Acid 'Near Total' Digest with ICPAES/ICPMS finish (ME-MS61)	Mercury (ME-MS42)	1:5 Leach (EN34)	Analysis of 1:5 Leach (as per Page 2_1:5 Leach)	NOTES
Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	
Preservative Code	none	none	none	none	none	none	none	none	none	none	none	

Analysis as per ALS Quotation BN/060/11 - Phase 2: Part A and Part B (1) - Solids Analysis (NO COMPOSITES)

Laboratory ID	ALS Code ID	Northing (m)	Easting (m))	Sample ID	Matrix	Type	Lithology	No of bags	EA011	EA011E	Carbon	EA046	CEC	Exchangeable	ESP	Four Acid	Mercury	1:5 Leach	Analysis of 1:5 Leach	NOTES
1	EB1110489-001	7588322.00	597856.00	GS1_01_12 Mths Goonyella tailings	Solid	Tailings	Coal Waste		X	X	X		X	X	X	X	X	X	X	
2	EB1110489-002	7589035.00	59766.00	GS1_02_6 Mths Goonyella tailings	Solid	Tailings	Coal Waste		X	X	X	X	X	X	X	X	X	X	X	
3	EB1110489-003	7588585.00	597292.00	GS1_03_Recent Goonyella tailings	Solid	Tailings	Coal Waste		X	X	X		X	X	X	X	X	X	X	
4	EB1110489-004	7587459.00	597273.00	GS1_04_2.5 Yrs Goonyella tailings	Solid	Tailings	Coal Waste		X	X	X		X	X	X	X	X	X	X	
5	EB1110489-005	7587469.00	598377.00	GS1_05_5 Yrs Goonyella tailings	Solid	Tailings	Coal Waste		X	X	X	X	X	X	X	X	X	X	X	
6	EB1110489-006	7595270.00	598304.00	GRT_01_March 2011 Riverside Tailings	Solid	Tailings	Coal Waste		X	X	X	X	X	X	X	X	X	X	X	
7	EB1110489-007	7594124.00	597637.00	GRT_02_End 2010 Riverside Tailings	Solid	Tailings	Coal Waste		X	X	X		X	X	X	X	X	X	X	
8	EB1110489-008	7594196.00	597579.00	GRT_03_2008 Riverside Tailings	Solid	Tailings	Coal Waste		X	X	X		X	X	X	X	X	X	X	
9	EB1110489-009	7594195.00	598286.00	GRT_04_6 Mths Riverside Tailings	Solid	Tailings	Coal Waste		X	X	X	X	X	X	X	X	X	X	X	
10	EB1110489-010	7594845.00	598298.00	GRT_05_4 Mths Riverside Tailings	Solid	Tailings	Coal Waste		X	X	X		X	X	X	X	X	X	X	
Remarks to Lab:	Analysis as per ALS Quotation BN/060/11 - Phase 2: Part A and Part B (1) - Solids Analysis (NO COMPOSITES)						TOTAL number of bags	0	10	10	10	4	10	10	10	10	10	10	10	

(TOTAL number of each analyte: 10, 10, 10, 4, 10, 10, 10, 10, 10, 10, 10)

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

Email Results to: tony_jong@urscorp.com lawrie_duck@urscorp.com

NOTE: SAMPLES MAY CONTAIN DANGEROUS AND HAZARDOUS SUBSTANCES. GLOVES SHOULD BE WORN WHILST HANDLING SAMPLES.

Chain of Custody and Analyses Request

Submit samples to: ALS Environmental 07 3243 7222
26 Shand St, Stafford QLD

THIS SECTION FOR LAB USE ONLY		
Job Code:		
Due Date:		
Comments:		
Custody seal intact?		
YES	NO	N/A
Sample cold?		
YES	NO	N/A

FROM: Tony Jong
Level 17, 240 Queen Street Brisbane QLD 4000
Contact: Tony Jong or Lawrie Duck
Ph: 07 3243 2119 / 0409 130 088

RESULTS REQUIRED:
Rapid turn-around

Project Name:	GRM_EIS
Project No:	42626689
Project Manager:	Kim Bidle
Agreement No.:	EN/001/10
Quote No.:	BN/060/11

Sampler Name:
Samples to be produced as per Page 1 of this COC
Sampler Contact:

Released by:
Date: **Time:**

Received for Laboratory by:
Date: **Time:**

Container Type, Preservative and Analysis

Container Identification

Type*	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB	PsB
Preservative Code	none	none	none	none	none	none	none	none	none	none	none
Analytes	Soluble Metals by ICP-MS (Ag, Al, As, Cd, Co, Cr, Cu, Pb, Ni, Mn, Mo, Sb, Se, U, V, Zn) (EG020S)	Soluble Metals by ICP-AES (B, Fe) (EG005S)	Soluble Mercury (Hg) by FIMS (EG035S)	pH (1:5) (EA002)	EC (1:5) (EA010)	Soluble Cations by ICP-AES (Ca, Mg, Na, K) (ED093S)	Soluble Chloride (ED045G)	Soluble Sulfate (ED040S)	Alkalinity (ED037)	Sodium Adsorption Ratio (SAR) (EA006)	

NOTES

Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B (2) - Analysis of 1:5 Leach

Laboratory ID	ALS Code ID	Northing (m)	Easting (m))	Sample ID	Matrix	Type	Lithology	No of bottles													NOTES
	EB1110489-001	7588322.00	597856.00	GS1_01_12 Mths Goonyella tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-002	7589035.00	59766.00	GS1_02_6 Mths Goonyella tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-003	7588585.00	597292.00	GS1_03_Recent Goonyella tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-004	7587459.00	597273.00	GS1_04_2.5 Yrs Goonyella tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-005	7587469.00	598377.00	GS1_05_5 Yrs Goonyella tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-006	7595270.00	598304.00	GRT_01_March 2011 Riverside Tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-007	7594124.00	597637.00	GRT_02_End 2010 Riverside Tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-008	7594196.00	597579.00	GRT_03_2008 Riverside Tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-009	7594195.00	598286.00	GRT_04_6 Mths Riverside Tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
	EB1110489-010	7594845.00	598298.00	GRT_05_4 Mths Riverside Tailings	Liquid (1:5 Leach)	Tailings	Coal Waste			X	X	X	X	X	X	X	X	X	X		
Remarks to Lab:				**Analysis as per ALS Quotation BN/060/11 - Phase 2: Part B (2) - Analysis of 1:5 Leach**			**TOTAL number of bottles**	0	**TOTAL number of each analyte**	10	10	10	10	10	10	10	10	10	10		

Courier Job No.

* Container Type and Preservative Codes: P = Neutral Plastic; N = Nitric Acid Preserved; C = Sodium Hydroxide Preserved; J = Solvent Washed Acid Rinsed Jar; S = Solvent Washed Acid Rinsed Glass Bottle; VC = Hydrochloric Acid Preserved Vial; VS = Sulfuric Acid Preserved Vial; BS = Sulfuric Acid Preserved Glass Bottle; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; PsB = Neutral Plastic Bag

Email Results to: tony_jong@urscorp.com lawrie_duck@urscorp.com

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CERTIFICATE OF ANALYSIS

Work Order	: **EB1111542**	Page	: 1 of 8
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: DR LAWRENCE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Order number	: ----		
C-O-C number	: ----	Date Samples Received	: 14-JUN-2011
Sampler	: Samples at ALS	Issue Date	: 05-JUL-2011
Site	: ----		
		No. of samples received	: 10
Quote number	: BN/060/11	No. of samples analysed	: 10

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.

WORLD RECOGNISED ACCREDITATION

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
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

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.**
- **EG035S (Soluble Mercury),Sample EB1111542-002 (GS1_02_6 Mths)shows poor matrix spike recovery due to matrix interference. Confirmed by re-extraction and re-analysis.**

Analytical Results

Sub-Matrix: **PULP**

Compound	CAS Number	LOR	Unit	GS1_01_12 Mths Goonyella tailings	GS1_02_6 Mths Goonyella tailings	GS1_03_Recent Goonyella tailings	GS1_04_2.5 Yrs Goonyella tailings	GS1_05_5 Yrs Goonyella tailings
Client sampling date / time				[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]
				EB1111542-001	EB1111542-002	EB1111542-003	EB1111542-004	EB1111542-005
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	8.2	8.2	9.3	7.8	7.6
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Absorption Ratio	----	0.01	-	4.21	1.78	10.5	1.51	0.32
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	621	948	459	2710	2380
EA011: Net Acid Generation								
pH (OX)	----	0.1	pH Unit	3.3	4.2	4.1	2.5	2.4
NAG (pH 4.5)	----	0.1	kg H2SO4/t	4.8	0.8	1.2	35.5	35.0
NAG (pH 7.0)	----	0.1	kg H2SO4/t	21.9	13.3	19.2	41.6	39.9
EA011-A: pH Ox								
pH (OX)	----	0.1	pH Unit	3.8	4.5	4.8	2.2	2.4
pH -2 (ext)	----	0.1	pH Unit	2.5	----	----	2.2	2.3
EA011-B: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	135	----	----	177	216
Chloride	16887-00-6	1	mg/L	2	----	----	3	2
EA011-C: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	39	----	----	47	114
Magnesium	7439-95-4	1	mg/L	27	----	----	15	14
Sodium	7440-23-5	1	mg/L	8	----	----	10	4
Potassium	7440-09-7	1	mg/L	2	----	----	3	2
EA011-D: Calculated Components								
Calculated Acid Component	----	0.1	kg H2SO4/t	41.3	----	----	54.1	66.1
Calculated Neutralisng Component	----	0.1	kg H2SO4/t	22.4	----	----	19.7	34.7
Calculated NAG Acidity	----	0.1	kg H2SO4/t	18.9	----	----	34.4	31.4
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	5.2	15.5	7.9	18.1	31.1
^ Exchangeable Magnesium	----	0.1	meq/100g	4.4	5.1	2.8	7.0	4.8
^ Exchangeable Potassium	----	0.1	meq/100g	0.3	0.2	0.2	0.3	0.2
^ Exchangeable Sodium	----	0.1	meq/100g	2.4	2.2	2.6	3.6	0.8
^ Cation Exchange Capacity	----	0.1	meq/100g	12.2	23.1	13.6	29.1	36.9
^ Exchangeable Sodium Percent	----	0.1	%	19.6	9.6	19.5	12.5	2.2
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	217	211	340	88	141
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	217	211	317	88	141
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	<1	<1	23	<1	<1

Analytical Results

Sub-Matrix: **PULP**

Compound	CAS Number	LOR	Unit	GS1_01_12 Mths Goonyella tailings	GS1_02_6 Mths Goonyella tailings	GS1_03_Recent Goonyella tailings	GS1_04_2.5 Yrs Goonyella tailings	GS1_05_5 Yrs Goonyella tailings
Client sampling date / time				[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]
				EB1111542-001	EB1111542-002	EB1111542-003	EB1111542-004	EB1111542-005
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**1010**	**2200**	**360**	**8300**	**7830**
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	**200**	**80**	**320**	**240**	**50**
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	**80**	**360**	**10**	**2220**	**2790**
Magnesium	7439-95-4	10	mg/kg	**60**	**210**	<10	**550**	**390**
Sodium	7440-23-5	10	mg/kg	**470**	**440**	**440**	**800**	**170**
Potassium	7440-09-7	10	mg/kg	**20**	**20**	<10	**40**	**30**
EG005S : Soluble Metals by ICPAES								
Boron	7440-42-8	1	mg/kg	<1	<1	<1	<1	<1
Iron	7439-89-6	1	mg/kg	<1	<1	<1	<1	<1
EG020S: Soluble Metals by ICPMS								
Arsenic	7440-38-2	0.01	mg/kg	<0.01	<0.01	**0.02**	<0.01	<0.01
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	**0.1**	<0.1
Silver	7440-22-4	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	7440-43-9	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	7440-48-4	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	**0.11**
Chromium	7440-47-3	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	7440-50-8	0.01	mg/kg	<0.01	<0.01	**0.01**	<0.01	<0.01
Manganese	7439-96-5	0.01	mg/kg	**0.02**	**0.05**	<0.01	**0.26**	**0.34**
Molybdenum	7439-98-7	0.01	mg/kg	**0.02**	<0.01	**0.06**	<0.01	<0.01
Nickel	7440-02-0	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	**0.29**
Lead	7439-92-1	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	7440-61-1	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.01	mg/kg	<0.01	<0.01	<0.01	**0.01**	**0.01**
Vanadium	7440-62-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aluminium	7429-90-5	0.1	mg/kg	**0.2**	<0.1	**4.3**	<0.1	<0.1
EG035S: Soluble Mercury by FIMS								
Mercury	7439-97-6	0.0005	mg/kg	<0.0005	<0.0050	**0.0009**	<0.0005	<0.0005
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**5.76**	**10.6**	**27.2**	**11.1**	**13.2**
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	----	0.02	%	**7.25**	**12.5**	**31.6**	**12.2**	**14.6**
EP003TIC: Total inorganic Carbon (TIC) in Soil								

Analytical Results

Sub-Matrix: **PULP**			Client sample ID	GS1_01_12 Mths Goonyella tailings	GS1_02_6 Mths Goonyella tailings	GS1_03_Recent Goonyella tailings	GS1_04_2.5 Yrs Goonyella tailings	GS1_05_5 Yrs Goonyella tailings
			Client sampling date / time	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]
Compound	*CAS Number*	*LOR*	*Unit*	EB1111542-001	EB1111542-002	EB1111542-003	EB1111542-004	EB1111542-005
EP003TIC: Total inorganic Carbon (TIC) in Soil - Continued								
^ Total Inorganic Carbon	----	0.02	%	1.49	1.92	4.31	1.11	1.50

Analytical Results

Sub-Matrix: PULP			Client sample ID	GRT_01_March 2011 Riverside tailings	GRT_02_End 2010 Riverside tailings	GRT_03_2008 Riverside tailings	GRT_04_6 Mths Riverside tailings	GRT_05_4 Mths Riverside tailings
			Client sampling date / time	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]
Compound	CAS Number	LOR	Unit	EB1111542-006	EB1111542-007	EB1111542-008	EB1111542-009	EB1111542-010
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	7.9	9.3	9.1	8.6	8.2
EA006: Sodium Adsorption Ratio (SAR)								
^ Sodium Absorption Ratio	----	0.01	-	2.72	11.6	6.89	7.40	1.23
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	579	694	737	1300	664
EA011: Net Acid Generation								
pH (OX)	----	0.1	pH Unit	4.2	3.5	6.6	4.0	2.9
NAG (pH 4.5)	----	0.1	kg H2SO4/t	1.0	3.8	<0.1	1.4	17.3
NAG (pH 7.0)	----	0.1	kg H2SO4/t	16.3	16.7	0.2	13.0	31.4
EA011-A: pH Ox								
pH (OX)	----	0.1	pH Unit	4.3	3.7	6.7	4.5	2.9
pH -2 (ext)	----	0.1	pH Unit	2.7	6.0	----	----	2.5
EA011-B: Dissolved Major Anions								
Sulfur as S	63705-05-5	1	mg/L	84	21	----	----	110
Chloride	16887-00-6	1	mg/L	2	7	----	----	2
EA011-C: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	23	11	----	----	40
Magnesium	7439-95-4	1	mg/L	16	7	----	----	12
Sodium	7440-23-5	1	mg/L	7	12	----	----	6
Potassium	7440-09-7	1	mg/L	2	2	----	----	2
EA011-D: Calculated Components								
Calculated Acid Component	----	0.1	kg H2SO4/t	25.8	6.4	----	----	33.6
Calculated Neutralisng Component	----	0.1	kg H2SO4/t	13.7	7.2	----	----	15.8
Calculated NAG Acidity	----	0.1	kg H2SO4/t	12.2	<0.1	----	----	17.8
ED007: Exchangeable Cations								
^ Exchangeable Calcium	----	0.1	meq/100g	4.2	4.4	7.5	9.6	11.9
^ Exchangeable Magnesium	----	0.1	meq/100g	4.9	3.4	3.6	5.5	3.7
^ Exchangeable Potassium	----	0.1	meq/100g	0.2	0.3	0.2	0.4	0.3
^ Exchangeable Sodium	----	0.1	meq/100g	1.9	3.8	2.9	7.0	1.7
^ Cation Exchange Capacity	----	0.1	meq/100g	11.3	12.0	14.2	22.5	17.6
^ Exchangeable Sodium Percent	----	0.1	%	17.2	32.0	20.7	31.0	9.7
ED037: Alkalinity								
Total Alkalinity as CaCO3	----	1	mg/kg	105	508	393	269	269
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	105	410	357	269	269
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	<1	98	35	<1	<1

Work Order : EB1111542
Client : URS AUSTRALIA PTY LTD (QLD)
Project : 42626689 GRM_EIS

Analytical Results

Sub-Matrix: **PULP**			*Client sample ID*	GRT_01_March 2011 Riverside tailings	GRT_02_End 2010 Riverside tailings	GRT_03_2008 Riverside tailings	GRT_04_6 Mths Riverside tailings	GRT_05_4 Mths Riverside tailings
			Client sampling date / time	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]
Compound	*CAS Number*	*LOR*	*Unit*	**EB1111542-006**	**EB1111542-007**	**EB1111542-008**	**EB1111542-009**	**EB1111542-010**
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**1200**	**1030**	**1190**	**2470**	**1540**
ED045G: Chloride Discrete analyser								
Chloride	16887-00-6	10	mg/kg	**40**	**340**	**350**	**680**	**40**
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	**100**	**30**	**40**	**140**	**330**
Magnesium	7439-95-4	10	mg/kg	**80**	**20**	**40**	**140**	**120**
Sodium	7440-23-5	10	mg/kg	**350**	**790**	**810**	**1350**	**260**
Potassium	7440-09-7	10	mg/kg	**10**	**10**	**10**	**30**	**30**
EG005S : Soluble Metals by ICPAES								
Boron	7440-42-8	1	mg/kg	<1	<1	<1	<1	<1
Iron	7439-89-6	1	mg/kg	<1	<1	<1	<1	<1
EG020S: Soluble Metals by ICPMS								
Arsenic	7440-38-2	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Silver	7440-22-4	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	7440-43-9	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	7440-48-4	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	7440-47-3	0.01	mg/kg	<0.01	<0.01	**0.01**	<0.01	<0.01
Copper	7440-50-8	0.01	mg/kg	<0.01	**0.01**	<0.01	<0.01	<0.01
Manganese	7439-96-5	0.01	mg/kg	**0.18**	<0.01	**0.01**	**0.08**	**0.11**
Molybdenum	7439-98-7	0.01	mg/kg	<0.01	**0.09**	**0.05**	**0.05**	**0.03**
Nickel	7440-02-0	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Lead	7439-92-1	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Uranium	7440-61-1	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.01	mg/kg	<0.01	<0.01	<0.01	<0.01	**0.01**
Vanadium	7440-62-2	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aluminium	7429-90-5	0.1	mg/kg	<0.1	**1.0**	**0.1**	<0.1	<0.1
EG035S: Soluble Mercury by FIMS								
Mercury	7439-97-6	0.0005	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0005
EP003: Total Organic Carbon (TOC) in Soil								
Total Organic Carbon	----	0.02	%	**17.6**	**38.3**	**43.6**	**34.0**	**33.5**
EP003TC: Total Carbon (TC) in Soil								
Total Carbon	----	0.02	%	**21.0**	**42.4**	**48.7**	**37.7**	**37.4**
EP003TIC: Total inorganic Carbon (TIC) in Soil								

Analytical Results

Sub-Matrix: **PULP**			Client sample ID	GRT_01_March 2011 Riverside tailings	GRT_02_End 2010 Riverside tailings	GRT_03_2008 Riverside tailings	GRT_04_6 Mths Riverside tailings	GRT_05_4 Mths Riverside tailings
			Client sampling date / time	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]	[26-MAY-2011]
Compound	CAS Number	LOR	Unit	EB1111542-006	EB1111542-007	EB1111542-008	EB1111542-009	EB1111542-010
EP003TIC: Total inorganic Carbon (TIC) in Soil - Continued								
^ Total Inorganic Carbon	----	0.02	%	3.38	4.11	5.10	3.66	3.87

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

QUALITY CONTROL REPORT

Work Order	: **EB1111542**	Page	: 1 of 10
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: DR LAWRENCE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 14-JUN-2011
Sampler	: Samples at ALS	Issue Date	: 05-JUL-2011
Order number	: ----		
		No. of samples received	: 10
Quote number	: BN/060/11	No. of samples analysed	: 10

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 Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

NATA
WORLD RECOGNISED ACCREDITATION

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
Myles.Clark	Acid Sulfate Soils Supervisor	Brisbane Acid Sulphate Soils

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.

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
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
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR:- No Limit; Result between 10 and 20 times LOR:- 0% - 50%; Result > 20 times LOR:- 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA002 : pH (Soils) (QC Lot: 1846724)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EA002: pH Value	----	0.1	pH Unit	8.2	8.3	0.0	0% - 20%
EA010: Conductivity (QC Lot: 1846726)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	621	621	0.0	0% - 20%
EA011: Net Acid Generation (QC Lot: 1834339)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EA011: NAG (pH 4.5)	----	0.1	kg H2SO4/t	4.8	5.6	15.4	0% - 20%
		EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	21.9	22.2	1.4	0% - 20%
		EA011: pH (OX)	----	0.1	pH Unit	3.3	3.3	0.0	0% - 20%
EA011-A: pH Ox (QC Lot: 1834340)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EA011E: pH -2 (ext)	----	0.1	pH Unit	2.5	2.5	0.0	0% - 20%
EB1111542-010	GRT_05_4 Mths Riverside tailings	EA011E: pH -2 (ext)	----	0.1	pH Unit	2.5	2.5	0.0	0% - 20%
EA011-B: Dissolved Major Anions (QC Lot: 1834340)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EA011E: Sulfur as S	63705-05-5	1	mg/L	135	128	5.1	0% - 20%
		EA011E: Chloride	16887-00-6	1	mg/L	2	2	0.0	No Limit
EB1111542-010	GRT_05_4 Mths Riverside tailings	EA011E: Sulfur as S	63705-05-5	1	mg/L	110	110	0.0	0% - 20%
		EA011E: Chloride	16887-00-6	1	mg/L	2	2	0.0	No Limit
EA011-C: Dissolved Major Cations (QC Lot: 1834340)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EA011E: Calcium	7440-70-2	1	mg/L	39	38	2.6	0% - 20%
		EA011E: Magnesium	7439-95-4	1	mg/L	27	26	6.0	0% - 20%
		EA011E: Sodium	7440-23-5	1	mg/L	8	8	0.0	No Limit
		EA011E: Potassium	7440-09-7	1	mg/L	2	3	0.0	No Limit
EB1111542-010	GRT_05_4 Mths Riverside tailings	EA011E: Calcium	7440-70-2	1	mg/L	40	40	0.0	0% - 20%
		EA011E: Magnesium	7439-95-4	1	mg/L	12	12	0.0	0% - 50%
		EA011E: Sodium	7440-23-5	1	mg/L	6	6	0.0	No Limit
		EA011E: Potassium	7440-09-7	1	mg/L	2	2	0.0	No Limit
EA011-D: Calculated Components (QC Lot: 1834340)									

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EA011-D: Calculated Components (QC Lot: 1834340) - continued									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EA011E: Calculated Acid Component	----	0.1	kg H2SO4/t	41.3	39.2	5.1	0% - 20%
		EA011E: Calculated Neutralisng Component	----	0.1	kg H2SO4/t	22.4	21.6	3.8	0% - 20%
		EA011E: Calculated NAG Acidity	----	0.1	kg H2SO4/t	18.9	17.7	6.6	0% - 20%
EB1111542-010	GRT_05_4 Mths Riverside tailings	EA011E: Calculated Acid Component	----	0.1	kg H2SO4/t	33.6	33.6	0.0	0% - 20%
		EA011E: Calculated Neutralisng Component	----	0.1	kg H2SO4/t	15.8	15.8	0.0	0% - 20%
		EA011E: Calculated NAG Acidity	----	0.1	kg H2SO4/t	17.8	17.8	0.0	0% - 20%
ED007: Exchangeable Cations (QC Lot: 1834308)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	ED007: Exchangeable Calcium	----	0.1	meq/100g	5.2	5.1	0.0	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	4.4	4.4	0.0	0% - 20%
		ED007: Exchangeable Potassium	----	0.1	meq/100g	0.3	0.3	0.0	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	2.4	2.4	0.0	0% - 20%
ED007: Exchangeable Cations (QC Lot: 1834309)									
EB1111542-007	GRT_02_End 2010 Riverside tailings	ED007: Exchangeable Calcium	----	0.1	meq/100g	4.4	4.1	6.8	0% - 20%
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	3.4	3.2	8.3	0% - 20%
		ED007: Exchangeable Potassium	----	0.1	meq/100g	0.3	0.3	0.0	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	3.8	3.6	4.7	0% - 20%
ED037: Alkalinity (QC Lot: 1846730)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	ED037: Total Alkalinity as CaCO3	----	1	meq/kg	217	211	2.8	0% - 20%
ED040S: Soluble Major Anions (QC Lot: 1846725)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	1010	1030	2.0	0% - 20%
EB1111542-009	GRT_04_6 Mths Riverside tailings	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	2470	2540	2.6	0% - 20%
ED045G: Chloride Discrete analyser (QC Lot: 1846735)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	ED045G: Chloride	16887-00-6	10	mg/kg	200	200	0.0	0% - 20%
ED093S: Soluble Major Cations (QC Lot: 1846728)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	ED093S: Calcium	7440-70-2	10	mg/kg	80	80	0.0	No Limit
		ED093S: Magnesium	7439-95-4	10	mg/kg	60	60	0.0	No Limit
		ED093S: Sodium	7440-23-5	10	mg/kg	470	480	0.0	0% - 20%
		ED093S: Potassium	7440-09-7	10	mg/kg	20	20	0.0	No Limit
EB1111542-009	GRT_04_6 Mths Riverside tailings	ED093S: Calcium	7440-70-2	10	mg/kg	140	140	0.0	0% - 50%

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
ED093S: Soluble Major Cations (QC Lot: 1846728) - continued									
EB1111542-009	GRT_04_6 Mths Riverside tailings	ED093S: Magnesium	7439-95-4	10	mg/kg	140	140	0.0	0% - 50%
		ED093S: Sodium	7440-23-5	10	mg/kg	1350	1370	1.7	0% - 20%
		ED093S: Potassium	7440-09-7	10	mg/kg	30	30	0.0	No Limit
EG005S : Soluble Metals by ICPAES (QC Lot: 1846727)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EG005S: Boron	7440-42-8	1	mg/kg	<1	<1	0.0	No Limit
		EG005S: Iron	7439-89-6	1	mg/kg	<1	<1	0.0	No Limit
EB1111542-009	GRT_04_6 Mths Riverside tailings	EG005S: Boron	7440-42-8	1	mg/kg	<1	<1	0.0	No Limit
		EG005S: Iron	7439-89-6	1	mg/kg	<1	<1	0.0	No Limit
EG020S: Soluble Metals by ICPMS (QC Lot: 1846732)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EG020X-S: Arsenic	7440-38-2	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Cobalt	7440-48-4	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Chromium	7440-47-3	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Copper	7440-50-8	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Manganese	7439-96-5	0.01	mg/kg	0.02	0.02	0.0	No Limit
		EG020X-S: Molybdenum	7439-98-7	0.01	mg/kg	0.02	0.02	0.0	No Limit
		EG020X-S: Nickel	7440-02-0	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Lead	7439-92-1	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Antimony	7440-36-0	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Uranium	7440-61-1	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Zinc	7440-66-6	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020X-S: Vanadium	7440-62-2	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
		EG020X-S: Aluminium	7429-90-5	0.1	mg/kg	0.2	0.1	0.0	No Limit
EG020S: Soluble Metals by ICPMS (QC Lot: 1846733)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EG020Y-S: Cadmium	7440-43-9	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020Y-S: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EB1111542-009	GRT_04_6 Mths Riverside tailings	EG020Y-S: Cadmium	7440-43-9	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
		EG020Y-S: Selenium	7782-49-2	0.1	mg/kg	<0.1	<0.1	0.0	No Limit
EG020S: Soluble Metals by ICPMS (QC Lot: 1846734)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EG020Z-S: Silver	7440-22-4	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
EB1111542-009	GRT_04_6 Mths Riverside tailings	EG020Z-S: Silver	7440-22-4	0.01	mg/kg	<0.01	<0.01	0.0	No Limit
EG035S: Soluble Mercury by FIMS (QC Lot: 1846736)									

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
				Laboratory Duplicate (DUP) Report					
EG035S: Soluble Mercury by FIMS (QC Lot: 1846736) - continued									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EG035S: Mercury	7439-97-6	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
EP003: Total Organic Carbon (TOC) in Soil (QC Lot: 1833769)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EP003: Total Organic Carbon	----	0.02	%	5.76	6.01	4.2	0% - 20%
EP003TC: Total Carbon (TC) in Soil (QC Lot: 1833770)									
EB1111542-001	GS1_01_12 Mths Goonyella tailings	EP003TC: Total Carbon	----	0.02	%	7.25	7.26	0.0	0% - 20%

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002 : pH (Soils) (QCLot: 1846724)								
EA002: pH Value	----	0.1	pH Unit	----	5.2 pH Unit	101	97	103
EA006: Sodium Adsorption Ratio (SAR) (QCLot: 1842254)								
EA006: Sodium Absorption Ratio	----	0.01		<0.01	----	----	----	----
EA010: Conductivity (QCLot: 1846726)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	196 µS/cm	91.8	85	115
EA011: Net Acid Generation (QCLot: 1834339)								
EA011: NAG (pH 7.0)	----	0.1	kg H2SO4/t	----	12 kg H2SO4/t	100	84	114
EA011-A: pH Ox (QCLot: 1834340)								
EA011E: pH (OX)	----	0.1	pH Unit	----	2.7 pH Unit	96.3	80	120
EA011E: pH -2 (ext)	----	0.1	pH Unit	----	2.6 pH Unit	88.5	80	120
EA011-B: Dissolved Major Anions (QCLot: 1834340)								
EA011E: Sulfur as S	63705-05-5	1	mg/L	----	53 mg/L	93.0	80	120
EA011E: Chloride	16887-00-6	1	mg/L	----	1.0 mg/L	# Not Determined	80	120
EA011-C: Dissolved Major Cations (QCLot: 1834340)								
EA011E: Calcium	7440-70-2	1	mg/L	----	.9 mg/L	# Not Determined	80	120
EA011E: Magnesium	7439-95-4	1	mg/L	----	.17 mg/L	# Not Determined	80	120
EA011E: Sodium	7440-23-5	1	mg/L	----	2 mg/L	85.4	80	120
EA011E: Potassium	7440-09-7	1	mg/L	----	.5 mg/L	# Not Determined	80	120
EA011-D: Calculated Components (QCLot: 1834340)								
EA011E: Calculated Acid Component	----	0.1	kg H2SO4/t	----	16.2 kg H2SO4/t	93.1	80	120
EA011E: Calculated Neutralisng Component	----	0.1	kg H2SO4/t	----	.6 kg H2SO4/t	96.8	80	120
EA011E: Calculated NAG Acidity	----	0.1	kg H2SO4/t	----	16.2 kg H2SO4/t	89.5	80	120
ED007: Exchangeable Cations (QCLot: 1834308)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	1.2 meq/100g	106	70	130
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	0.65 meq/100g	102	70	130
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	0.20 meq/100g	73.6	70	130
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.4 meq/100g	91.1	70	130
ED007: Cation Exchange Capacity	----	0.1	meq/100g	----	2.46 meq/100g	99.4	70	130
ED007: Exchangeable Cations (QCLot: 1834309)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	1.2 meq/100g	108	70	130
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	0.65 meq/100g	105	70	130
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	0.20 meq/100g	75.3	70	130
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	0.4 meq/100g	94.7	70	130

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
ED007: Exchangeable Cations (QCLot: 1834309) - continued								
ED007: Cation Exchange Capacity	----	0.1	meq/100g	----	2.46 meq/100g	102	70	130
ED037: Alkalinity (QCLot: 1846730)								
ED037: Total Alkalinity as CaCO3	----	1	meq/kg	<1	200 meq/kg	99.5	85	115
ED040S: Soluble Major Anions (QCLot: 1846725)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	238 mg/kg	93.4	77	125
ED045G: Chloride Discrete analyser (QCLot: 1846735)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	5000 mg/kg	97.6	73	129
ED093S: Soluble Major Cations (QCLot: 1846728)								
ED093S: Calcium	7440-70-2	10	mg/kg	<10	----	----	----	----
ED093S: Magnesium	7439-95-4	10	mg/kg	<10	----	----	----	----
ED093S: Sodium	7440-23-5	10	mg/kg	<10	----	----	----	----
ED093S: Potassium	7440-09-7	10	mg/kg	<10	----	----	----	----
EG005S : Soluble Metals by ICPAES (QCLot: 1846727)								
EG005S: Boron	7440-42-8	1.00	mg/kg	<1	----	----	----	----
EG005S: Iron	7439-89-6	1.00	mg/kg	<1	----	----	----	----
EG020S: Soluble Metals by ICPMS (QCLot: 1846732)								
EG020X-S: Arsenic	7440-38-2	0.01	mg/kg	<0.01	0.5 mg/kg	110	84.7	124
EG020X-S: Cobalt	7440-48-4	0.01	mg/kg	<0.01	0.5 mg/kg	106	72	130
EG020X-S: Chromium	7440-47-3	0.01	mg/kg	<0.01	0.5 mg/kg	108	70	125
EG020X-S: Copper	7440-50-8	0.01	mg/kg	<0.01	1.0 mg/kg	99.8	70	130
EG020X-S: Manganese	7439-96-5	0.01	mg/kg	<0.01	0.5 mg/kg	104	77.6	130
EG020X-S: Molybdenum	7439-98-7	0.01	mg/kg	<0.01	0.5 mg/kg	107	83	117
EG020X-S: Nickel	7440-02-0	0.01	mg/kg	<0.01	0.5 mg/kg	99.1	78	124
EG020X-S: Lead	7439-92-1	0.01	mg/kg	<0.01	0.5 mg/kg	104	70	117
EG020X-S: Antimony	7440-36-0	0.01	mg/kg	<0.01	0.5 mg/kg	102	77	117
EG020X-S: Uranium	7440-61-1	0.01	mg/kg	<0.01	----	----	----	----
EG020X-S: Zinc	7440-66-6	0.01	mg/kg	<0.01	1.0 mg/kg	109	70	125
EG020X-S: Vanadium	7440-62-2	0.1	mg/kg	<0.1	0.5 mg/kg	114	83	125
EG020X-S: Aluminium	7429-90-5	0.1	mg/kg	<0.1	2.5 mg/kg	94.4	70	121
EG020S: Soluble Metals by ICPMS (QCLot: 1846733)								
EG020Y-S: Selenium	7782-49-2	0.1	mg/kg	<0.1	0.5 mg/kg	105	77	116
EG020Y-S: Cadmium	7440-43-9	0.01	mg/kg	<0.01	0.5 mg/kg	104	79	116
EG020S: Soluble Metals by ICPMS (QCLot: 1846734)								
EG020Z-S: Silver	7440-22-4	0.01	mg/kg	<0.01	0.5 mg/kg	101	75	130
EG035S: Soluble Mercury by FIMS (QCLot: 1846736)								
EG035S: Mercury	7439-97-6	0.0005	mg/kg	<0.0005	0.05 mg/kg	97.6	74	116
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 1833769)								

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
				Result	Concentration	LCS	Low	High
EP003: Total Organic Carbon (TOC) in Soil (QCLot: 1833769) - continued								
EP003: Total Organic Carbon	----	0.02	%	<0.02	100 %	99.0	70	130
EP003TC: Total Carbon (TC) in Soil (QCLot: 1833770)								
EP003TC: Total Carbon	----	0.02	%	<0.02	100 %	99.6	70	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report Spike Concentration	Spike Recovery (%) MS	Recovery Limits (%) Low	Recovery Limits (%) High
EG035S: Soluble Mercury by FIMS (QCLot: 1846736)							
EB1111542-002	GS1_02_6 Mths Goonyella tailings	EG035S: Mercury	7439-97-6	0.05 mg/kg	# 19.7	70	130

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

INTERPRETIVE QUALITY CONTROL REPORT

Work Order	: **EB1111542**	Page	: 1 of 12
Client	: URS AUSTRALIA PTY LTD (QLD)	Laboratory	: Environmental Division Brisbane
Contact	: DR LAWRENCE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Site	: ----		
C-O-C number	: ----	Date Samples Received	: 14-JUN-2011
Sampler	: Samples at ALS	Issue Date	: 05-JUL-2011
Order number	: ----		
		No. of samples received	: 10
Quote number	: BN/060/11	No. of samples analysed	: 10

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 Interpretive Quality Control Report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Parameter Frequency Compliance
- Brief Method Summaries
- Summary of Outliers

Analysis Holding Time Compliance

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and precludes subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the analysis aliquot was taken. Elapsed period to analysis represents number of days from sampling where no extraction / digestion is involved or period from extraction / digestion where this is present. For composite samples, sampling date is assumed to be that of the oldest sample contributing to the composite. Sample date for laboratory produced leachates is assumed as the completion date of the leaching process. Outliers for holding time are based on USEPA SW 846, APHA, AS and NEPM (1999). A listing of breaches is provided in the Summary of Outliers.

Holding times for leachate methods (excluding elutriates) vary according to the analytes being determined on the resulting solution. For non -volatile analytes, the holding time compliance assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These soil holding times are: Organics (14 days); Mercury (28 days) & other metals (180 days). A recorded breach therefore does not guarantee a breach for all non-volatile parameters.

Matrix: **SOIL**

Evaluation: ✘ = Holding time breach ; ✓ = Within holding time.

Method	*Sample Date*	*Extraction / Preparation*			*Analysis*		
***Container** / Client Sample ID(s)*		***Date extracted***	*Due for extraction*	*Evaluation*	***Date analysed***	*Due for analysis*	*Evaluation*
EA002 : pH (Soils)							
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	**26-MAY-2011**	**28-JUN-2011**	02-JUN-2011	✘	**29-JUN-2011**	28-JUN-2011	✘
EA006: Sodium Adsorption Ratio (SAR)							
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	**26-MAY-2011**	**28-JUN-2011**	22-NOV-2011	✓	**29-JUN-2011**	22-NOV-2011	✓
EA010: Conductivity							
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	**26-MAY-2011**	**28-JUN-2011**	02-JUN-2011	✘	**29-JUN-2011**	26-JUL-2011	✓
EA011: Net Acid Generation							
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	**26-MAY-2011**	**17-JUN-2011**	25-MAY-2012	✓	**28-JUN-2011**	14-DEC-2011	✓
EA011-A: pH Ox							
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	**26-MAY-2011**	**17-JUN-2011**	26-MAY-2011	✘	**28-JUN-2011**	26-MAY-2011	✘

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA011-B: Dissolved Major Anions								
Pulp Bag								
GS1_01_12 Mths Goonyella - tailings,	GS1_02_6 Mths Goonyella - tailings,	**26-MAY-2011**	**17-JUN-2011**	26-MAY-2011	×	**28-JUN-2011**	26-MAY-2011	×
GS1_03_Recent Goonyella - tailings,	GS1_04_2.5 Yrs Goonyella - tailings,							
GS1_05_5 Yrs Goonyella - tailings,	GRT_01_March 2011 Riverside - tailings,							
GRT_02_End 2010 Riverside - tailings,	GRT_03_2008 Riverside - tailings,							
GRT_04_6 Mths Riverside - tailings,	GRT_05_4 Mths Riverside - tailings							
EA011-C: Dissolved Major Cations								
Pulp Bag								
GS1_01_12 Mths Goonyella - tailings,	GS1_02_6 Mths Goonyella - tailings,	**26-MAY-2011**	**17-JUN-2011**	26-MAY-2011	×	**28-JUN-2011**	26-MAY-2011	×
GS1_03_Recent Goonyella - tailings,	GS1_04_2.5 Yrs Goonyella - tailings,							
GS1_05_5 Yrs Goonyella - tailings,	GRT_01_March 2011 Riverside - tailings,							
GRT_02_End 2010 Riverside - tailings,	GRT_03_2008 Riverside - tailings,							
GRT_04_6 Mths Riverside - tailings,	GRT_05_4 Mths Riverside - tailings							
EA011-D: Calculated Components								
Pulp Bag								
GS1_01_12 Mths Goonyella - tailings,	GS1_02_6 Mths Goonyella - tailings,	**26-MAY-2011**	**17-JUN-2011**	26-MAY-2011	×	**28-JUN-2011**	26-MAY-2011	×
GS1_03_Recent Goonyella - tailings,	GS1_04_2.5 Yrs Goonyella - tailings,							
GS1_05_5 Yrs Goonyella - tailings,	GRT_01_March 2011 Riverside - tailings,							
GRT_02_End 2010 Riverside - tailings,	GRT_03_2008 Riverside - tailings,							
GRT_04_6 Mths Riverside - tailings,	GRT_05_4 Mths Riverside - tailings							
EA046 Acid Buffering Characterisation Curves								
Pulp Bag								
GS1_02_6 Mths Goonyella - tailings,	GS1_05_5 Yrs Goonyella - tailings,	**26-MAY-2011**	**----**	----	----	**30-JUN-2011**	25-MAY-2012	✓
GRT_01_March 2011 Riverside - tailings,	GRT_04_6 Mths Riverside - tailings							
ED007: Exchangeable Cations								
Pulp Bag								
GS1_01_12 Mths Goonyella - tailings,	GS1_02_6 Mths Goonyella - tailings,	**26-MAY-2011**	**28-JUN-2011**	22-NOV-2011	✓	**29-JUN-2011**	22-NOV-2011	✓
GS1_03_Recent Goonyella - tailings,	GS1_04_2.5 Yrs Goonyella - tailings,							
GS1_05_5 Yrs Goonyella - tailings,	GRT_01_March 2011 Riverside - tailings,							
GRT_02_End 2010 Riverside - tailings,	GRT_03_2008 Riverside - tailings,							
GRT_04_6 Mths Riverside - tailings,	GRT_05_4 Mths Riverside - tailings							
ED037: Alkalinity								
Pulp Bag								
GS1_01_12 Mths Goonyella - tailings,	GS1_02_6 Mths Goonyella - tailings,	**26-MAY-2011**	**28-JUN-2011**	22-NOV-2011	✓	**29-JUN-2011**	22-NOV-2011	✓
GS1_03_Recent Goonyella - tailings,	GS1_04_2.5 Yrs Goonyella - tailings,							
GS1_05_5 Yrs Goonyella - tailings,	GRT_01_March 2011 Riverside - tailings,							
GRT_02_End 2010 Riverside - tailings,	GRT_03_2008 Riverside - tailings,							
GRT_04_6 Mths Riverside - tailings,	GRT_05_4 Mths Riverside - tailings							

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation: Date extracted	Due for extraction	Evaluation	Analysis: Date analysed	Due for analysis	Evaluation
ED040S : Soluble Sulfate by ICPAES							
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	**26-MAY-2011**	**28-JUN-2011**	02-JUN-2011	×	**29-JUN-2011**	26-JUL-2011	✓
ED045G: Chloride Discrete analyser							
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	**26-MAY-2011**	**28-JUN-2011**	02-JUN-2011	×	**29-JUN-2011**	26-JUL-2011	✓
ED093S: Soluble Major Cations							
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	**26-MAY-2011**	**28-JUN-2011**	22-NOV-2011	✓	**29-JUN-2011**	22-NOV-2011	✓
EG005S : Soluble Metals by ICPAES							
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	**26-MAY-2011**	**28-JUN-2011**	22-NOV-2011	✓	**29-JUN-2011**	22-NOV-2011	✓
EG020S: Soluble Metals by ICPMS							
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	**26-MAY-2011**	**28-JUN-2011**	22-NOV-2011	✓	**29-JUN-2011**	22-NOV-2011	✓
EG035S: Soluble Mercury by FIMS							
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	**26-MAY-2011**	**28-JUN-2011**	23-JUN-2011	×	**29-JUN-2011**	23-JUN-2011	×

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP003: Total Organic Carbon (TOC) in Soil								
Pulp Bag								
GS1_01_12 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_02_End 2010 Riverside - tailings, GRT_04_6 Mths Riverside - tailings,	GS1_02_6 Mths Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_05_4 Mths Riverside - tailings	**26-MAY-2011**	**17-JUN-2011**	23-JUN-2011	✓	**17-JUN-2011**	23-JUN-2011	✓
EP003TC: Total Carbon (TC) in Soil								
Pulp Bag								
GS1_01_12 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_02_End 2010 Riverside - tailings, GRT_04_6 Mths Riverside - tailings,	GS1_02_6 Mths Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_05_4 Mths Riverside - tailings	**26-MAY-2011**	**17-JUN-2011**	22-NOV-2011	✓	**17-JUN-2011**	22-NOV-2011	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(where) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Alkalinity in Soil	ED037	1	10	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Cations - soluble by ICP-AES	ED093S	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride Soluble By Discrete Analyser	ED045G	1	10	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	1	10	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Exchangeable Cations	ED007	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Net Acid Generation	EA011	1	10	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Net Acid Generation (Extended Boil)	EA011E	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	1	10	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Mercury by FIMS	EG035S	1	10	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICPAES	EG005S	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite X	EG020X-S	1	10	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite Y	EG020Y-S	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite Z	EG020Z-S	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Carbon	EP003TC	1	10	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	1	10	**10.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Laboratory Control Samples (LCS)							
Alkalinity in Soil	ED037	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride Soluble By Discrete Analyser	ED045G	2	10	**20.0**	**10.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Exchangeable Cations	ED007	2	10	**20.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Net Acid Generation	EA011	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Net Acid Generation (Extended Boil)	EA011E	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
pH (1:5)	EA002	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Mercury by FIMS	EG035S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICPAES	EG005S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite X	EG020X-S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite Y	EG020Y-S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite Z	EG020Z-S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Carbon	EP003TC	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Method Blanks (MB)							
Alkalinity in Soil	ED037	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Cations - soluble by ICP-AES	ED093S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Chloride Soluble By Discrete Analyser	ED045G	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Electrical Conductivity (1:5)	EA010	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Exchangeable Cations	ED007	2	10	**20.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Major Anions - Soluble	ED040S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Method Blanks (MB) - Continued							
Sodium Absorption Ratio (SAR)	EA006	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Mercury by FIMS	EG035S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICPAES	EG005S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite X	EG020X-S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite Y	EG020Y-S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Soluble Metals by ICP-MS - Suite Z	EG020Z-S	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Carbon	EP003TC	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Total Organic Carbon	EP003	1	10	**10.0**	**5.0**	✓	NEPM 1999 Schedule B(3) and ALS QCS3 requirement
Matrix Spikes (MS)							
Soluble Mercury by FIMS	EG035S	1	10	**10.0**	**5.0**	✓	ALS QCS3 requirement

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	(APHA 21st ed., 4500H+) pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 103)
Sodium Absorption Ratio (SAR)	EA006	SOIL	USEPA 600/2 - 78 - 54. The concentration as meq of Ca, Mg and Na are determined on saturated soil by water leach. Results are used to calculate SAR.
Electrical Conductivity (1:5)	EA010	SOIL	(APHA 21st ed., 2510) Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM (1999) Schedule B(3) (Method 104)
Net Acid Generation	EA011	SOIL	Miller (1998) Titremetric procedure determines net acidity in a soil following peroxide oxidation. Titrations to both pH 4.5 and pH 7 are reported.
Acid Buffering Characterisation Curves (ABCC's)	EA046	SOIL	Miller and Jeffery (1995) Determine the portion of an ANC value of a particular sample is readily available for acid neutralisation.
Exchangeable Cations	ED007	SOIL	Rayment & Higginson (1992) Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM (1999) Schedule B(3) (Method 301)
Alkalinity in Soil	ED037	SOIL	APHA 21st ed., 2320 B Alkalinity is determined and reported on a 1:5 soil/water leach.
Major Anions - Soluble	ED040S	SOIL	In-house. Soluble Anions are determined off a 1:5 soil / water extract by ICPAES.
Chloride Soluble By Discrete Analyser	ED045G	SOIL	The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm APHA 21st edition 4500-Cl- E.
Cations - soluble by ICP-AES	ED093S	SOIL	APHA 21st ed., 3120; USEPA SW 846 - 6010 (ICPAES) Water extracts of the soil are analyzed for major cations by ICPAES. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (1999) Schedule B(3)
Soluble Metals by ICPAES	EG005S	SOIL	(APHA 21st ed., 3120; USEPA SW 846 - 6010) (ICPAES) Soluble metals are determined following an appropriate soil / water extraction of the soil. The ICPAES technique ionises samples in a plasma, emitting characteristic spectrums based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards.
Soluble Metals by ICP-MS - Suite X	EG020X-S	SOIL	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Soluble Metals by ICP-MS - Suite Y	EG020Y-S	SOIL	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Soluble Metals by ICP-MS - Suite Z	EG020Z-S	SOIL	(APHA 21st ed., 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020): The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.

Analytical Methods	Method	Matrix	Method Descriptions
Soluble Mercury by FIMS	EG035S	SOIL	AS 3550, APHA 21st ed., 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the extract. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve.
Total Organic Carbon	EP003	SOIL	In-house C-IR17. Dried and pulverised sample is reacted with acid to remove inorganic Carbonates, then combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved (Organic) Carbon (as CO2) is automaticaly measured by infra-red detector.
Total Carbon	EP003TC	SOIL	In-house C-IR07. Dried and pulverised sample is combusted in a LECO furnace in the presence of strong oxidants / catalysts. The evolved Carbon (as CO2) is measured by infra-red detector
Total Inorganic Carbon	EP003TIC	SOIL	In-house C-CAL15. Determined as the difference between Total Carbon and Organic Carbon.

Preparation Methods	Method	Matrix	Method Descriptions
SAR Prep	EA006PR	SOIL	USEPA 600/2. Soil is bought to saturation with distilled water by capiliary action.
Exchangeable Cations Preparation Method	ED007PR	SOIL	Rayment & Higginson (1992) method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of distilled water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.
Sample splitting	GEO31	SOIL	Sample aliquots are split for use in other departments, eg Minerals

Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged in the Quality Control (QC) Report. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). This report displays QC Outliers (breaches) only.

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **SOIL**

Compound Group Name	Laboratory Sample ID	Client Sample ID	Analyte	CAS Number	Data	Limits	Comment
Laboratory Control Spike (LCS) Recoveries							
EA011-B: Dissolved Major Anions	2161187-004	----	**Chloride**	16887-00-6	Not Determined	----	**Standard recovery not determined, result less than LOR**
EA011-C: Dissolved Major Cations	2161187-004	----	**Calcium**	7440-70-2	Not Determined	----	**Standard recovery not determined, result less than LOR**
EA011-C: Dissolved Major Cations	2161187-004	----	**Magnesium**	7439-95-4	Not Determined	----	**Standard recovery not determined, result less than LOR**
EA011-C: Dissolved Major Cations	2161187-004	----	**Potassium**	7440-09-7	Not Determined	----	**Standard recovery not determined, result less than LOR**
Matrix Spike (MS) Recoveries							
EG035S: Soluble Mercury by FIMS	EB1111542-002	GS1_02_6 Mths Goonyella taili	**Mercury**	7439-97-6	19.7 %	70-130%	**Recovery less than lower data quality objective**

- **For all matrices, no Method Blank value outliers occur.**
- **For all matrices, no Duplicate outliers occur.**

Regular Sample Surrogates

- **For all regular sample matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

This report displays Holding Time breaches only. Only the respective Extraction / Preparation and/or Analysis component is/are displayed.

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
Container / Client Sample ID(s)	*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EA002 : pH (Soils)						
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	28-JUN-2011	02-JUN-2011	**26**	29-JUN-2011	28-JUN-2011	**1**
EA010: Conductivity						

Matrix: **SOIL**

Method	*Extraction / Preparation*			*Analysis*		
Container / Client Sample ID(s)	*Date extracted*	*Due for extraction*	***Days overdue***	*Date analysed*	*Due for analysis*	***Days overdue***
EA010: Conductivity - Analysis Holding Time Compliance						
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	28-JUN-2011	02-JUN-2011	**26**	----	----	----
EA011-A: pH Ox						
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	17-JUN-2011	26-MAY-2011	**22**	28-JUN-2011	26-MAY-2011	**33**
EA011-B: Dissolved Major Anions						
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	17-JUN-2011	26-MAY-2011	**22**	28-JUN-2011	26-MAY-2011	**33**
EA011-C: Dissolved Major Cations						
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	17-JUN-2011	26-MAY-2011	**22**	28-JUN-2011	26-MAY-2011	**33**
EA011-D: Calculated Components						
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	17-JUN-2011	26-MAY-2011	**22**	28-JUN-2011	26-MAY-2011	**33**
ED040S : Soluble Sulfate by ICPAES						
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	28-JUN-2011	02-JUN-2011	**26**	----	----	----
ED045G: Chloride Discrete analyser						

Matrix: **SOIL**

Method Container / Client Sample ID(s)	Extraction / Preparation Date extracted	 Due for extraction	 Days overdue	Analysis Date analysed	 Due for analysis	 Days overdue
ED045G: Chloride Discrete analyser - Analysis Holding Time Compliance						
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	28-JUN-2011	02-JUN-2011	**26**	----	----	----
EG035S: Soluble Mercury by FIMS						
Pulp Bag GS1_01_12 Mths Goonyella - tailings, GS1_02_6 Mths Goonyella - tailings, GS1_03_Recent Goonyella - tailings, GS1_04_2.5 Yrs Goonyella - tailings, GS1_05_5 Yrs Goonyella - tailings, GRT_01_March 2011 Riverside - tailings, GRT_02_End 2010 Riverside - tailings, GRT_03_2008 Riverside - tailings, GRT_04_6 Mths Riverside - tailings, GRT_05_4 Mths Riverside - tailings	28-JUN-2011	23-JUN-2011	**5**	29-JUN-2011	23-JUN-2011	**6**

Outliers : Frequency of Quality Control Samples

The following report highlights breaches in the Frequency of Quality Control Samples.

- **No Quality Control Sample Frequency Outliers exist.**

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

SAMPLE RECEIPT NOTIFICATION (SRN)

Comprehensive Report

Work Order	: **EB1111542**		
Client	: **URS AUSTRALIA PTY LTD (QLD)**	Laboratory	: Environmental Division Brisbane
Contact	: MR LAWRIE DUCK	Contact	: Dean Sullivan
Address	: GPO BOX 302 BRISBANE QLD, AUSTRALIA 4001	Address	: 32 Shand Street Stafford QLD Australia 4053
E-mail	: lawrie_duck@urscorp.com	E-mail	: dean.sullivan@alsglobal.com
Telephone	: +61 32432111	Telephone	: +61 7 3243 7144
Facsimile	: +61 07 32432199	Facsimile	: +61 7 3243 7218
Project	: 42626689 GRM_EIS	Page	: 1 of 4
Order number	: ----		
C-O-C number	: ----	Quote number	: EB2011URSQLD0327 (BN/060/11)
Site	: ----		
Sampler	: Samples at ALS	QC Level	: NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Dates

Date Samples Received	: 14-JUN-2011	Issue Date	: 17-JUN-2011 09:21
Client Requested Due Date	: 30-JUN-2011	Scheduled Reporting Date	: **30-JUN-2011**

Delivery Details

Mode of Delivery	: Samples on hand	Temperature	: AMBIENT
No. of coolers/boxes	: REBATCH	No. of samples received	: 10
Security Seal	: Intact.	No. of samples analysed	: 10

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Requested Deliverables
- **Sample containers do not comply to pretreatment / preservation standards (AS, APHA, USEPA). Please refer to the Sample Container(s)/Preservation Non-Compliance Log at the end of this report for details.**
- **Total metals (four-acid digest) analysis will be performed by ALS Minerals and reported separately.**
- **Sample(s) have been received within recommended holding times.**
- Discounted Package Prices apply only when specific ALS Group Codes ('W', 'S', 'NT' suites) are referenced on COCs.
- Please direct any turn around / technical queries to the laboratory contact designated above.
- Please direct any queries related to sample condition / numbering / breakages to Matt Goodwin.
- Analytical work for this work order will be conducted at ALS Brisbane.
- Sample Disposal - Aqueous (14 days), Solid (90 days) from date of completion of work order.

Sample Container(s)/Preservation Non-Compliances

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

Method *Client sample ID*	**Sample Container Received**	**Preferred Sample Container for Analysis**
EA006 : Sodium Absorption Ratio (SAR)		
GS1_01_12 Mths Goonyella tailings	- Pulp Bag	- Soil Glass Jar - Unpreserved
GS1_02_6 Mths Goonyella tailings	- Pulp Bag	- Soil Glass Jar - Unpreserved
GS1_03_Recent Goonyella tailings	- Pulp Bag	- Soil Glass Jar - Unpreserved
GS1_04_2.5 Yrs Goonyella tailings	- Pulp Bag	- Soil Glass Jar - Unpreserved
GS1_05_5 Yrs Goonyella tailings	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRT_01_March 2011 Riverside tailings	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRT_02_End 2010 Riverside tailings	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRT_03_2008 Riverside tailings	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRT_04_6 Mths Riverside tailings	- Pulp Bag	- Soil Glass Jar - Unpreserved
GRT_05_4 Mths Riverside tailings	- Pulp Bag	- Soil Glass Jar - Unpreserved

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process neccessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.

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.

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - EA002 pH (1:5)	SOIL - EA006 (solids) Sodium Absorption Ratio	SOIL - EA010 (solids): Electrical Conductivity (1:5) Electrical Conductivity (1:5)	SOIL - EA011 Net Acid Generation (NAG)	SOIL - EA011E Net Acid Generation (Extended Boil)	SOIL - EA046 Acid Buffering Characterisation Curve	SOIL - ED007 CEC / Exchangeable Cations (ED007)	SOIL - ED037 Alkalinity in Soil
EB1111542-001	[26-MAY-2011]	GS1_01_12 Mths Goony	✓	✓	✓	✓	✓		✓	✓
EB1111542-002	[26-MAY-2011]	GS1_02_6 Mths Goonye	✓	✓	✓	✓	✓	✓	✓	✓
EB1111542-003	[26-MAY-2011]	GS1_03_Recent Goonye	✓	✓	✓	✓	✓		✓	✓
EB1111542-004	[26-MAY-2011]	GS1_04_2.5 Yrs Goony.	✓	✓	✓	✓	✓		✓	✓
EB1111542-005	[26-MAY-2011]	GS1_05_5 Yrs Goonyel.	✓	✓	✓	✓	✓	✓	✓	✓
EB1111542-006	[26-MAY-2011]	GRT_01_March 2011 Ri.	✓	✓	✓	✓	✓	✓	✓	✓
EB1111542-007	[26-MAY-2011]	GRT_02_End 2010 Rive.	✓	✓	✓	✓	✓		✓	✓
EB1111542-008	[26-MAY-2011]	GRT_03_2008 Riversid..	✓	✓	✓	✓	✓		✓	✓
EB1111542-009	[26-MAY-2011]	GRT_04_6 Mths Rivers..	✓	✓	✓	✓	✓	✓	✓	✓
EB1111542-010	[26-MAY-2011]	GRT_05_4 Mths Rivers..	✓	✓	✓	✓	✓		✓	✓

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - ED040S Soluble Major Anions	SOIL - ED045G (solids) Chloride Soluble by Discrete Analyser	SOIL - ED093S Cations - Soluble	SOIL - EG005S Soluble Metals by ICPAES	SOIL - EG020S Soluble Metals by ICPMS	SOIL - EG035S Soluble Mercury by FIMS	SOIL - EP003 Total Organic Carbon (TOC) in Soil	SOIL - EP003TC Total Carbon in Soil
EB1111542-001	[26-MAY-2011]	GS1_01_12 Mths Goony	✓	✓	✓	✓	✓	✓	✓	✓
EB1111542-002	[26-MAY-2011]	GS1_02_6 Mths Goonye	✓	✓	✓	✓	✓	✓	✓	✓
EB1111542-003	[26-MAY-2011]	GS1_03_Recent Goonye	✓	✓	✓	✓	✓	✓	✓	✓
EB1111542-004	[26-MAY-2011]	GS1_04_2.5 Yrs Goony.	✓	✓	✓	✓	✓	✓	✓	✓

			SOIL - ED040S Soluble Major Anions	SOIL - ED045G (solids) Chloride Soluble by Discrete Analyser	SOIL - ED093S Cations - Soluble	SOIL - EG005S Soluble Metals by ICPAES	SOIL - EG020S Soluble Metals by ICPMS	SOIL - EG035S Soluble Mercury by FIMS	SOIL - EP003 Total Organic Carbon (TOC) in Soil	SOIL - EP003TC Total Carbon in Soil
EB1111542-005	[26-MAY-2011]	GS1_05_5 Yrs Goonyel.	✓	✓	✓	✓	✓	✓	✓	✓
EB1111542-006	[26-MAY-2011]	GRT_01_March 2011 Ri.	✓	✓	✓	✓	✓	✓	✓	✓
EB1111542-007	[26-MAY-2011]	GRT_02_End 2010 Rive.	✓	✓	✓	✓	✓	✓	✓	✓
EB1111542-008	[26-MAY-2011]	GRT_03_2008 Riversid..	✓	✓	✓	✓	✓	✓	✓	✓
EB1111542-009	[26-MAY-2011]	GRT_04_6 Mths Rivers..	✓	✓	✓	✓	✓	✓	✓	✓
EB1111542-010	[26-MAY-2011]	GRT_05_4 Mths Rivers..	✓	✓	✓	✓	✓	✓	✓	✓

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - EP003TIC Total Inorganic Carbon in Soil
EB1111542-001	[26-MAY-2011]	GS1_01_12 Mths Goony	✓
EB1111542-002	[26-MAY-2011]	GS1_02_6 Mths Goonye	✓
EB1111542-003	[26-MAY-2011]	GS1_03_Recent Goonye	✓
EB1111542-004	[26-MAY-2011]	GS1_04_2.5 Yrs Goony.	✓
EB1111542-005	[26-MAY-2011]	GS1_05_5 Yrs Goonyel.	✓
EB1111542-006	[26-MAY-2011]	GRT_01_March 2011 Ri.	✓
EB1111542-007	[26-MAY-2011]	GRT_02_End 2010 Rive.	✓
EB1111542-008	[26-MAY-2011]	GRT_03_2008 Riversid..	✓
EB1111542-009	[26-MAY-2011]	GRT_04_6 Mths Rivers..	✓
EB1111542-010	[26-MAY-2011]	GRT_05_4 Mths Rivers..	✓

Requested Deliverables

DR TONY JONG		
- *AU Certificate of Analysis - NATA (COA)	Email	tony_jong@urscorp.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	tony_jong@urscorp.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	tony_jong@urscorp.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	tony_jong@urscorp.com
- Attachment - Report (SUBCO)	Email	tony_jong@urscorp.com
- Chain of Custody (CoC) (COC)	Email	tony_jong@urscorp.com
- EDI Format - EQUIS V5 URS (EQUIS_V5_URS)	Email	tony_jong@urscorp.com
- EDI Format - MRED (MRED)	Email	tony_jong@urscorp.com
- EDI Format - XTab (XTAB)	Email	tony_jong@urscorp.com
MR LAWRIE DUCK		
- *AU Certificate of Analysis - NATA (COA)	Email	lawrie_duck@urscorp.com
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	lawrie_duck@urscorp.com
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	lawrie_duck@urscorp.com
- A4 - AU Sample Receipt Notification - Environmental (SRN)	Email	lawrie_duck@urscorp.com
- Attachment - Report (SUBCO)	Email	lawrie_duck@urscorp.com
- Chain of Custody (CoC) (COC)	Email	lawrie_duck@urscorp.com
- EDI Format - EQUIS V5 URS (EQUIS_V5_URS)	Email	lawrie_duck@urscorp.com
- EDI Format - MRED (MRED)	Email	lawrie_duck@urscorp.com
- EDI Format - XTab (XTAB)	Email	lawrie_duck@urscorp.com
THE ACCOUNTS BRISBANE		
- A4 - AU Tax Invoice (INV)	Email	brisbane_accounts@urscorp.com

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