TECHNICAL REPORT

Geochemical Assessment of Waste Rock and Coal Reject
Vulcan Complex Project

Prepared for: **Vitrinite Pty. Ltd.**

LEADERS IN MINING GEOCHEMISTRY

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1 INTRODUCTION

1.1 Project Overview

Vitrinite Pty. Ltd., owner of Qld Coal Aust No. 1 Pty. Ltd. And Queensland Coking Coal Pty. Ltd. (Vitrinite) is the proponent of the Vulcan Complex Project (VCP), located north of Dysart and approximately 33 km south-east of Moranbah in Queensland's Bowen Basin (**Figure 1**). The Project lies to the immediate west of several established mining operations including BHP's Peak Downs and Saraji mines.

The Jupiter hard coking coal target has been defined and selected for open cut development via a single pit. The project will operate for 4 years and will extract approximately 6 million tonnes (Mt) of Run of Mine (ROM) hard coking coal at a rate of up to 1.95 Mt per annum. The Project will target the Alex and multiple Dysart Lower coal seams. Truck and shovel operations will be used to develop the pit. ROM coal will be trucked off site for toll washing at a nearby facility between Moranbah and Coppabella on the Peak Downs Highway.

A small out-of-pit waste rock dump will be established prior to commencing in-pit dumping activities that will continue for the life of the operation. Ancillary infrastructure, including a ROM pad, Mine Infrastructure Area (MIA), offices, roads and surface water management infrastructure will be established to the west and south of the open cut.

A realignment of the existing Saraji Road and services infrastructure to the eastern boundary of the proposed Mining Lease Application (MLA) area, adjacent to the existing rail easement, is also proposed (**Figure 2**). The re-alignment will occur on lease however the connection back to the existing alignment of Saraji Road to the north will extend off lease and will be subject to a separate approvals process.

In-pit dumping will fill the majority of the pit during operations with the remaining final void to be backfilled upon cessation of mining, resulting in the establishment of a low waste rock dump (WRD) landform over the former pit area. The initial out-of-pit WRD will be rehabilitated in-situ.

Vitrinite has been granted an Environmental Authority (EA0002054) and a Mineral Development Licence (MDL3039) to permit extraction of a bulk sample of coal from the Jupiter target. Prior to commencement of the VCP, Vitrinite will extract up to 6 Mt of high-quality ROM coking coal from the bulk sample pit for testing by a number of international coal consumers. To access the coking coal within the bulk sample area, up to an additional 150 kt of weathered thermal coal lying above the coking coal will also be extracted incidentally. The bulk sample does not form part of the VCP, however its features are assumed to form part of baseline conditions for the purposes of environmental assessment of the VCP.

1.2 Bulk Sample and Baseline Conditions

The approved Bulk Sample Project (BSP) is located within the proposed VCP target footprint. It will include an in-pit WRD and two out of pit WRDs, and small scale ancillary infrastructure including an MIA, ROM pad, haul roads and surface water management infrastructure. It is Vitrinite's intention, subject to favourable testing of the bulk sample coal and successful approval of the VCP, to retain part of the bulk sample void to facilitate commencement of the VCP. Similarly, the out-of-pit WRD required for the initial stages of the VCP will be developed as an extension of the bulk sample out-of-pit dump. **Figure 2** provides the approved bulk sample footprint and infrastructure layout at the end of the bulk sample activities. This 'existing' disturbance footprint has been incorporated in the consideration of baseline conditions at the site.

The bulk sample is planned to commence in 2020 and to run for 9-12 months while the VCP is subject to environmental authority and mining lease application processes.

1.3 Project Development Stages

The VCP is a small scale mining operation, with coal extraction planned for approximately 3 years, followed by completion of rehabilitation activities in Year 4. Construction of temporary infrastructure associated with the mining operation is expected to be completed within a month. Construction of the Saraji Road realignment is anticipated to be completed within 6 months. Ongoing establishment of internal road networks, surface water management infrastructure and other ancillary infrastructure will continue to be developed as the pit and in-pit WRD advance.



Figure 1: VCP Regional Location Plan

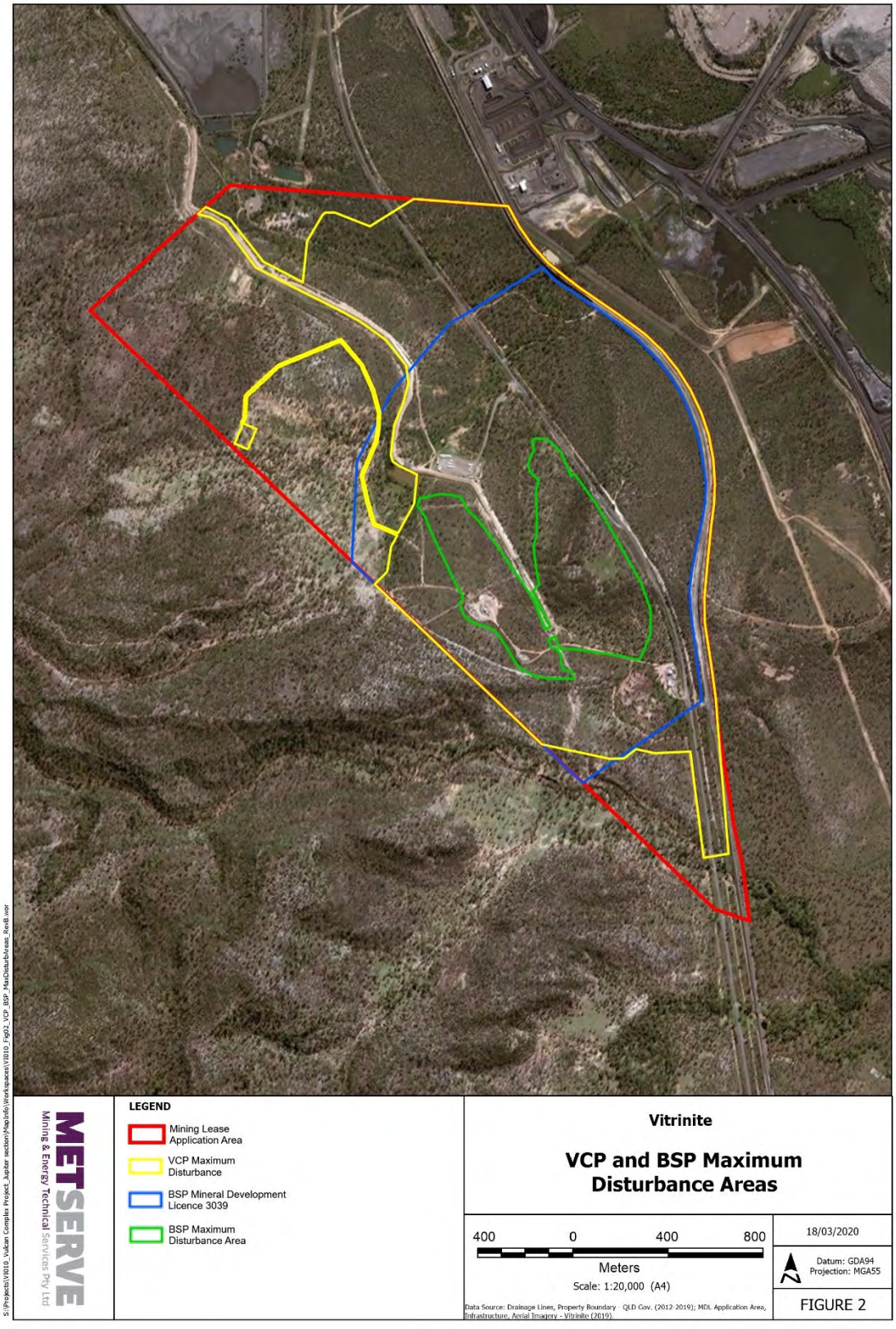


Figure 2: VCP and BSP Maximum Disturbance Areas

1.4 Scope of Work

RGS Environmental Pty. Ltd. (RGS) was commissioned by Mining and Energy Technical Services Pty. Ltd. (METServe) on behalf of Vitrinite to complete a geochemical assessment of waste rock and coal reject materials at the Project.

The objective of the work program was to complete a Geochemical Assessment of waste rock (i.e. overburden and interburden) and coal reject materials as part of the technical studies being completed to support an Environmental Authority Application for the Project, in accordance with relevant industry guidelines (DME, 1995; DEHP, 2013; COA, 2016a,b,c; and INAP, 2009).

The scope of work was developed by RGS based upon information provided by METServe and included:

- Review of available geochemical and geological data and existing drill hole database (including plans, drill hole logs and drill core photographs) associated with the Project;
- Design of a geochemical assessment program, including sampling for, and testing of, representative overburden, interburden and coal reject materials within the Project boundary. The program would utilise exploration drill core and drill chip samples from upcoming drilling programs, where available;
- Coordination of the material sampling and geochemical analysis programs;
- Geochemical characterisation of overburden and interburden from the proposed open pit area and coal reject material from processing the target seams;
- Development of any necessary environmental management measures related to overburden, interburden and coal reject emplacement and rehabilitation; and
- Preparation of a Geochemical Assessment Report based on existing information, sample analyses and discussion regarding any Acid and Metalliferous Drainage (AMD) potential or other salinity/erosion/ dispersion issues related to the Project.

The geochemical test program was designed to assess the degree of risk from acid and metalliferous drainage (AMD), oxidation of pyrite, leachability of metals/metalloids, and characterisation of standard soil parameters including salinity, cation exchange capacity and major metal/metalloid compositions.

1.5 Study Area

As part of project planning and feasibility assessment, Vitrinite has completed environmental assessments of a considerably larger study area than the proposed MLA. Baseline geochemistry data has been collected within this larger study area and has been used in the assessment of the VCP, for context, as required.

Subject to further project planning, Vitrinite may, in future, utilise this baseline geochemistry information to assess the potential impacts of additional project development opportunities within the larger study area.

2 GEOLOGY, MINING ACTIVITIES AND REHABILITATION

The project is located north of Dysart to the immediate west of several established mining operations including Peak Downs and Saraji coal mines. As part of initial baseline studies, two hard coking coal targets, Jupiter to the north and Vulcan to the south were defined, although only Jupiter has been selected for open cut development and forms the basis of the proposed project subject of the EA and ML applications.

2.1 Geology and Stratigraphy

The Project will target the Alex and multiple Dysart Lower coal seams within the Permian-aged Moranbah Coal Measures. A surficial Tertiary waste rock (overburden) sequence is present in the Project area, consisting of unconsolidated soils and sands. Underlying this is Permian-aged waste rock (overburden), which is comprised of sandstone and siltstone.

The Permian waste rock (interburden) materials in the Project area generally comprise sandstone, siltstone, claystone and coal, that were deposited in a fluvial flood plain environment within the Bowen Basin. Significant mesa hills formed by highly resistant sandstones have provided target coal seams throughout the centre of the study area. The typical stratigraphic profile encountered at the Project is provided in **Figure 3**.

The Alex seam generally quite shallow and occurs just below the base of weathering in the stratigraphic profile. The Dysart Lower Seam comprises several plys with the waste rock (interburden/parting) in between generally consisting of fine-grained sedimentary units such as siltstone, mudstone and claystone, with the occasional carbonaceous or coaly unit.

The May Seam (consisting of carbonaceous claystone) and Matilda Seam (consisting of interbedded coal and siltstone) underlie the Dysart seam, but are not considered economic.

2.2 Mining Activities

2.2.1 Overview

The open cut will extend to a depth of approximately 45 m, following the seam as it dips eastwards. The footprint of the proposed open cut is approximately 136 hectares (ha). Development of the open cut will progress from the south western corner (starting in the former bulk sample pit) in a northerly direction, to the northern boundary of the proposed MLA. Truck and shovel mining methods and blasting will be employed to extract waste rock and coal from the pit.

2.2.2 Waste rock removal and placement

Initial waste rock extracted during the early stages of Year 1 will be placed in an out-of-pit dump to the west of the open pit. This dump will build off the existing bulk sample west out-of-pit dump and will extend further to the west at a similar geometry. Following this initial out of pit placement and once sufficient pit space has been established, in-pit placement of waste rock will commence. This will continue for the life of the project as the pit advances north. The in-pit dump will extend approximately 15 m above the surrounding ground level, with batters shaped at 15%. A central plateau will drain to the west to minimise the requirement for significant drainage infrastructure along the eastern toe of the dump (where space is limited).

An initial assessment of waste rock geochemistry (RGS, 2019) showed that the waste rock does not pose a significant risk of generating acid, saline or metalliferous drainage. Therefore, no selective handling and treatment measures are proposed and low permeability capping over the dump is unlikely to be required.

2.2.3 Coal extraction

Once waste rock has been removed to expose the coal seams, coal will be extracted via truck and shovel. The coal will be hauled to the ROM pad and processed through dry crushing and screening mobile plant (including Sorterra screening), as required. Once crushed and screened, coal will be placed on the ROM stockpile for haulage. Coal rejects from the crushing and screening process will be stockpiled separately and placed within the relevant active WRD. There are no coal washing activities, facilities or processing waste (reject) storage proposed as part of the Project. However, if waste storage from coal washing was to be

required on site, this would be achieved by back-loading ROM coal haul trucks to bring reject material back to site for co-disposal in-pit with the Project waste rock material.

2.2.4 Production rate and schedule

An indicative annual mining schedule is provided in **Table 2-1**.

Table 2-1: Indicative Mining Schedule

Year	Total ROM coal (tpa)#	Total waste rock (tpa)#	Total anticipated product coal (processed offsite) (tpa)#
1	1,950,000	7,434,900	1,170,000
2	1,950,000	7,441,500	1,170,000
3	1,865,000	6,182,700	1,118,210
Total	**5,765,000**	**21,059,100**	**3,458,210**

tpa – tonnes per annum

ROM coal will be loaded and trucked from the ROM stockpile. The transport of coal will be from the Project MLA to an existing coal wash and load out facility along the Peak Downs Highway.

2.2.5 Ancillary Infrastructure

A new mine access road will be established from Saraji Road in the south east of the MLA. This will lead to the site offices and administration and then on to the ROM pad. The ROM pad will be located adjacent to the south western corner of the in-pit dump. The MIA will be established within the first year and will be located on top of the completed out-of-pit dump. The MIA will include heavy vehicle workshops and park-up, equipment laydown areas, project offices and facilities. An explosives magazine will be established to the north west of the out-of-pit dump, away from operational areas and critical infrastructure. This will be accessed via an existing track from the northern end of the out-of-pit dump.

Surface water management infrastructure will be established progressively to divert clean water catchments around operational areas and to manage runoff from disturbed areas. A mine water dam will be established as a water supply dam for dust suppression. This will also receive any accumulated pit water that requires dewatering. A series of drains and bunds will be established to direct runoff to sediment control structures. The existing BHP Mitsubishi Alliance (BMA) surface water levee will be retained during operations. Whilst no maintenance of the structure is proposed, it has been included in the Project disturbance footprint to allow maintenance, if required.

Linking roads, tracks and pipelines will be established around site as required. Similarly, temporary stockpiles of useful materials (topsoil, subsoil, gravels, etc.) will be established as required in available and appropriate locations. To facilitate flexible establishment of such infrastructure, a conservative disturbance footprint has been proposed and assessed (refer to **Figure 2**).

2.3 Progressive Rehabilitation

A Progressive Rehabilitation and Closure Plan (PRCP) has been prepared to support the Environmental Authority Application and to meet Vitrinite's obligations under the *Environmental Protection Act, 1994* as amended by the *Mineral and Energy Resources (Financial Provisioning) Act 2018*. In summary, the PRCP describes the proposed final landform, post-mine land uses, rehabilitation planning information and a schedule of progressive rehabilitation activities.

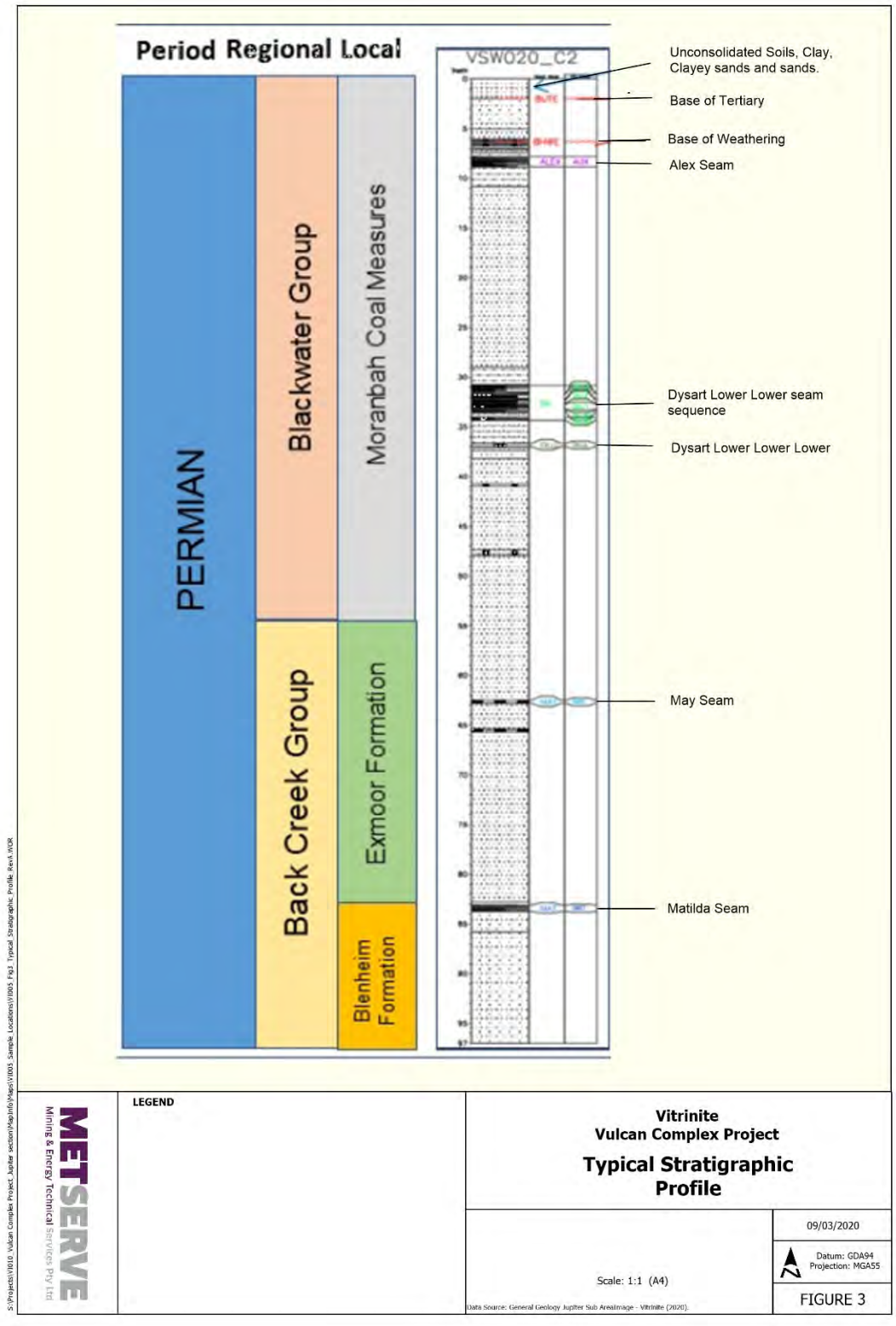


Figure 3: Typical Stratigraphic Profile

3 METHODOLOGY

RGS personnel worked closely with Vitrinite (geological) personnel to develop an appropriate sampling and geochemical testing plan, which was used to obtain representative samples of waste rock (overburden and interburden) and coal reject materials associated with the Project.

3.1 Sample Selection and Preparation

The sampling methodology used to obtain representative samples of waste rock and coal reject materials from the Project was undertaken in accordance with relevant guideline documents. While there are no specific regulatory guidelines regarding the number of samples required, existing risk-based technical guidelines for the geochemical assessment of mining waste materials in Australia (AMIRA, 2002; COA, 2016c) and worldwide (INAP, 2009) were used by RGS as a framework for the sampling program.

3.1.1 Waste Rock (Overburden and Interburden)

Representative samples of waste rock (overburden and interburden) materials were identified and collected as drill chips from the 2018-2019 exploration drilling program. A total of 138 waste rock samples were collected from 21 drill holes at the Project. Seven of these holes were drilled within the Jupiter target area and 14 within the Vulcan target area. The locations of the Jupiter and Vulcan drill holes with respect to the Project pit are shown in **Figure 4** and **Figure 5, respectively**.

The samples represented the waste rock (overburden and interburden; including roof, floor and parting materials, i.e. potential coal reject material) expected to be encountered during development activities, from the surface to a depth of approximately 45 m. This covers the entire stratigraphic profile that is currently under consideration for mining. **Table 3-1** provides the number of samples of each type of material collected from the Jupiter and Vulcan targets and used in the geochemical assessment. Further information on the identity of the 138 individual waste rock samples is provided in Table B1 (Attachment B). The number of samples was selected to provide a good statistical representation of the amount and type of mined material expected to be encountered at the Project, considering the risk profile indicated from the geology and geochemical information from nearby coal projects.

3.1.2 Coal Reject

Two size fractions (coarse: wash 2, -50+2mm; and fine: wash 3 & fines, -2+0.25 & -0.25+0mm) of coal reject materials were selected to best represent the two coal reject streams that will be produced from coal washing off site. Coal core from a total of six holes was collected by Vitrinite personnel and delivered to the ALS coal quality laboratory in Richlands, Queensland. This core was composited into 11 samples of coarse and fine reject material (four from Jupiter and seven from Vulcan) and sent to ALS Environmental Laboratory (ALS) in Stafford, Queensland for geochemical testing.

Table 3-1: Sample materials used for geochemical testing

Sample Description	Sample Type	Number of samples	
		Vulcan Target	Jupiter Target
Waste Rock and Potential Coal Reject			
Soil, clay, sandstone, siltstone, claystone and conglomerate	Overburden	83	17
Sandstone, siltstone and claystone	Interburden	12	1
Sandstone, siltstone and claystone; carbonaceous sandstone, siltstone, claystone and coal	Roof, floor and parting	20	5
	Total	**115**	**23**
Coal Reject		Coarse	Fine
Coarse and fine reject	Coal Reject	5	6
	Total	**5**	**6**

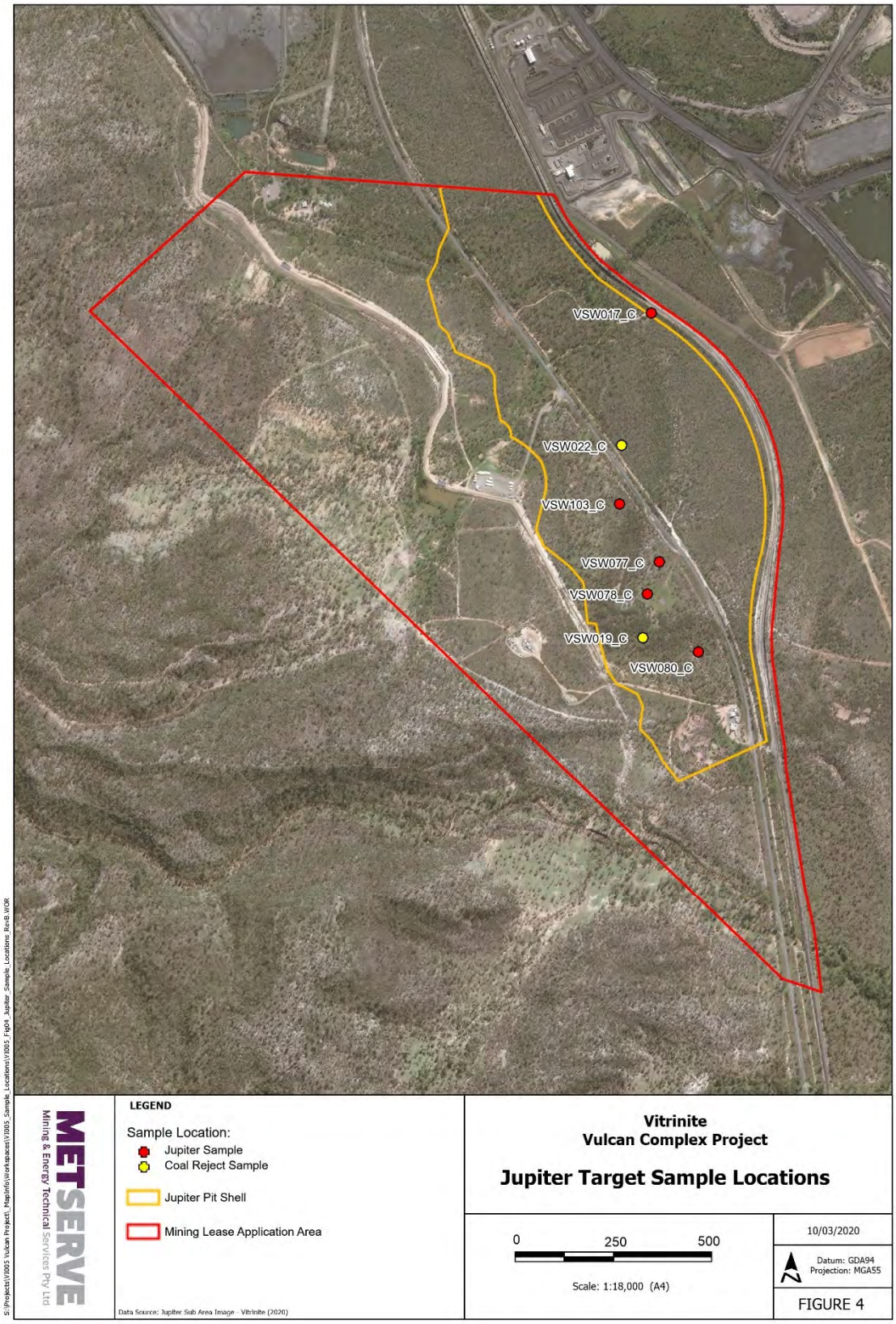


Figure 4: Jupiter Sample Locations



Figure 5: Vulcan Sample Locations

3.1.3 Sample Preparation

Once received, the waste rock and coal reject samples were prepared by crushing and pulverising to less than 75 µm size, where necessary. This method of sample preparation results in a homogenous sample, but also generates a large sample surface area in contact with the assay solution. This provides a greater potential for dissolution and reaction and represents an assumed initial 'worst case' scenario for these materials. A list describing the source of all of the 149 waste rock and coal reject samples included in this study is provided in **Table B1** (**Attachment B**).

3.2 Geochemical Test Program

A series of geochemical and physical tests were completed on the total of 149 waste rock and coal reject samples described in detail in **Section 3.1**. The test program was designed to assess the degree of risk from the presence and potential oxidation of sulfides, as well as the generation and the presence/leaching of soluble metals/metalloids and salts. The assessment also included characterisation of standard soil parameters including salinity, sodicity, cation exchange capacity, exchangeable sodium percentage and major metal concentrations.

A detailed summary of the parameters involved in completing a static and kinetic geochemical characterisation and assessment of mine waste materials is provided in **Attachment A**.

3.2.1 Static Tests

Static geochemical tests provide a 'snapshot' of the characteristics of a sample material at a single point in time. These tests were staged to screen individual samples before selecting either individual and/or composite samples for more detailed static test work.

The Acid Base Account (ABA) method was used as a screening procedure whereby the acid-neutralising and acid-generating characteristics of a material are assessed. All 149 samples were screened using the ABA method. The ABA screening included static geochemical testing for the following parameters:

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

The results of the ABA screening tests are discussed in **Section 4.1**. After the results of the screening tests were received and interpreted, two waste rock (interburden) samples and 11 coal reject samples were also tested for sulfide sulfur, using the chromium reducible sulfur (Scr), Australian Standard (AS 4969.7, 2008) method.

From the total sulfur value (or Scr value, where available), maximum potential acidity (MPA) values were calculated. Scr data was preferentially used, as it provides a more accurate representation of the potential MPA, as acid generation primarily forms from the oxidation of reactive sulfide measured by this method.

After the results of the initial static geochemical tests were received and reviewed, 122 of the original 149 samples were used to create six composite samples for waste rock and four composite samples for coal reject materials. For the Vulcan target, soil, sandstone, clay and claystone composites were prepared; while sandstone and siltstone composites were prepared for the Jupiter target. All ten composite samples were sent for whole rock multi-element testing at ALS Stafford laboratory. The composite samples were tested for:

- Paste pH and EC [1:5 w:v. sample: deionised water];
- Major cations (Ca, Mg, K, Na) [HCl and HNO3 acid digest followed by ICP-AES/MS];
- Major anions (Cl, SO_4, F) [ICP-AES/MS and PC Titrator (1:5 w:v water extracts)];
- Acidity and alkalinity as $CaCO_3$ mg/L [PC Titrator (1:5 w:v water extracts)];

- Total metals (Ag, Al, As, B, Cd, Cr, Co, Cu, F, Fe, Hg, Pb, Mn, Mo, Ni, Sb, Se, U, V and Zn) [HCl and HNO_3 acid digest followed by FIMS and/or ICP-AES/MS]; and
- Soluble metals (Ag, Al, As, B, Cd, Cr, Co, Cu, F, Fe, Hg, Pb, Mn, Mo, Ni, Sb, Se, U, V and Zn) [ICPAES/MS and FIMS (1:5 w:v water extracts)].

The six composite waste rock samples were also tested for exchangeable cations (Ca, Mg, Na and K) [ICP-AES], and results were used to calculate the cation exchange capacity (CEC) and exchangeable sodium percentage (ESP).

Summary geochemical results tables for the static geochemical test program are provided in **Attachment B**. The ALS laboratory certificates of analysis are provided in **Attachment D**.

3.2.2 Kinetic Tests

Following receipt and interpretation of the static geochemical test results, six kinetic leach column (KLC) tests were set up at the RGS 'in-house' laboratory using composite waste rock and coal reject materials from the Vulcan and Jupiter targets. The KLC tests for waste rock were completed from June to December 2019 and are being completed from December 2019 to June 2020 for coal reject materials. A summarised description of the material represented by each KLC test is shown below in **Table 3-2**. The identities of the specific individual samples included in composite samples used for the KLC test program are detailed in **Table B7** (**Attachment B**).

Table 3-2: KLC material description

KLC Sample #	Description
KLC1	Mainly Sandstone waste rock (Vulcan target)
KLC2	Mainly Claystone waste rock (Vulcan target)
KLC3	Mainly Sandstone waste rock (Jupiter target)
KLC4	Mainly Siltstone waste rock (Jupiter target)
KLC 5	Coarse Reject (Jupiter/Vulcan Target)
KLC 6	Fine Reject (Jupiter/Vulcan Target)

Approximately 2 kg of each composite sample was accurately weighed and used in each of the KLC tests. Heat lamps were used daily to simulate sunshine and ensure that the KLC test materials were unsaturated and subject to oxidising conditions between leaching events (this is essentially an assumed "worst case" scenario for sulfide oxidation and potential acid/salt generation). Further details and a schematic of the KLC test arrangement are provided in **Attachment A**.

All leachate samples collected from the KLC tests were assayed at ALS Stafford laboratory for:

- pH and EC;
- Acidity and alkalinity [PC Titrator];
- Dissolved metals/metalloids (Al, As, B, Cd, Co, Cr, Cu, Fe, Mn, Mo, Ni, Pb, Sb, Se, V and Zn) [ICP-AES/MS];
- Dissolved major cations (Ca, Mg, Na and K) [ICP-AES/MS]; and
- Dissolved major anions (Cl, SO_4) and F [ICP-AES/MS].

Summary results tables and trends for the KLC tests are provided in **Attachment C**. The raw ALS laboratory test results received for the KLC test program are provided in **Attachment D**.

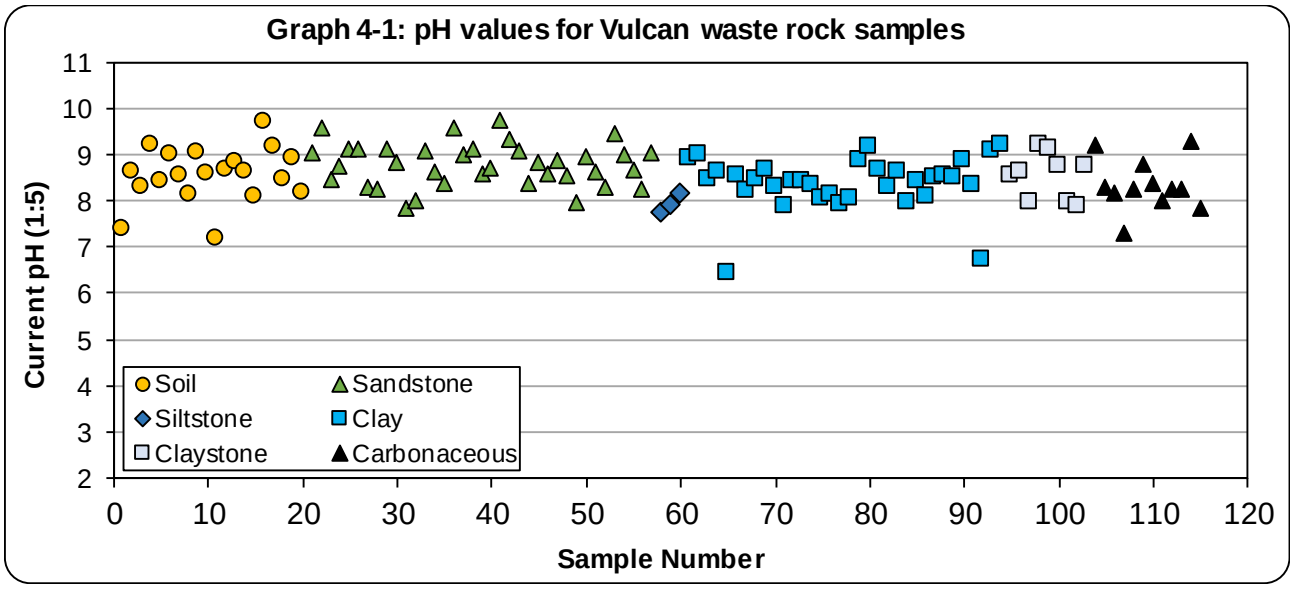
4 GEOCHEMICAL AND PHYSICAL CHARACTERISATION RESULTS

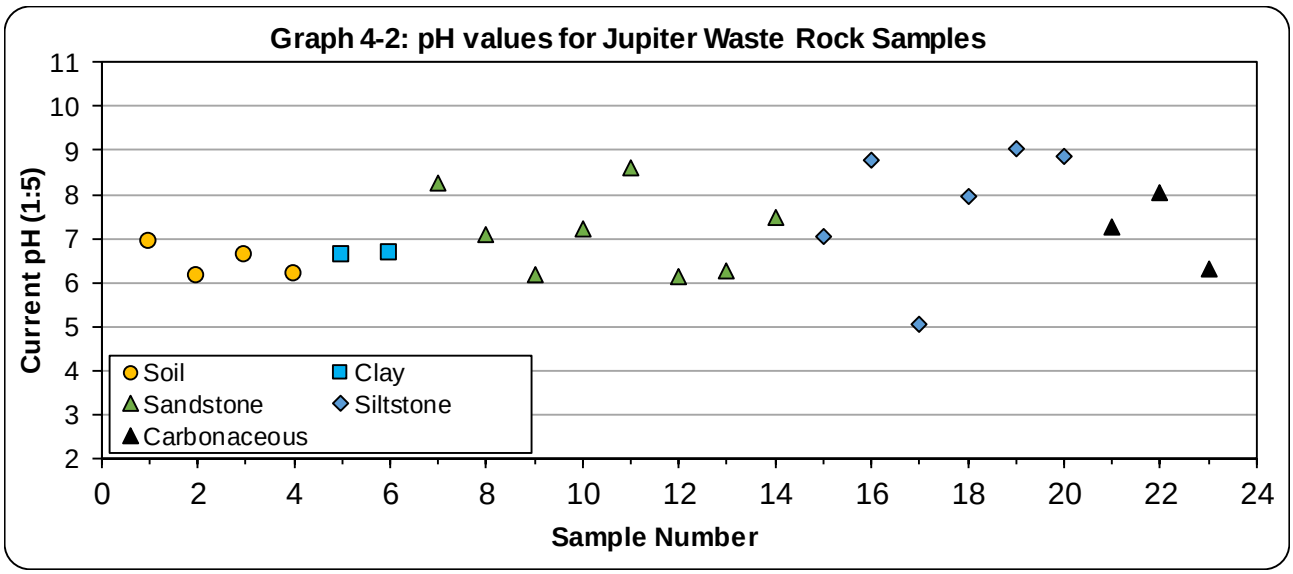
4.1 Acid Base Account

4.1.1 Overburden/Interburden

Acid Base Account results for the 138 waste rock (overburden/interburden) samples from the Project (115 from the Vulcan target; 23 from the Jupiter target) are presented in **Table B2** (**Attachment B**) and summarised below. The results are shown by target and lithology to facilitate interpretation.

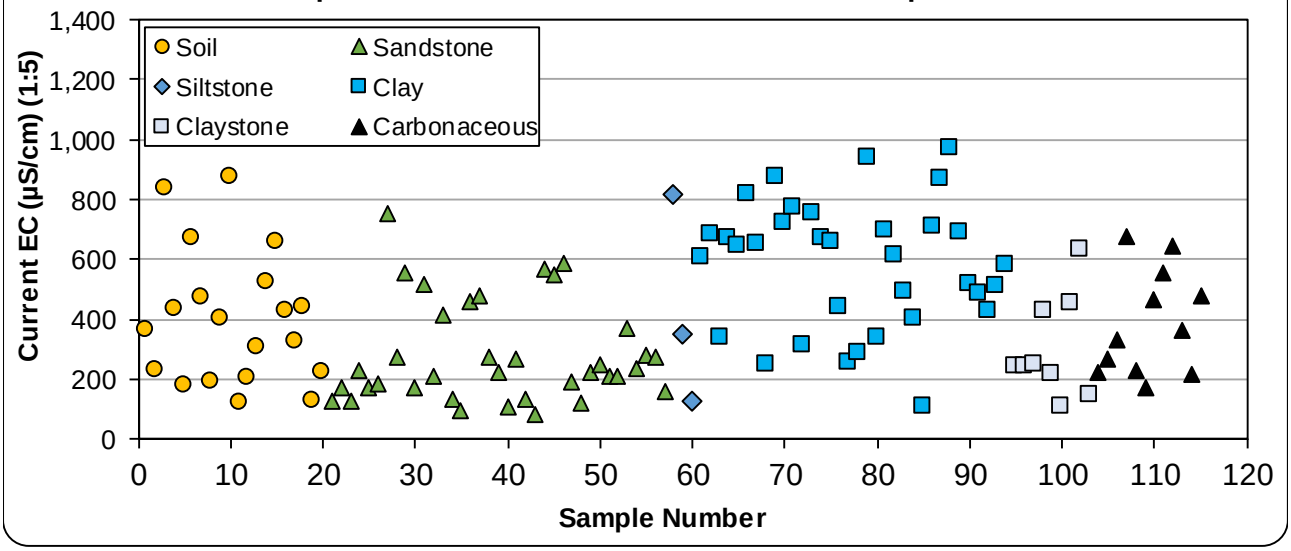
- **pH:** The $pH_{(1:5)}$ of the 115 samples from the Vulcan target ranges from 6.4 to 9.7, with a median pH value of 8.6 (**Graph 4-1**). The $pH_{(1:5)}$ of the 23 samples from the Jupiter target ranges from 5.1 to 9.0, with a median value of 7.0 (**Graph 4-2**). The pH results indicate that waste rock material at the Vulcan and Jupiter targets will add some alkalinity to any contact water as the pH of deionised water used in the pH tests is typically in the pH range of 5.0 to 6.5.



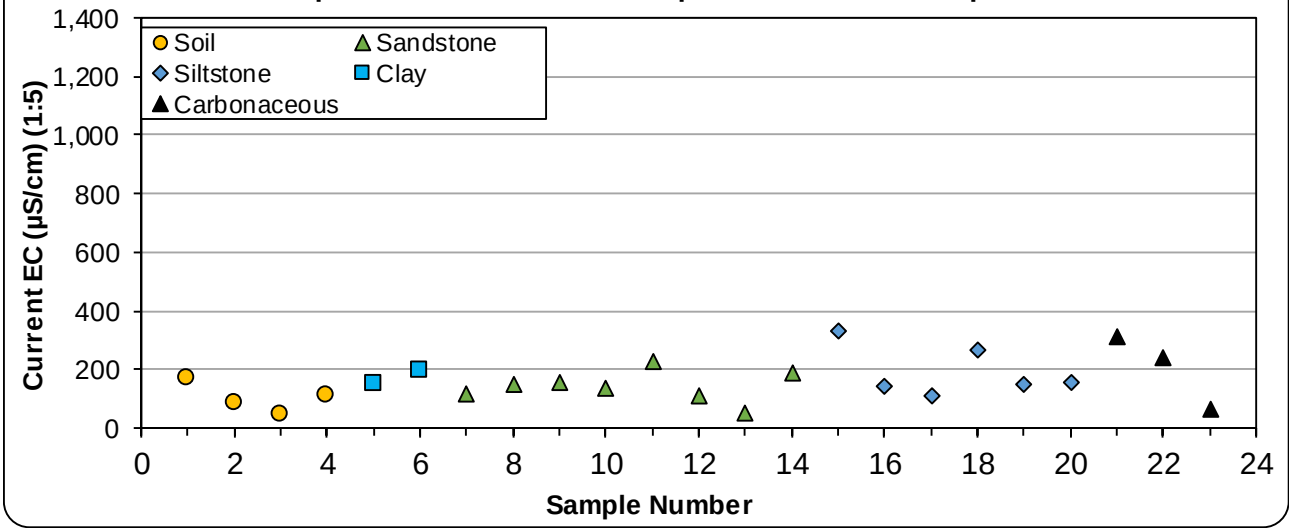


- **EC:** The current $EC_{(1:5)}$ of the Vulcan target samples ranges from 85 to 972 µS/cm, with a median value of 365 µS/cm (**Graph 4-3**). The current $EC_{(1:5)}$ of the Jupiter target samples ranges from 43 to 331 µS/cm, with a median value of 152 µS/cm (**Graph 4-4**). The highest EC values tend to be associated with some of the soil and clay materials at the Vulcan target.

Graph 4-3: EC values for Vulcan waste rock samples



Graph 4-4: EC values for for Jupiter Waste Rock Samples



To provide additional context, the $EC_{(1:5)}$ and $pH_{(1:5)}$ results for waste rock (overburden and interburden) are classified against pH and salinity criteria for mine waste materials, as defined by the Queensland DME (1995) technical guidelines for the environmental management of exploration and mining in Queensland (**Table 4-1**).

Based on the median pH and EC values, the waste rock (overburden/interburden) samples tested are generally regarded as having a 'Medium' to 'High' soil pH and 'Low' salinity characteristics, as indicated by the distribution of samples corresponding to each pH and salinity class. Samples from the Jupiter target have a lower (neutral) median pH value than samples from the Vulcan target.

Table 4-1: Salinity and pH criteria for assessment of waste rock samples

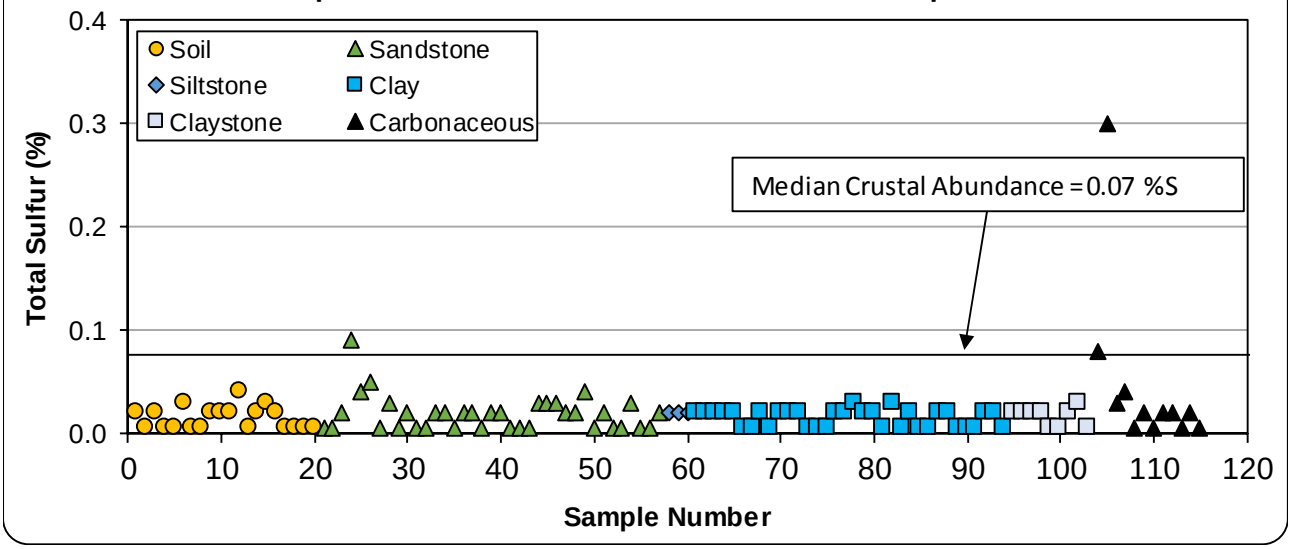
Vulcan Target	Very Low	Low	Medium	High	Very High
$pH_{1:5}$	< 4.5	4.5 – 5.5	5.5 – 7.0	7.0 – 9.0 (Median – 8.6)	> 9.0
$EC_{1:5}$ (µS/cm)	< 150	150 – 450 (Median – 365)	450 – 900	900 – 2,000	> 2,000
Jupiter Target	**Very Low**	**Low**	**Medium**	**High**	**Very High**
$pH_{1:5}$	< 4.5	4.5 – 5.5	5.5 – 7.0 (Median 7.0)	7.0 – 9.0	> 9.0
$EC_{1:5}$ (µS/cm)	< 150	150 – 450 (Median – 152)	450 – 900	900 – 2,000	> 2,000

Note: Adapted from DME, 1995. Highlighted cells show the category corresponding to the median pH and EC values (orange shading) for the waste rock (overburden/interburden) samples.

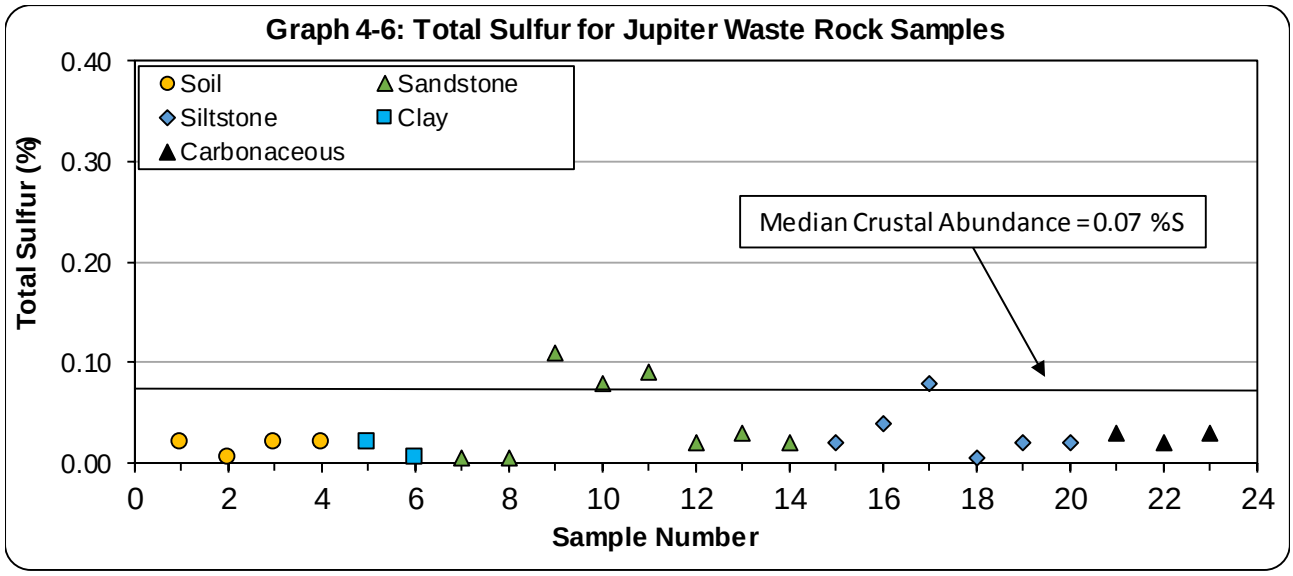
The pH and EC tests were completed on pulverised samples (≤ 75 µm) with a large surface area in contact with the leaching solution, thereby providing greater potential for dissolution and reaction, and represent an assumed 'worst case' scenario. It is also expected that the salinity of leachate from low sulfur mining waste materials will diminish with time as salts are flushed from the rock matrix and a state of equilibrium develops. At that point, the salinity of seepage/runoff should stabilise at a lower asymptotic concentration relative to the weathering/erosion of the materials.

- **Sulfur:** The total sulfur content of the samples from the two targets ranges from below the laboratory limit of reporting (LoR) to 0.30 %S and has a very low median value of 0.02 %S, compared with the median crustal abundance value of 0.07 %S in unmineralised soils (Bowen, 1979; INAP, 2009). Materials with a total sulfur content less than or equal to 0.1 %S are essentially barren of sulfur, generally represent background concentrations, and have negligible capacity to generate acidity[1]. **Graphs 4-5 and 4-6** illustrate the total sulfur content of the sample materials from the Vulcan and Jupiter targets, respectively. The results demonstrate that most samples have a total sulfur concentration well below median crustal abundance.

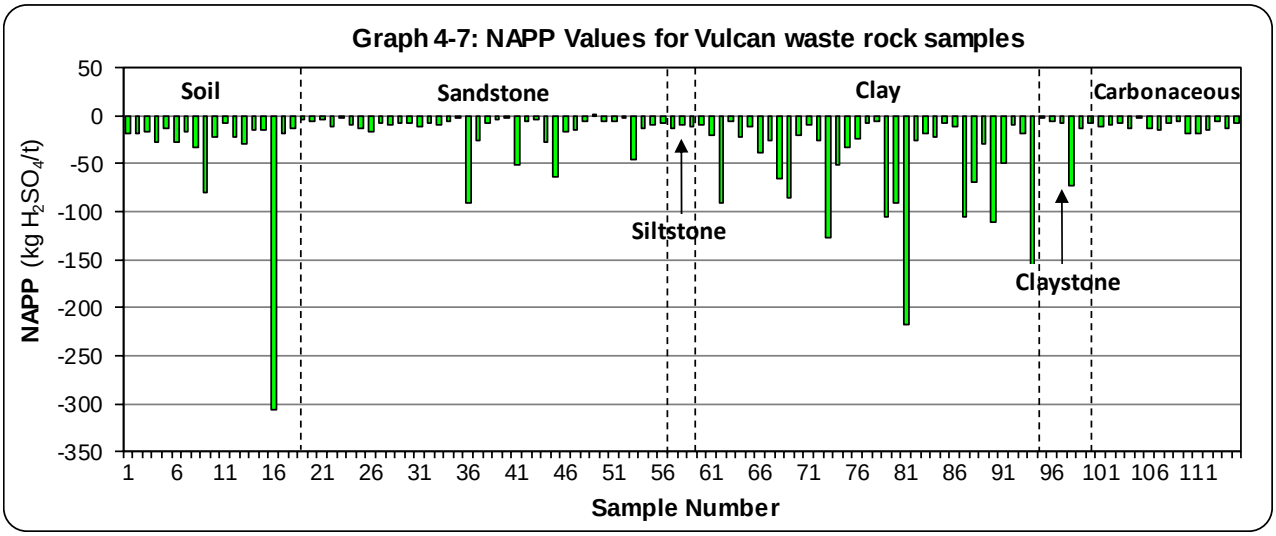
Graph 4-5: Total Sulfur for Vulcan waste rock samples

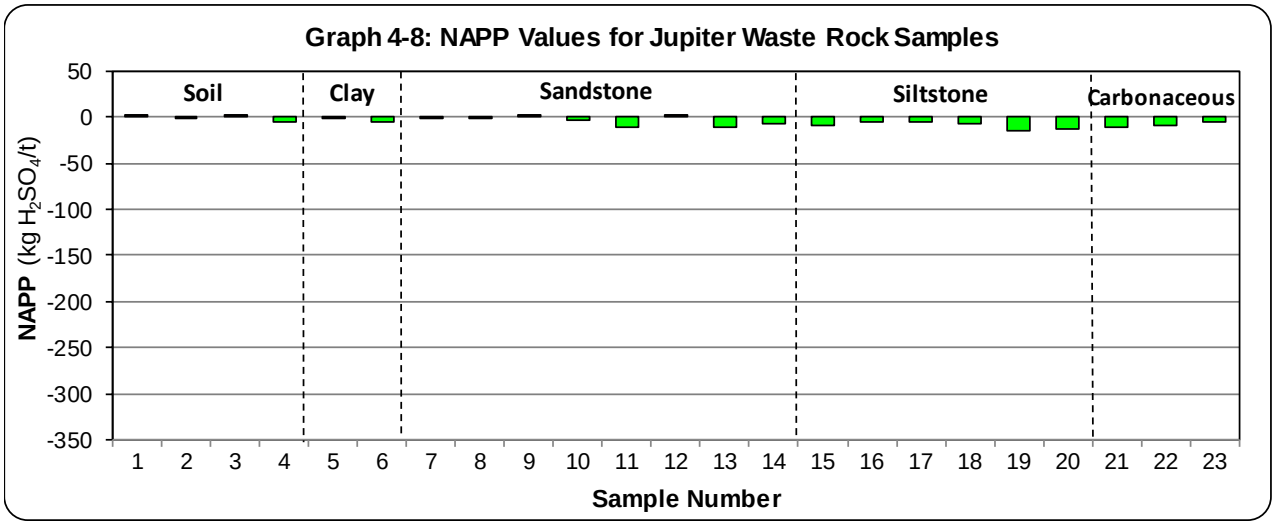


[1] The average crustal abundance of sulfur (0.07 %S) has been rounded up to 0.1 % (INAP, 2009).



- **Sulfide sulfur:** Due to the very low total sulfur content of most of the waste rock (overburden/interburden) samples, only two samples (a weathered coal sample from the Alex coal seam at Vulcan and a sandstone sample from Jupiter) were tested for sulfide sulfur using the Scr method. The test results show that only the weathered coal sample from Vulcan contains any appreciable sulfide sulfur and approximately half of the total sulfur content is likely to be present as organic sulfur.
- **MPA:** Based on the total sulfur content (and sulfide sulfur content, where available), the (MPA that could be generated by the Vulcan and Jupiter waste rock samples ranges from 0.2 (i.e., below the laboratory LoR) to 4.7 kg H_2SO_4/t, and has a very low median value of 0.6 kg H_2SO_4/t.
- **ANC:** The ANC for the 138 samples ranges from 0.25 to 307 kg H_2SO_4/t and has a median value of 13.6 kg H_2SO_4/t, which is approximately 20 times the median MPA.
- **ANC:MPA ratio:** The ANC:MPA ratio of the 138 samples ranges from 0.2 to 1,423.7, with a median value of 36.1. In simplistic terms, this means that on average, the overburden and interburden sample materials have more than an order of magnitude excess ANC over MPA.
- **NAPP:** The calculated Net Acid Producing Potential (NAPP) values range from -306.4 to 1.0 kg H_2SO_4/t, with a negative median value of -12.7 kg H_2SO_4/t. The NAPP data is presented in **Graphs 4-7 and 4-8**.

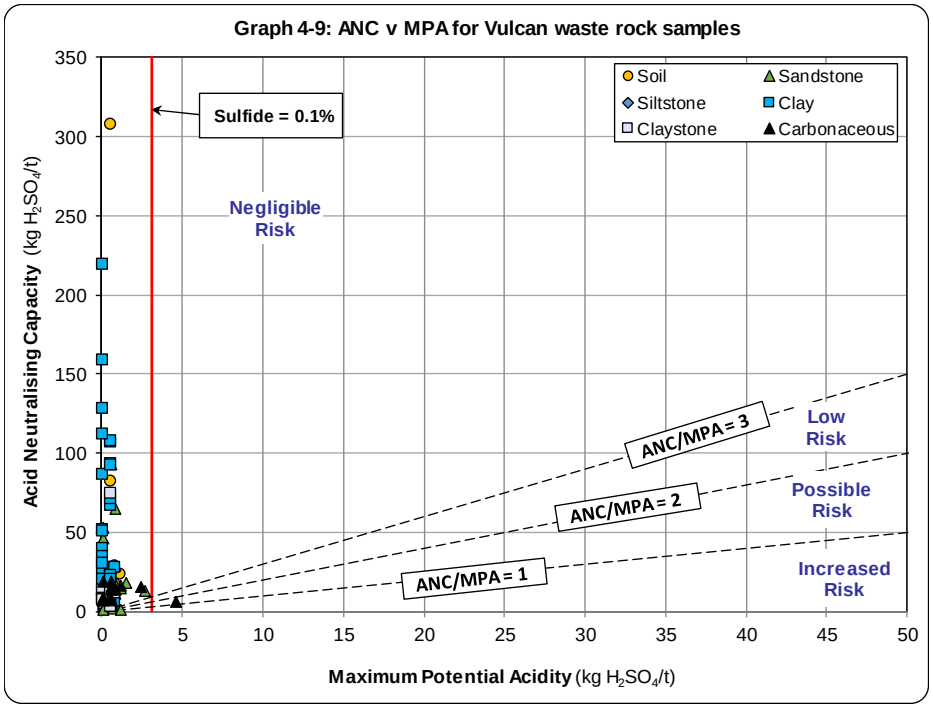




Given the very low sulfur content of the waste rock tested and the generally negative NAPP values, the risk of generating any significant amounts of acidity from these materials is considered to be negligible.

Graphs 4-9 and **4-10** show plots of ANC versus MPA for the waste rock samples tested by material type from the Vulcan and Jupiter targets, respectively. ANC:MPA ratio lines have been plotted on the figures to illustrate the factor of safety associated with the samples in terms of potential for generation of acidity. Generally, those samples with an ANC:MPA ratio of greater than 2 and a sulfide content of <0.1 %S are considered to represent material with a high factor of safety and a very low risk of generating acidity (COA, 2016c; INAP, 2009).

The Acid Base Account results show that all but one sample (a weathered coal sample from the Alex seam at Vulcan) plots in the negligible risk domain shown in the figures and therefore the overwhelming majority of samples tested represent waste rock materials that have a high factor of safety and a very low risk of generating acidity. If economic, it is likely that the Alex seam will be mined and report as coal to the ROM pad. As can be seen in **Figure 3**, the Alex seam covers a depth interval of only 1 m and therefore is expected to represent a small fraction (up to 2 %) of waste rock materials at the Vulcan target if found to be uneconomic and reports as waste rock.



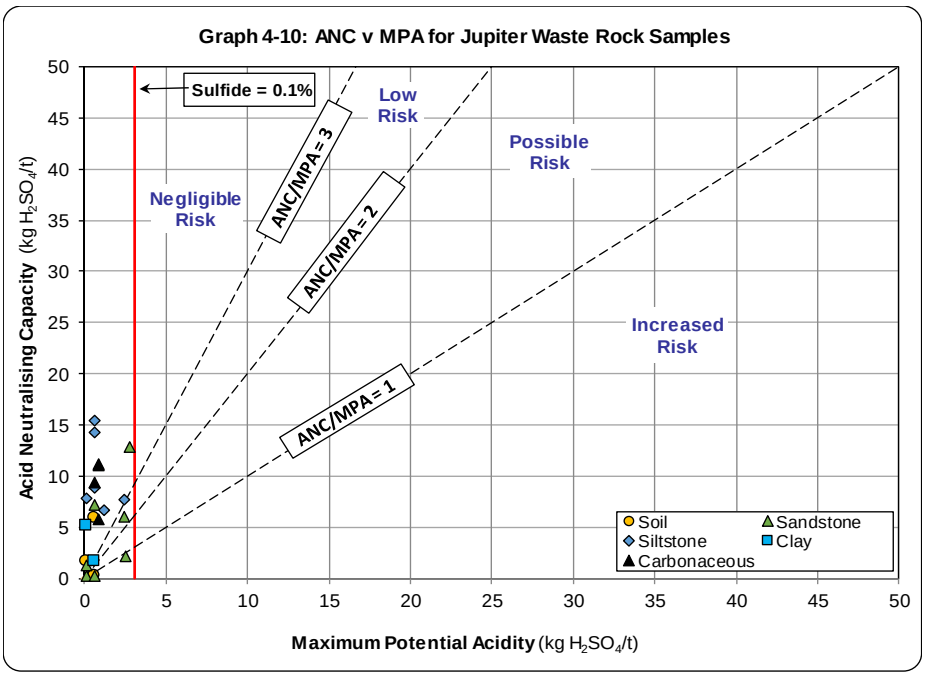


Table 4-2 provides a summary of the geochemical classification criteria used by RGS to classify the acid forming nature of the waste rock and a breakdown of the number of samples in each classification category. The classification criteria reflect Australian (COA, 2016c) and international (INAP, 2009) guidelines for the classification of mine waste materials.

The Acid Base Account test data presented in **Table C2 (Attachment C)** and discussed in this section have been used to classify the acid forming nature of the 138 waste rock samples from the Project. The results in **Table 4-2** demonstrate that of the 138 samples tested, 137 samples (~99.3 %) are classified as Non-Acid Forming (NAF) (Barren) and one sample (~1 %) is classified as Uncertain. None of the samples are classified as Potentially Acid Forming (PAF).

Table 4-2: Geochemical classification criteria for waste rock materials

Geochemical Classification	Total Sulfur[1] (%)	NAPP (kg H_2SO_4/t)	ANC:MPA Ratio	No. Samples (n = 138)
Non-Acid Forming (Barren)[2]	≤ 0.1	-	-	137
Non-Acid Forming	> 0.1	≤ -5	≥ 2	0
Uncertain	> 0.1	> -5 and ≤ +5	< 2	1
Potentially Acid Forming	> 0.1	> +5	< 2	0

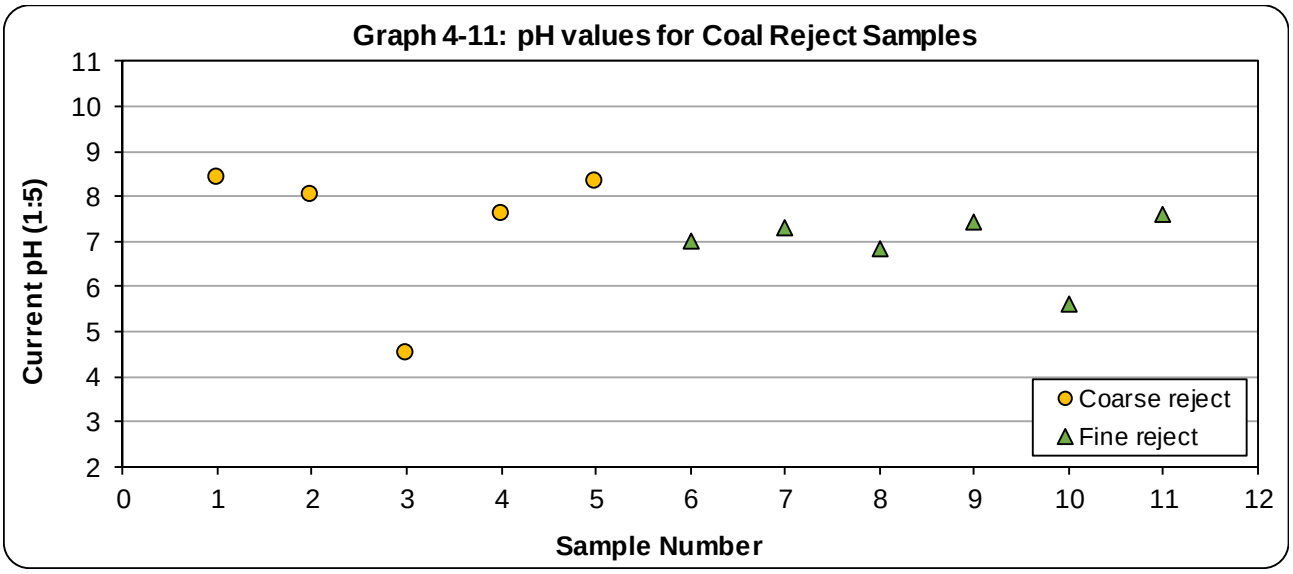
Notes:
1. If total sulfur is less than or equal to 0.1 %S, the NAPP and ANC:MPA ratio are not required for material classification as the sample is essentially barren of oxidisable sulfur.
2. A sample classified as NAF can be further described as 'barren' if the total sulfur and/or sulfide sulfur content is less than or equal to 0.1 %S, as the sample essentially has negligible acid generating capacity.

Overall, the Acid Base Account results confirm that the overwhelming majority of the waste rock materials represented by the samples tested have low sulfur content, excess ANC, and are classified as NAF. These materials have a high factor of safety and a very low risk of generating acidic drainage. One carbonaceous (weathered coal) sample has a slightly elevated sulfur content, however, as a bulk material, waste rock is likely to have excess ANC and be classified as NAF.

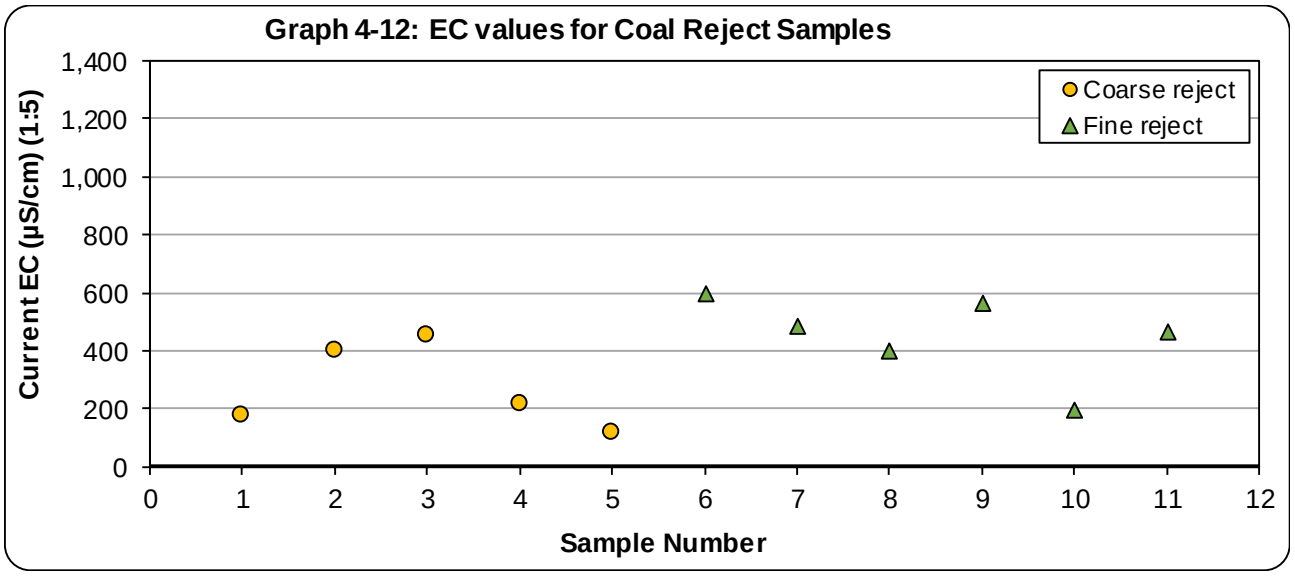
4.1.2 Coal Reject

Acid Base Account results for the 11 coal reject samples from the Project (five coarse reject and six fine reject samples) are presented in **Table B3** (**Attachment B**) and summarised below. The results are shown by material type to facilitate interpretation.

- **pH:** The $pH_{(1:5)}$ of the 11 coal reject samples ranges from 4.5 to 8.4 and has a median pH value of 7.4 (**Graph 4-11**). The pH results indicate that bulk coal reject material generated at the Project will most likely add some alkalinity to any contact water as the pH of deionised water used in the pH tests is typically in the pH range of 5.0 to 6.5. The lowest pH value was obtained for one of the coarse reject samples however the remaining four coarse reject samples have a neutral to slightly alkaline pH value. On the basis of these results, it is expected that leachate from bulk coal reject materials will be pH neutral.



- **EC:** The current $EC_{(1:5)}$ of the coal reject samples ranges from 116 to 595 µS/cm and has a median value of 401 µS/cm (**Graph 4-12**). The highest EC is measured for the fine reject materials.



To provide additional context, the $EC_{(1:5)}$ and $pH_{(1:5)}$ results for coal reject are classified against pH and salinity criteria for mine waste materials, as defined by the Queensland DME (1995) technical guidelines for the environmental management of exploration and mining in Queensland (see **Table 4-3**).

Table 4-3: Salinity and pH criteria for assessment of coal reject samples

Coal Reject	Very Low	Low	Medium	High	Very High
$pH_{1:5}$	< 4.5	4.5 – 5.5	5.5 – 7.0	7.0 – 9.0 (Median – 7.4)	> 9.0
$EC_{1:5}$ (µS/cm)	< 150	150 – 450 (Median – 401)	450 – 900	900 – 2,000	> 2,000

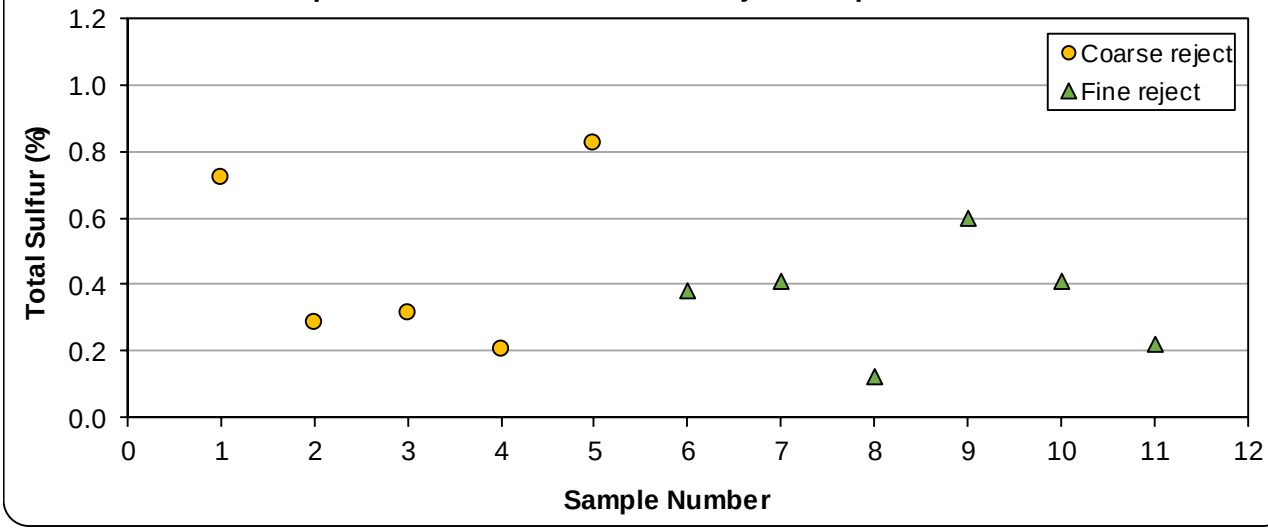
Note: Adapted from DME, 1995. Highlighted cells show the category corresponding to the median pH and EC values (orange shading) for the coal reject samples.

Based on the median pH and EC values, the coal reject samples tested are generally regarded as having a slightly 'High' soil pH and 'Low' salinity characteristics, as indicated by the distribution of samples corresponding to each pH and salinity class.

The pH and EC tests were completed on pulverised samples (≤ 75 µm) with a large surface area in contact with the leaching solution, thereby providing greater potential for dissolution and reaction, and represent an initial 'worst case' scenario. While sulfide oxidation in some coal reject materials may contribute to increases in the salinity of leachate in the short term, it is expected that in the longer term the salinity from bulk coal reject materials will stabilise and potentially diminish over time at a concentration relative to the weathering/erosion of the materials as salts are flushed from the material matrix and a state of equilibrium develops.

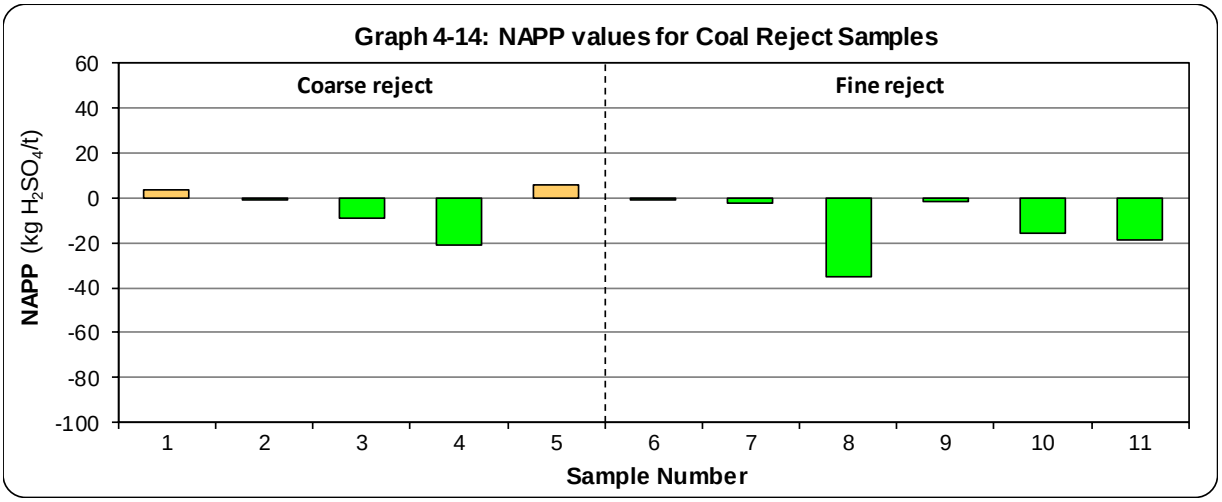
- **Sulfur:** The total sulfur content of the 11 coal reject samples ranges from 0.12 to 0.82 %S and has an elevated median value of 0.38 %S, compared with the median crustal abundance value of 0.07 %S in unmineralised soils (Bowen, 1979; INAP, 2009). **Graph 4-13** illustrates the total sulfur content of the coal reject materials. The results demonstrate that most samples have a total sulfur concentration greater than median crustal abundance.

Graph 4-13: Total Sulfur for Coal Reject Samples

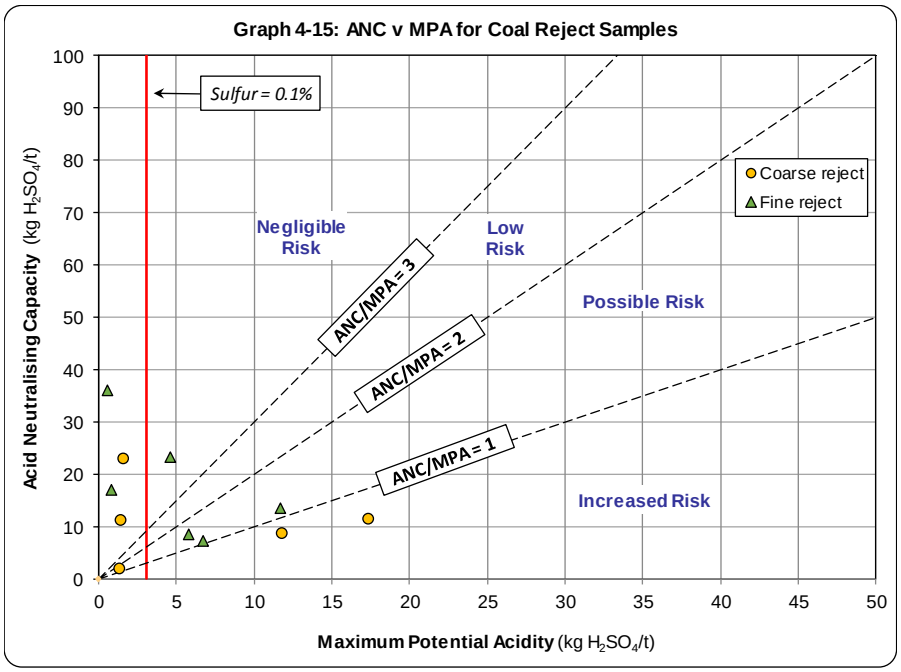


- **Sulfide sulfur:** Due to the elevated total sulfur content of most of the coal reject samples, all of the samples were tested for sulfide using the Scr method. The test results show that on average, approximately 40 % of the total sulfur is present as sulfide and the remainder of the total sulfur is likely to be present as organic sulfur or sulfate.

- **MPA:** Based on the sulfide content, the MPA that could be generated by the 11 coal reject samples ranges from 0.6 to 17.4 kg H_2SO_4/t, and has a moderate median value of 4.7 kg H_2SO_4/t.
- **ANC:** The ANC for the 11 coal reject samples ranges from 1.8 to 36 kg H_2SO_4/t and has a median value of 11.3 kg H_2SO_4/t, which is over twice the median MPA.
- **ANC:MPA ratio:** The ANC:MPA ratio of the 11 coal reject samples ranges from 0.6 to 65.3 (median of 1.5). In simplistic terms, this means that most coal reject materials have excess ANC over MPA.
- **NAPP:** The calculated NAPP values range from -35.4 to +6.1 kg H_2SO_4/t, with a negative median value of -2.7 kg H_2SO_4/t. The NAPP data is presented in **Graph 4-14** and shows that while most of the coal reject samples have negative NAPP value or a value that is close to zero, two coarse reject samples have a slightly positive NAPP value. Overall, as a bulk mixed material, the risk of generating any significant amounts of acidity from these materials is considered to be low.



Graph 4-15 shows a plot of ANC versus MPA for the 11 samples tested by material type from the Vulcan and Jupiter targets, respectively. ANC:MPA ratio lines have been plotted on the figures to illustrate the factor of safety associated with the samples in terms of potential for generation of acidity. Those samples with an ANC:MPA ratio of greater than 2 and a sulfide content of <0.1 %S are considered to represent material with a high factor of safety and a very low risk of generating acidity (COA, 2016c; INAP, 2009).



The Acid Base Account result show that six coal reject samples plot in the negligible to low risk domains, three samples plot in the possible risk domain (i.e., the ANC:MPA ratio is between 1 and 2) and two (coarse reject) samples plot in the increased risk domain (i.e., the ANC:MPA ratio is less than 1). Overall, as a bulk mixed material it is expected that the coal reject materials will have a relatively low risk of generating acidity.

Given that coal from the Project will be toll washed off site, disposal of coal reject materials from coal washing is not proposed nor does it present an issue for this Project on the MLA. In the unlikely event that off-site storage of coal reject materials from coal washing does not occur, Vitrinite will maintain the option to to back-load the ROM coal haul trucks to bring reject material back to site for co-disposal in-pit with the Project waste rock material. From a geochemistry viewpoint, co-disposal of any coarse and fine reject materials at the Project would be beneficial. This is because coalreject materials will typically remain moist and any oxidation will only occur at surface (i.e., the fine reject will fill the gaps between the coarse reject particles and generally limit oxygen ingress). Similarly, disposal of a small amount of mixed coarse and fine reject materials within waste rock cells would be beneficial as waste rock typically has very low sulfur content and excess ANC. This approach to coal reject management has been successfully used at a number of existing coal mining operations in Queensland including Middlemount Coal Mine (RGS, 2013).

Table 4-4 provides a summary of the geochemical classification criteria used by RGS to classify the acid forming nature of the coal reject samples, and a breakdown of the number of samples in each classification category.

Table 4-4: Geochemical classification criteria for coal reject materials

Geochemical Classification	Total Sulfur[1] (%)	NAPP (kg H_2SO_4/t)	ANC:MPA Ratio	No. Samples (n = 11)
Non-Acid Forming (Barren)[2]	≤ 0.1	-	-	5
Non-Acid Forming	> 0.1	≤ -5	≥ 2	1
Uncertain	> 0.1	> -5 and ≤ +5	< 2	4
Potentially Acid Forming	> 0.1	> +5	< 2	1

Notes:
1. If total sulfur is less than or equal to 0.1 %S, the NAPP and ANC:MPA ratio are not required for material classification as the sample is essentially barren of oxidisable sulfur.
2. A sample classified as NAF can be further described as 'barren' if the total sulfur and/or sulfide sulfur content is less than or equal to 0.1 %S, as the sample essentially has negligible acid generating capacity.

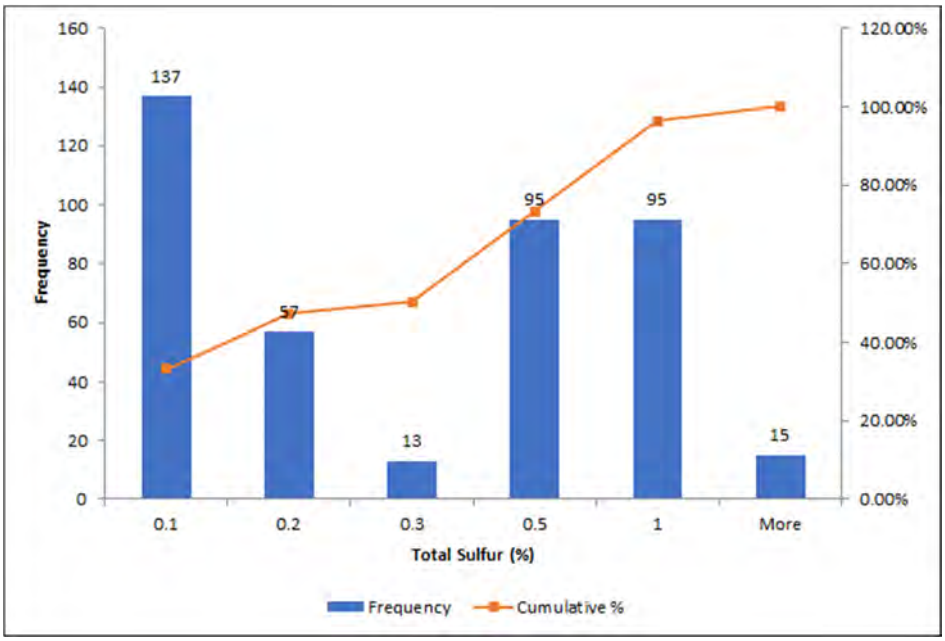
The Acid Base Account test data presented in **Table B3 (Attachment B)** and discussed in this section have been used to classify the acid forming nature of the 11 coal reject samples from the Project. The results in **Table 4-4** demonstrate that of the 11 samples tested, five samples are classified as NAF (Barren), one sample is classified as NAF, four samples are classified as Uncertain and one sample is classified as PAF. The classification criteria reflect Australian (COA, 2016c) and international (INAP, 2009) guidelines for the classification of mine waste materials.

Overall, the Acid Base Account results confirm that most of the coal reject materials represented by the samples tested have relatively low sulfide content, excess ANC, and are classified as NAF. As a bulk mixed material, it is expected that coal reject will have a relatively low risk of generating acidic drainage. If the Project progresses beyond the current approval and it is planned to wash coal on site, future co-disposal of coarse and fine reject materials and subsequent disposal within cells in waste rock materials is likely to be beneficial and eliminate any residual risk.

4.1.3 Coal

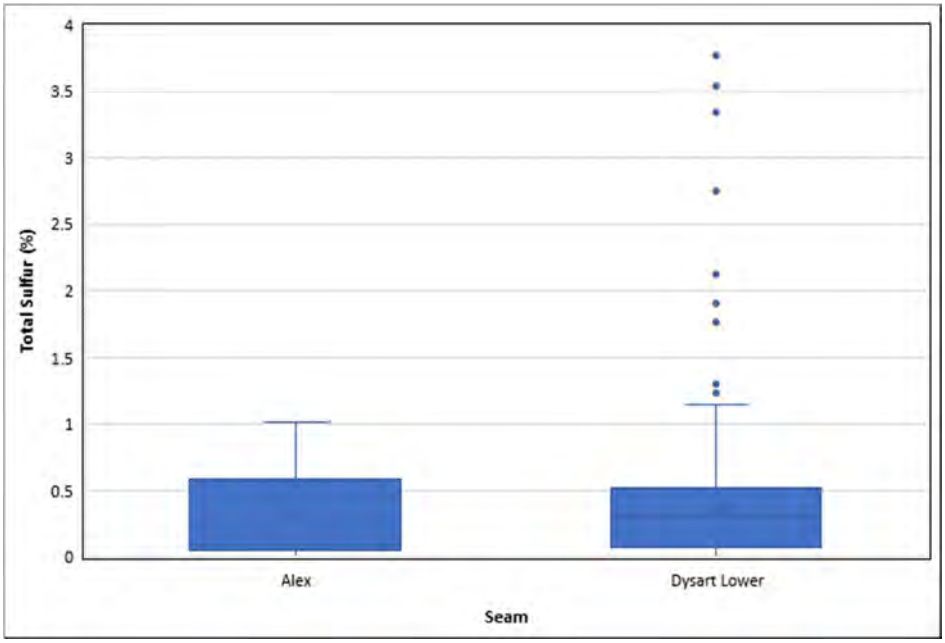
Mined coal will be temporarily stockpiled at the ROM area prior to transport for toll washing and product coal handling services off-site. Based on the total sulfur content of a range of coal samples from the Project target seams (Alex and Dysart Lower) (412 samples) it is likely that the coal materials will have similar geochemical characteristics to the coal reject materials described in **Section 4.1.2**. **Graph 4-16** shows the total sulfur distribution in raw coal materials for the target coal seams at the Project. The results demonstrate that approximately 75 % of the raw coal material represented by the samples tested has a

relatively low total sulfur content <0.5 %S. It should also be noted that approximately half of the total sulfur content is likely to be present as organic sulfur which has negligible capacity to generate acid.



Graph 4-16: Total sulfur distribution for raw coal samples

Graph 4-17 shows a "box and whisker" total sulfur plot for the target Alex and Dysart Lower coal seams using the same dataset (412 samples) used to generate **Graph 4-16**. The results show that the mean, median and 75th percentile total sulfur values in coal are low and generally at or below 0.5 %S. While a small number of higher total sulfur outliers occur for the Dysart Lower seam most samples have lower total sulfur content, Available sulfur speciation indicates that approximately half of the total sulfur will be present as organic sulfur, which has negligible capacity to generate acid.



Graph 4-17: Total sulfur "box and whisker" plot for raw coal samples

In terms of potential impacts from the temporary ROM coal stockpile, it is expected that the quality of any leachate will be similar to that of coal reject materials described in **Section 4.1.2**. As is standard practice at coal mining operations in the Bowen Basin, any surface runoff and seepage from the temporary ROM coal stockpile will be monitored for quality and managed in the mine water management system as part of the Project Water Management Plan.

4.2 Multi-Element Concentration in Solids

Multi-element scans were carried out on 10 mine waste samples (i.e. six composite samples of waste rock and four composite samples of coal reject materials) as described in **Section 3.2.1** to identify any elements (metals/metalloids) present at concentrations that may be of environmental concern with respect to materials handling, storage, revegetation and water quality.

To provide relevant context, RGS has compared the total metal/metalloid concentration in samples to National Environmental Protection Council (NEPC) Health-based Investigation Levels (HIL(C)) for soils in public open spaces (NEPC, 2013).

The results from multi-element testing (total metals/metalloids) of the 10 selected mine waste samples are presented in **Table B4 (Attachment B)**. The results indicate that the sample materials have low total metal and metalloid concentrations in solids below the applied NEPC (HIL(C)) guideline for soils.

The results from multi-element testing (total metals/metalloids) of the 10 selected mine waste samples are discussed with respect to median crustal abundance in unmineralised soils in **Section 4.3**.

4.2.1 Geochemical Abundance Index

Total metal/metalloid concentrations in mine waste materials can be compared to the median crustal abundance for un-mineralised soils (Bowen, 1979, COA, 2016c and INAP, 2009). The extent of enrichment is reported as the Geochemical Abundance Index (GAI), which relates the actual concentration in a sample with the median (or average) crustal abundance on a $\log_{10}$ scale. The GAI is expressed in integer increments from 0 to 6, where a GAI value of 0 indicates that the element is present at a concentration less than, or similar to, the median crustal abundance; and a GAI value of 6 indicates approximately a 100-fold enrichment above median crustal abundance (see **Table 4-5**).

Table 4-5: Geochemical abundance index values and enrichment factors

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

As a general rule, a GAI of 3 or greater signifies enrichment that may warrant further examination. This is particularly the case with some environmentally important 'trace' elements, such as arsenic, chromium, cadmium, copper, lead, selenium and zinc, more so than with major rock-forming elements, such as aluminium, calcium, iron, manganese and sodium.

Elements identified as enriched may not necessarily be a concern for revegetation, drainage water quality or public health, but their significance should still be evaluated. While the GAI provides an indication of metals/metalloids that may be enriched relative to the global average crustal abundance, the following points should also be considered:

- The median crustal abundance varies between different literature sources, thereby affecting the calculated GAI values.

- Samples that are enriched relative to the median crustal abundance, do not necessarily leach metals/metalloids at elevated concentrations. The mobility of metals/metalloids is dependent on mineralogy, adsorption/desorption and the environment in which it occurs.

Similarly, because an element is not enriched does not mean it will never be a concern, because under some conditions (e.g., low pH) the solubility of common environmentally important elements such as aluminium, copper, cadmium, iron and zinc increase significantly.

Table B4 (**Attachment B**) provides total metal/metalloid concentrations for the 10 composite mine waste samples described in **Section 3.2.1**. The relative enrichment of metals/metalloids in the samples compared to median crustal abundance (the Geochemical Abundance Index - GAI) is presented in **Table B5** (**Attachment B**).

The GAI results indicate that of the metals/metalloids measured, none of the 10 samples are enriched compared to median crustal abundance (i.e., all samples have a GAI < 3). While the concentration of selenium appears slightly elevated relative to median crustal abundance (GAI = 2) this is generally an artefact of the concentrations used in the GAI calculation (i.e., half the laboratory LoR of 5 mg/kg).

The potential solubility of any metals/metalloids in the sample materials was investigated further through water extract and KLC tests as presented in **Sections 4.4** and **4.5**, respectively.

A total of six composite waste rock samples were selected for physical characterisation as they are classified as NAF (Barren) and could potentially report to the outer surfaces of the WRD and could also be earmarked for use in other site infrastructure and rehabilitation works. The tests focussed on exchangeable cations and allowed the effective cation exchange capacity and exchangeable sodium percentage values. The results of these tests and calculated values are provided in **Table B4** (**Attachment B**) and are summarised below.

4.3 Soil Characteristics and Sodicity

4.3.1 Soil Characteristics

The effective cation exchange capacity (eCEC) results for the six composite waste rock samples are presented in **Table B4** (**Attachment B**). The results indicate that the eCEC of the six samples ranges from 4.8 to 18.6 meq/100g and is typically in the low to moderate range as described in **Table 4-6** (Hazelton and Murphy, 2007). The calcium:magnesium ratio is low and less than unity in all samples tested. For waste rock materials with a low to moderate eCEC value and low calcium:magnesium ratio, some fertiliser and gypsum addition may be required to provide a reasonable growth medium for vegetation roots as part of revegetation and rehabilitation activities.

Table 4-6: Ratings for cation exchange capacity

eCEC Rating	CEC (meq/100g)
Very low	<6
Low	6 – 12
Moderate	12 – 25
High	25 – 40
Very high	>40

4.3.2 Sodicity

The exchangeable sodium percentage (ESP) results for the six composite waste rock samples are presented in **Table B4** (**Attachment B**). The ESP results for the samples range from 10.8 to 24.6 % and are typically elevated and are typical of waste rock (overburden/interburden) materials found in this part of the Bowen Basin. Generally, samples with ESP values less than 6 % are considered non-sodic, and greater than 14 % are considered strongly sodic and may be susceptible to dispersion and erosion (Isbell, 2002; and Northcote

and Skene, 1972). Sodicity can result in surface crusting and low infiltration and hydraulic conductivity within the affected soils (Hazelton and Murphy, 2007).

Overall, the results of the ESP tests indicate that most waste rock materials represented by these samples are likely to be moderately to strongly sodic; and consequently, may be susceptible to dispersion and erosion and should be managed appropriately. The addition of gypsum to sodic waste rock materials has the potential to reduce the sodicity and reduce the potential for dispersion and erosion.

4.4 Water Quality Static Tests

There are no specific regulatory criteria for metal/metalloid concentrations in leachate from mine waste materials on mine sites in Queensland. As such, RGS has compared the multi-element results in water extracts from the ten composite mining waste samples (six waste rock and four coal reject) from the Project, described in **Section 4.2**, with Australian guidelines for livestock drinking water and aquatic freshwater ecosystems (ANZECC & ARMCANZ, 2000) guideline values. These guidelines are provided for context only and are not intended to be interpreted as "maximum permissible levels" for site water storage or discharge.

It should also be recognised that direct comparison of geochemical data with guideline values can be misleading. For the purpose of this study, guideline values are only provided for broad context and should not be interpreted as arbitrary "maximum" values or "trigger" values. Using sample pulps (ground to passing 75 µm) provides a very high surface area to solution ratio, which encourages mineral reaction and dissolution of the solid phase. Therefore, the results of screening tests on water extract solutions are assumed to represent an assumed 'worst case' scenario for initial surface runoff and seepage from mine waste materials.

The results from multi-element testing of water extracts (1:5 solid:water) from the 10 mine waste samples are presented in **Table B6** (**Attachment B**). The pH of the water extracts for the waste rock samples representing the Vulcan target ranges from pH 8.2 to 8.6 and is considered to be slightly alkaline. The pH of the water extracts for the waste rock samples representing the Jupiter target ranges from 6.8 to 7.1 and is considered to be neutral. The pH of the water extracts for the four coal reject samples ranges from 5.8 to 8.6. In all cases it is expected that some alkalinity will be added to contact water from these materials as the deionised water used in the tests ranged from pH 5.4 to 5.7. The pH results for all samples (except one coarse reject sample) are within the range (pH 6 to 9) for 95 % species protection in freshwater aquatic ecosystems as set out in ANZECC and ARMCANZ (2000).

The water extracts from the 10 mine waste samples have moderate EC values ranging from 54 to 788 µS/cm, with higher values seen in the samples representing the Vulcan target (median 544 µS/cm) than those representing the Jupiter target (median 216 µS/cm) or coal reject (median 91 µS/cm), indicating low to moderate salinity levels (and low to moderate concentrations of dissolved solids).

The total alkalinity in the water extracts from the Vulcan waste rock samples ranges from moderate to elevated (564 to 2,980 mg $CaCO_3$/L). The total alkalinity from the two composite samples from the Jupiter target is lower and ranges from 34 to 144 mg $CaCO_3$/L. For the coal reject samples, the total alkalinity ranges from 24 to 1,032 mg $CaCO_3$/L. All of the alkalinity in the water extract samples is in the form of bicarbonate (HCO_3), with carbonate values being less than the laboratory LoR (1 mg/L). The acidity in the water extracts from the waste rock samples is generally low, ranging from less than the laboratory LoR (1 mg/L) to 3 mg $CaCO_3$/L for Vulcan samples, 5 to 8 mg $CaCO_3$/L for Jupiter samples, and 19 to 178 mg $CaCO_3$/L for coal reject samples, respectively, leading to a positive net alkalinity value for all samples.

The total concentration of major ions in the water extracts is dominated by bicarbonate, sodium, chloride and sulfate. The concentration of sulfate in the water extracts from all 10 samples ranges from 18 to 46 mg/L (median 29 mg/L), and therefore is more than an order of magnitude below the applied (ANZECC & ARMCANZ, 2000) water quality guideline criterion (1,000 mg/L) for livestock drinking water for this anion.

The concentration of trace metals/metalloids tested in the water extracts is typically low and predominantly below the laboratory LoR. Most metal/metalloid concentrations tested in the water extracts are below the applied water quality guideline criteria. The main exceptions are aluminium (four samples) and copper (three

samples), which have concentrations in some of the water extracts above the applied freshwater aquatic ecosystem water quality guideline value for 95 % species protection (ANZECC & ARMCANZ, 2000), but are below the applied guideline values for livestock drinking water.

Given that the pH values in the relevant water extracts are pH neutral to slightly alkaline, the elevated aluminium concentrations in these water extracts may in some part be due to the formation of colloidal materials in the water extracts, which can pass through the (0.45 µm filter) filtration stage used in the standard laboratory preparation procedure. This can occur due to the physical preparation of the sample at the laboratory to pass a 75 µm particle size.

On the basis of these results, it is expected that the risk of potential impact on the quality of surface runoff and groundwater from bulk mine waste materials at the Project will be low. Based on the water extract results presented in this section, the quality of any leachate from any coal reject materials co-disposed in-pit would be similar to leachate at areas of the pit where co-disposal in cells was not used.

The dynamic quality of mine waste contact water (if these materials are left exposed to atmospheric i.e., oxidising conditions) and any potential risk to water resources at the site is investigated further using KLC tests in **Section 4.5.**

4.5 Water Quality Kinetic Tests

KLC tests were completed on six composite samples of mine waste materials (four waste rock and two coal reject samples) using the methodology described in **Section 3.2.2** and **Attachment A**. The composition of the six composite samples used in the KLC tests is summarised in **Table 4-7** and detailed in **Table B7** (**Attachment B**). The six KLC tests cover the range of waste rock (sandstone, claystone and siltstone) and coal reject (coarse and fine reject) likely to be generated by the Project. The KLC tests on waste rock were operated for a period of six months from June 2019 to December 2019 under a monthly watering and leaching regime. The KLC tests on coal reject were operated from December 2019 to June 2020 under a monthly watering and leaching regime. The KLC tests were operated following mining industry guidelines for such tests (AMIRA, 2002; COA, 2016).

The leachate results from the KLC test program are presented alongside Australian water quality guideline values for livestock drinking water quality (ANZECC & ARCANZ, 2000). These guidelines are provided for context only and are not intended to be interpreted as “maximum permissible levels” for site water storage or discharge. It should be noted that the KLC samples were crushed to pass a 10 mm sieve size, where required, and therefore have a high surface area for potential geochemical reaction. The ratio of sample to water in the KLC tests was approximately 3:1 (w/v) (i.e., concentrated), whereas the ratio of sample to water generally used in tests where results can (arbitrarily) be compared against guideline concentrations to provide relevant context is over an order of magnitude more dilute at 1:5 (w/v). Whilst arbitrary comparisons against guideline concentrations can be helpful in some situations to provide relevant context, such comparisons cannot be directly extrapolated to the field situation at the Project.

Table 4-7: Composite mine waste samples selected for KLC tests

KLC Sample Number	RGS Composite ID	Description
KLC1	Composite 2 Waste Rock	Mainly Vulcan sandstone
KLC2	Composite 4 Waste Rock	Mainly Vulcan claystone
KLC3	Composite 5 Waste Rock	Mainly Jupiter sandstone
KLC4	Composite 6 Waste Rock	Mainly Jupiter siltstone
KLC5	Composite Fine Reject	Vulcan Fine Reject
KLC6	Composite Coarse Reject	Vulcan Coarse Reject

The monthly KLC test results for the four composite waste rock samples are presented in **Attachment C**. Tables **KLC 1** to **KLC 4** provide the KLC test data for seven leach events on waste rock samples (over six

months), selected components of which are also shown graphically. For the two coal reject samples (**KLC 5** and **KLC 6**), data from the seven leach events (over six months) is provided in **Attachment C**. The KLC test results indicate that:

- Leachate from the six KLC tests has a pH in the range of 5.55 to 8.27 over the test period. Whilst some pH fluctuations are noted within this range, the majority of pH values generally lie in the range pH 6 to 8. The lowest pH value is still greater than the deionised water used in the test program. Therefore, it is likely that the mine waste materials add some alkalinity to contact/leaching water. These results suggest that pH values in any surface runoff and seepage from bulk mine waste materials exposed to oxidising conditions will be in the range pH 6 to 8.
- Leachate from the six KLC tests has an EC value in the range of 54 to 1,796 µS/cm over the test period. Most EC values in leachate show a downward trend over time however leachate from KLC1 (Vulcan Sandstone) shows and increasing EC trend, before reducing again at the end of the test period. These results indicate EC values from most bulk mine waste materials exposed to oxidising conditions will be low to moderate.

  The slightly elevated EC value in the initial 'first flush' from the some of the mine waste sample materials is probably due to the increased solubility of minerals through crushing/preparation of the sample materials before loading into the KLC test columns.
- The acidity value in leachate from the six KLC tests over the test period is very low, ranging from below the laboratory LoR (<1 mg/L, as $CaCO_3$) to 8 mg/L. The alkalinity values in leachate from the KLC tests are also relatively low, but generally more than sufficient to create net alkalinity values that are either positive or close to zero (i.e., the alkalinity is predominantly greater than the acidity) during the test period.
- The concentration of major ions in leachate from the six KLC tests is typically dominated by variable concentrations of sodium, chloride and sulfate. Lower concentrations of other major ions are also likely to be present in leachate from these materials. The concentration of calcium in leachate from the fine rejects (KLC 5) is an order of magnitude greater than observed in leachate from the other KLC tests.
- The sulfate release rate from the six KLC samples generally shows a relatively stable trend over the test period for most samples. The exception is the sulfate release rate from the fine rejects sample which increases before decreasing towards the end of the test period d. The highest sulfate release rate is displayed by the fine rejects (KLC 5). Notwithstanding, the sulfate concentration in leachate from all of the KLC tests is well below the applied guideline value of 1,000 mg/L (ANZECC & ARMCANZ, 2000).
- The four waste rock materials used in the KLC tests retain at least ~81.3 % of their inherent total sulfur content after six months of exposure to idealised oxidising conditions, which reflects slow rate of sulfide oxidation (and low potential for acid generation) for these materials. The two coal reject samples show similar sample characteristics and retain at least 95 % of their inherent total sulfur content at the end of the six month test period.
- The four KLC waste rock samples retain at least ~99.1 % of their inherent ANC value after six months of exposure to idealised oxidising conditions, which reflects the slow release of alkalinity from these materials. The two coal reject samples show similar sample characteristics and retain at least 88 % of their inherent ANC value at the end of the six month test period.
- The concentration of trace metals/metalloids in the leachate from the six KLC tests is generally low and typically below the laboratory LoR. Most trace metals/metalloids are therefore sparingly soluble at the current pH of the KLC leachate. The concentrations of all metals/metalloids are typically below the applied water quality guideline criteria for livestock drinking water (ANZECC & ARMCANZ, 2000). The only exception is selenium in some of the leachate collected from the two coal reject samples, which show concentrations marginally above the livestock drinking water low risk trigger levels (0.02 mg/L). Based on the KLC results presented in this section, the quality of leachate from any co-disposed coal

reject materials in-pit in terms of trace metal/metalloid concentrations would be similar to leachate at areas of the pit where co-disposal in cells was not used.

- The sulfate generation rate results obtained for the six KLC test samples have been used to determine the rate of sulfide oxidation in these materials. Most sulfate salts generated from sulfide reaction involving materials with a relatively low sulfide sulfur concentration are highly soluble, and therefore will be collected in column leachate. The dissolved sulfate (and calcium) concentrations in most of the KLC leachate are typically much less than the solubility limit of gypsum ($CaSO_4$), for example, which indicates that sulfate generation is not controlled by gypsum dissolution in the KLC test materials. Therefore, the sulfate concentrations and oxidation rate calculations provide reasonable estimates of these parameters and the results align well with existing static and dynamic geochemical data derived from a wide range of mine waste materials (AMIRA, 1995). The sulfate generation rate and associated sulfide oxidation rate for the KLC tests are shown in **Table 4-8**.
- The sulfate generation rate from the KLC samples ranges from 1.71 to 24.78 mg/kg/week which is equivalent to a sulfide oxidation rate ranging from 6.99×10^{-10} to 1.01×10^{-8} kg $O_2/m^3/s$. Mining waste materials with an oxidation rate less than 5×10^{-8} kg $O_2/m^3/s$ and a moderate ANC level have an increased factor of safety and are likely to generate leachate that is pH neutral and/or has a low level of acidity (AMIRA, 1995; Bennett *et al*., 2000). Hence, all of the mine waste materials tested fall into this category. Overall, the KLC results reflect the range of material characteristics predicted from the static geochemical test results shown in **Section 4.1**.

  Potential implications of these results with respect to the management of the mine waste materials at the Project are discussed further in **Section 5.**

Table 4-8: Sulfate generation and sulfide oxidation rates for KLC tests

KLC Sample Number	Sample Description	Sulfate Generation Rate (mg/kg/week)	Oxidation Rate (kg $O_2/m^3/s$)
KLC1	Vulcan sandstone	3.42	1.37×10^{-9}
KLC2	Vulcan claystone	1.71	6.99×10^{-10}
KLC3	Jupiter sandstone	3.97	1.66×10^{-9}
KLC4	Jupiter siltstone	4.32	1.78×10^{-9}
KLC5	Fine reject	24.78	1.01×10^{-8}
KLC6	Coarse reject	7.82	3.18×10^{-9}

5 DISCUSSION

5.1 AMD potential and Management

The results of the static and kinetic geochemical tests demonstrate that the overwhelming majority of the waste rock materials contain negligible sulfide content, have excess ANC, and are classified as NAF. These samples represent materials with a very low risk of acid generation and a high factor of safety with respect to generating acidic drainage.

The static and kinetic geochemical test results for coal reject demonstrate that most of the coal reject materials represented by the samples tested have relatively low sulfide content and excess ANC. As a bulk mixed material, it is expected that coal reject will be classified as NAF and have a relatively low risk of generating acidic drainage. Given that coal from the Project will be toll washed off site, disposal of coal reject materials from coal washing is not proposed nor does it present an issue for this Project on the MLA. Based on the KLC results presented in **Section 4.5**, apart from slightly elevated sulfate, the quality of leachate from any co-disposed coal reject materials in-pit would be similar to leachate at areas of the pit where co-disposal in cells was not used.

For future reference, it expected that from a geochemistry viewpoint, co-disposal of coarse and fine reject materials in-pit would be beneficial. This is because coal reject materials typically remain moist and any oxidation will only occur at surface (i.e., the fine reject will fill the gaps between the coarse reject particles and generally limit oxygen ingress). The coarse reject also would also provide some geotechnical stability to the mixed reject cell structure. The in-pit disposal of mixed coarse and fine reject materials within waste rock cells is also a low risk strategy as the much larger volume of waste rock typically has very low sulfur content and excess ANC.

5.2 Multi-Element Composition and Water Quality

5.2.1 Multi-Element Composition and Enrichment

The multi-element concentrations of metal/metalloids in mine waste materials are presented in **Section 4.1.2 and 4.2.1**, along with a comparison against applied guideline values and median crustal abundance in soils. The results indicate that the mine waste materials are not significantly enriched with metals/metalloids compared to median crustal abundance in unmineralised soils.

5.2.2 Water Quality

The static and kinetic geochemical test results presented in this report indicate that the surface runoff and seepage from NAF mine waste materials is likely to be pH neutral to slightly alkaline and have a low to moderate EC value indicating low to moderate salinity levels (and low to moderate concentrations of dissolved solids). Surface runoff and seepage from mine waste materials is likely to fall within the range for 95 % species protection in freshwater aquatic ecosystems (pH 6 to 9) as set out in ANZECC and ARMCANZ (2000).

The major ion concentrations in leachate from mine waste materials are relatively low and dominated by sodium, chloride and sulfate. Lower concentrations of other major ions are also likely to be present in leachate from these materials. The sulfate concentration in leachate from all mine waste samples is well below the applied ANZECC & ARMCANZ stock water quality guideline criterion (1,000 mg/L).

The water extract and KLC test results for mining waste materials indicate that most trace metals/metalloids are sparingly soluble, and that the concentration of dissolved metals/metalloids in surface runoff and seepage is relatively low, predominantly below the laboratory LoR, and below the applied water quality guideline criteria. Minor exceptions may include aluminium, copper and selenium in pore water, which can occasionally be greater than the applied guideline concentrations (ANZECC & ARMCANZ, 2000) in selected samples. The KLC test data over the test period indicates that the concentrations of most dissolved trace

metal/metalloid in contact water are typically low and well within applied livestock drinking water guideline values.

Whilst significantly elevated metal/metalloid concentrations in contact water are not expected at the Project, it is recommended that the suite of metals/metalloids described in the static and KLC test in this report be included from time to time, where appropriate, in the site water quality monitoring program.

It is recommended that samples of surface runoff and seepage from areas used to store mine waste materials and coal be included in the site water quality monitoring program.

5.3 Revegetation and Rehabilitation

From a soil chemistry viewpoint, bulk waste rock materials are classified as NAF and are likely to be pH neutral to slightly alkaline and have low to moderate levels of salinity. Most waste rock materials may be susceptible to dispersion and erosion, although these material characteristics may be improved to some extent by the addition of gypsum. In addition, fertiliser supplementation may also need to be considered for surface mining waste materials for the purpose of providing a reasonable growth medium for revegetation and rehabilitation.

Additional confirmatory sampling and testing should be completed on bulk mine waste materials when available during the operational phase of the Project to determine the best management option for progressive rehabilitation of these materials during operations and at mine closure. Sampling should focus on collecting representative samples of any waste rock (i.e., spoil) materials planned to be used at the surface of final landforms to supplement any existing subsoil and topsoil salvaged re-used in revegetation and rehabilitation activities. Testing should include typical soil parameters including pH, EC, exchangeable cations, organic matter, total organic carbon, Emerson Aggregate, particle size distribution, and nutrients (including available K, P, S, as well as Nitrogen (N) species (TKN, TN, Nitrite and Nitrate).

5.4 Management Measures

Table 4-9 provided a summary how the waste rock, coal reject and coal materials will be managed through all stages of the mine life including construction, operations, rehabilitation and decommissioning.

Table 5-1: Material Management Over Mine Life

Project Phase	Waste Rock	Coal Rejects	Coal
Construction	Stored at out-of-pit WRD	None produced	None produced
Operations	Stored at out-of-pit WRD and/or backfilled in-pit.	Stored at off-site toll wash facility and/or co-disposed / backfilled within cells in-pit. Contact water monitored for quality and managed in the mine water management system as part of Water Management Plan	Temporarily stockpiled at ROM. Contact water monitored for quality and managed in the mine water management system as part of Water Management Plan
Rehabilitation	Final landforms rehabilitated/ revegetated	Final landforms rehabilitated/ revegetated	ROM removed and footprint rehabilitated/revegetated
Decommissioning	Final landform performance monitoring moving towards lease relinquishment	Final landform performance monitoring moving towards lease relinquishment	None

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

RGS has completed a geochemistry assessment of mine waste (waste rock and coal reject) materials at the Project. The main findings of the geochemical assessment are as follows:

- The overwhelming majority of the waste rock materials have low sulfide content, excess ANC, and are classified as NAF (Barren). These materials have a very low risk of acid generation and a high factor of safety with respect to potential for generation of acidity.
- Coal reject materials have relatively low sulfide content and excess ANC. As a bulk mixed material, it is expected that coal reject will be classified as NAF and have a relatively low risk of generating acidic drainage. Given that coal from the Project will be toll washed off site, disposal of coal reject materials from coal washing will most likely not be required unless reject disposal at the toll washing facility is not possible.
- Initial and ongoing surface runoff and seepage from mine waste materials is expected to be pH neutral to slightly alkaline and have a low level of salinity.
- There is no significant metal/metalloid enrichment in mine waste materials compared to applied guideline values and median crustal abundance in unmineralised soils.
- Most metals/metalloids are sparingly soluble at the neutral to slightly alkaline pH of leachate expected from bulk NAF mine waste materials. Dissolved metal/metalloid concentrations in surface runoff and leachate from bulk NAF mine waste materials are expected to be low and unlikely to pose a significant risk to the quality of surface and groundwater resources at relevant storage facilities.
- NAF waste rock materials should be amenable to revegetation as part of rehabilitation activities, although, gypsum and fertiliser addition may need to be considered for sodic materials to limit dispersion and erosion and to provide a reasonable growth medium for revegetation and rehabilitation.

6.2 Recommendations

As a result of the geochemical assessment work completed on waste rock and coal reject materials at the project, several recommendations are provided to minimise the risk of any significant environmental harm to the immediate and downstream environment:

- Confirmatory sampling and testing should be completed when the mine is operational and bulk materials become available to confirm the most appropriate management methodology for progressive rehabilitation of these materials during mine operations and at mine closure.
- If coal is washed on site or reject from the toll-washing is required to be returned to site for disposal in future, placement of any coal reject materials at or near the final surfaces of waste rock storage facilities should be avoided. In addition, the merits of in-pit co-disposal of coarse and fine reject materials and subsequent disposal within cells in waste rock materials should be considered.
- Surface water and seepage from the proposed open pit, ROM coal and mine waste storage areas should be monitored to ensure that key water quality parameters remain within appropriate criteria. Whilst significantly elevated metal/metalloid concentrations in contact water are not expected at the Project, it is recommended that the suite of metals/metalloids described in the static and KLC test in this report be included from time to time, where appropriate, in the site water quality monitoring program.

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Attachment A Geochemical Assessment of Mine Waste Materials

GEOCHEMICAL ASSESSMENT OF MINE WASTE MATERIALS

ACID GENERATION AND PREDICTION

Acid generation is caused by the exposure of sulfide minerals, most commonly pyrite (FeS_2), to atmospheric oxygen and water. Sulfur assay results are used to calculate the potential acidity that could be generated by the sample typically by determining the sulfidic S content directly. Pyrite reacts under oxidising conditions to generate acid according to the following overall reaction:

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

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

Net Acid Producing Potential

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

Determination of pH and EC

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

Total sulfur content and Maximum Potential Acidity (MPA)

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

Acid neutralising capacity (ANC)

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

Net Acid Generation (NAG)

The net acid generation (NAG) test involves the addition of hydrogen peroxide to a sample of mine rock or process residue to oxidise reactive sulfide, then measurement of pH and titration of any net acidity produced by the acid generation and neutralisation reactions occurring in the sample. A significant NAG result (i.e., final $NAG_{pH} < 4.5$) indicates that the sample is potentially acid forming (PAF) and the test provides a direct measure of the net amount of acid remaining in the sample after all acid generating and acid neutralising reactions have taken place. A $NAG_{pH} > 4.5$ indicates that the sample is non-acid forming (NAF). The NAG test can provide a direct assessment of the potential for a material to produce acid after a period of exposure and weathering and is used to refine the results of the theoretical NAPP predictions. The NAG test can be used as a stand-alone test but is recommended that this only be considered after site specific calibration work is carried out. The standard NAG test is generally unsuitable for coal mining projects as the high organic content of some materials can cause erroneous results (Stewart et al., 2003; ACARP, 2008).

ASSESSMENT OF ELEMENT ENRICHMENT AND SOLUBILITY

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

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

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

Multi-element composition of solids.

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

Multi-element composition of water extracts (1:5 sample:deionised water).

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

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

KINETIC LEACH COLUMN TESTS

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

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

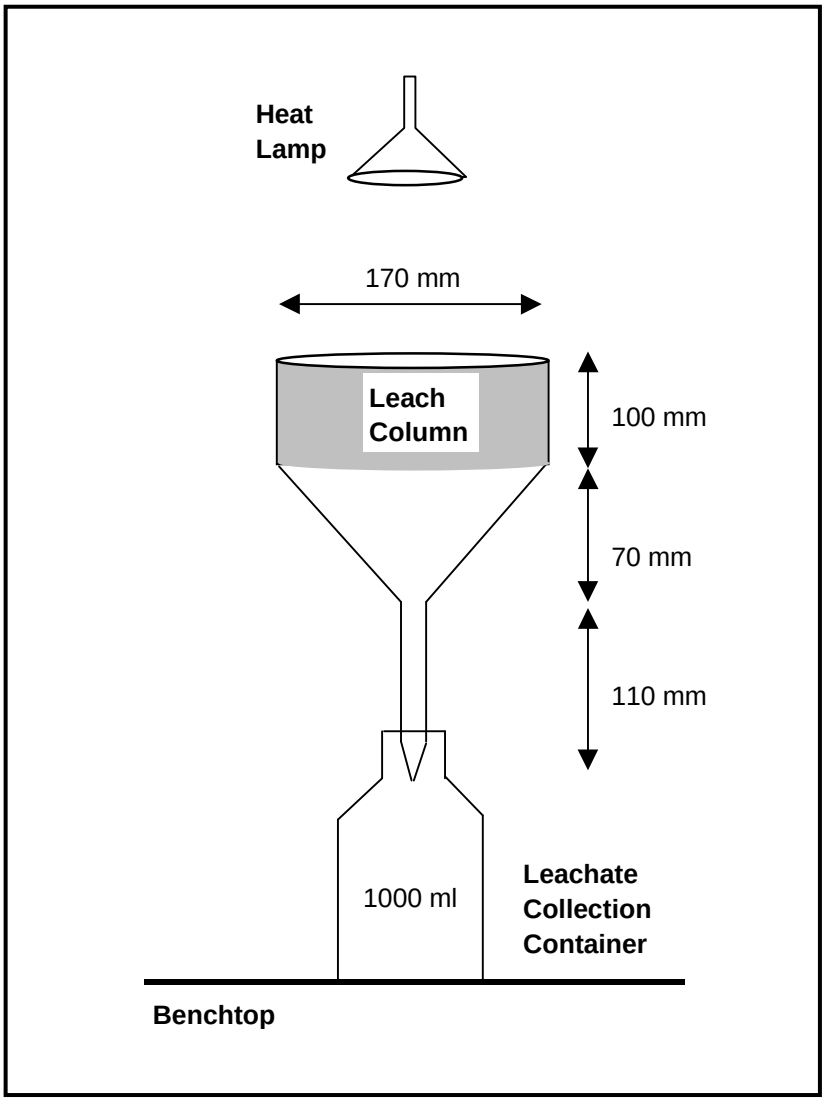
The KLC tests simulate the weathering process that leads to acid and base generation and reaction under laboratory controlled or site conditions. The kinetic tests allow an assessment of the acid forming characteristics and indicate the rate of acid generation, over what period it will occur, and what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

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

Figure A1 shows the kinetic leach column set up typically used by RGS adapted from *AMIRA, 2002*. The columns are placed under heat lamps to allow the sample to dry between water additions to ensure adequate oxygen ingress into the sample material.

Approximately 2 kg of sample is accurately weighed and used in the leach columns and depending on the physical nature of the material and particle size can be used on an as-received basis (i.e., no crushing as with process residues) or crushed to nominal 5-10 mm particle size (as with waste rock). The sample in the column is initially leached with deionised water at a rate of about 400 ml/kg of sample and the initial leachate from the columns collected and analysed. Subsequent column leaching is carried out at a rate of about 400 ml/kg per month and again collected and analysed. The leaching rate can be varied to better simulate expected site conditions or satisfy test program data requirements. The column must be exposed to drying conditions in between watering events. The residual water content and air void content in the column can be determined by comparing the wet and dry column weights. A heat lamp is generally used above the sample during daylight hours to maintain the leach column surface temperature at about 30^{o}C.

Figure A1: Kinetic leach column setup



Attachment B Static Geochemical Test Results

Table B1: List of Waste Rock and Coal Reject Samples

RGS Sample No.	ALS ID	Deposit	Vitronite Sample ID	Drillhole ID	Sample Lithology	Sample Type	From	To	Interval
							(m)		
Vulcan Prospect									
Overburden									
Composite 18	EB1914213018	Vulcan	134781	VSW082_C	Soil 100%	Overburden	0.0	1.0	1.0
Composite 26	EB1914213026	Vulcan	134789	VSW083_C	Soil 100%	Overburden	0.0	1.0	1.0
Composite 34	EB1914213034	Vulcan	163117	VSW084_C	Soil 100%	Overburden	0.0	3.0	3.0
Composite 36	EB1914213036	Vulcan	163119	VSW084_C	Sand 100%	Overburden	7.0	11.0	4.0
Composite 53	EB1914213053	Vulcan	163001	VSW087_C	Soil 100%	Overburden	0.0	1.0	1.0
Composite 54	EB1914213054	Vulcan	163002	VSW087_C	Soil 100%	Overburden	1.0	3.0	2.0
Composite 63	EB1914213063	Vulcan	163014	VSW088_C	Soil 100%	Overburden	0.0	3.0	3.0
Composite 70	EB1914213070	Vulcan	134807	VSW089_C	Soil 100%	Overburden	0.0	1.0	1.0
Composite 84	EB1914214014	Vulcan	134832	VSW092_C	Soil 100%	Overburden	0.0	1.0	1.0
Composite 91	EB1914214021	Vulcan	163038	VSW095_C	Soil 100%	Overburden	0.0	3.0	3.0
Composite 101	EB1914214031	Vulcan	163251	VSW099_C	Soil 100%	Overburden	0.0	1.0	1.0
Composite 109	EB1914214039	Vulcan	163233	VSW104_C	Soil 100%	Overburden	0.0	1.0	1.0
Composite 55	EB1914213055	Vulcan	163003	VSW087_C	Alluvium 100%	Overburden	3.0	4.0	1.0
Composite 93	EB1914214023	Vulcan	163041	VSW095_C	Alluvium 100%	Overburden	8.0	9.0	1.0
Composite 8	EB1914213008	Vulcan	145303	VSW070_C	Calcrete 100%	Overburden	6.0	7.0	1.0
Composite 37	EB1914213037	Vulcan	163120	VSW084_C	Gravel 100%	Overburden	11.0	14.0	3.0
Composite 39	EB1914213039	Vulcan	163122	VSW084_C	Gravel 100%	Overburden	16.0	18.0	2.0
Composite 4	EB1914213004	Vulcan	145166	VSW052_C	Conglomerate 100%	Overburden	30.0	32.4	2.4
Composite 5	EB1914213005	Vulcan	145167	VSW052_C	Conglomerate 100%	Overburden	32.4	37.4	5.0
Composite 9	EB1914213009	Vulcan	145304	VSW070_C	Sandstone 100%	Overburden	7.0	16.0	9.0
Composite 10	EB1914213010	Vulcan	145305 - 145306	VSW070_C	Sandstone 100%	Overburden	16.0	23.0	7.0
Composite 11	EB1914213011	Vulcan	145307	VSW070_C	Sandstone 100%	Overburden	23.0	25.0	2.0
Composite 21	EB1914213021	Vulcan	134784	VSW082_C	Sandstone 100%	Overburden	5.0	16.0	11.0
Composite 28	EB1914213028	Vulcan	134791	VSW083_C	Sandstone 100%	Overburden	4.0	20.0	16.0
Composite 41	EB1914213041	Vulcan	163124 - 163125	VSW084_C	Sandstone 100%	Overburden	19.0	26.0	7.0
Composite 43	EB1914213043	Vulcan	163127 - 163128	VSW084_C	Sandstone 100%	Overburden	27.0	37.0	10.0
Composite 56	EB1914213056	Vulcan	163004	VSW087_C	Sandstone 100%	Overburden	4.0	9.0	5.0
Composite 57	EB1914213057	Vulcan	163005 - 163006	VSW087_C	Sandstone 100%	Overburden	9.0	13.0	4.0
Composite 58	EB1914213058	Vulcan	163007 - 163009	VSW087_C	Sandstone 100%	Overburden	13.0	18.0	5.0
Composite 59	EB1914213059	Vulcan	163010	VSW087_C	Sandstone 100%	Overburden	18.0	21.0	3.0
Composite 66	EB1914213066	Vulcan	163018 - 163019	VSW088_C	Sandstone 100%	Overburden	12.0	18.0	6.0
Composite 67	EB1914213067	Vulcan	163020 - 163022	VSW088_C	Sandstone 100%	Overburden	18.0	23.0	5.0
Composite 68	EB1914213068	Vulcan	163023	VSW088_C	Sandstone 100%	Overburden	23.0	29.0	6.0
Composite 94	EB1914214024	Vulcan	163042 - 163043	VSW095_C	Sandstone 100%	Overburden	9.0	12.0	3.0
Composite 95	EB1914214025	Vulcan	163044	VSW095_C	Sandstone 100%	Overburden	12.0	14.0	2.0
Composite 97	EB1914214027	Vulcan	163046 - 163047	VSW095_C	Sandstone 100%	Overburden	15.0	18.0	3.0
Composite 98	EB1914214028	Vulcan	163048 - 163050	VSW095_C	Sandstone 100%	Overburden	18.0	24.0	6.0
Composite 99	EB1914214029	Vulcan	163201	VSW095_C	Sandstone 100%	Overburden	24.0	25.0	1.0
Composite 103	EB1914214033	Vulcan	163253 - 163254	VSW099_C	Sandstone 100%	Overburden	3.0	7.0	4.0
Composite 104	EB1914214034	Vulcan	163255 - 163256	VSW099_C	Sandstone 100%	Overburden	7.0	14.0	7.0
Composite 105	EB1914214035	Vulcan	163257 - 163258	VSW099_C	Sandstone 100%	Overburden	14.0	19.0	5.0
Composite 111	EB1914214041	Vulcan	163236	VSW104_C	Sandstone 100%	Overburden	4.0	7.0	3.0
Composite 112	EB1914214042	Vulcan	163237	VSW104_C	Sandstone 100%	Overburden	7.0	14.0	7.0
Composite 113	EB1914214043	Vulcan	163238 - 163240	VSW104_C	Sandstone 100%	Overburden	14.0	20.0	6.0
Composite 1	EB1914213001	Vulcan	145163	VSW052_C	Clay 100%	Overburden	0.1	5.0	4.9
Composite 2	EB1914213002	Vulcan	145164	VSW052_C	Clay 100%	Overburden	5.0	10.0	5.0
Composite 3	EB1914213003	Vulcan	145165	VSW052_C	Clay 100%	Overburden	25.0	30.0	5.0
Composite 6	EB1914213006	Vulcan	145301	VSW070_C	Clay 100%	Overburden	0.0	3.0	3.0
Composite 7	EB1914213007	Vulcan	145302	VSW070_C	Clay 100%	Overburden	3.0	6.0	3.0
Composite 19	EB1914213019	Vulcan	134782	VSW082_C	Clay 100%	Overburden	1.0	2.0	1.0
Composite 20	EB1914213020	Vulcan	134783	VSW082_C	Clay 100%	Overburden	2.0	5.0	3.0
Composite 27	EB1914213027	Vulcan	134790	VSW083_C	Clay 100%	Overburden	1.0	4.0	3.0
Composite 35	EB1914213035	Vulcan	163118	VSW084_C	Clay 100%	Overburden	3.0	7.0	4.0
Composite 38	EB1914213038	Vulcan	163121	VSW084_C	Clay 100%	Overburden	14.0	16.0	2.0
Composite 40	EB1914213040	Vulcan	163123	VSW084_C	Clay 100%	Overburden	18.0	19.0	1.0
Composite 46	EB1914213046	Vulcan	134797	VSW085_C	Clay 100%	Overburden	0.0	2.0	2.0
Composite 47	EB1914213047	Vulcan	134798 - 134799	VSW085_C	Clay 100%	Overburden	2.0	8.0	6.0
Composite 48	EB1914213048	Vulcan	1347800	VSW085_C	Clay 100%	Overburden	8.0	14.0	6.0
Composite 49	EB1914213049	Vulcan	1347801 - 1347802	VSW085_C	Clay 100%	Overburden	14.0	18.0	4.0
Composite 50	EB1914213050	Vulcan	1347803 - 1347804	VSW085_C	Clay 100%	Overburden	18.0	25.0	7.0
Composite 51	EB1914213051	Vulcan	1347805	VSW085_C	Clay 100%	Overburden	25.0	29.0	4.0
Composite 52	EB1914213052	Vulcan	1347806	VSW085_C	Clay 100%	Overburden	29.0	30.7	1.7
Composite 64	EB1914213064	Vulcan	163015 - 163016	VSW088_C	Clay 100%	Overburden	3.0	7.0	4.0
Composite 65	EB1914213065	Vulcan	163017	VSW088_C	Clay 100%	Overburden	7.0	12.0	5.0
Composite 71	EB1914214001	Vulcan	134808 - 134809	VSW089_C	Clay 100%	Overburden	1.0	3.0	2.0
Composite 72	EB1914214002	Vulcan	134810	VSW089_C	Clay 100%	Overburden	3.0	14.0	11.0
Composite 73	EB1914214003	Vulcan	134811	VSW089_C	Clay 100%	Overburden	14.0	16.0	2.0
Composite 74	EB1914214004	Vulcan	134812	VSW089_C	Clay 100%	Overburden	16.0	28.0	12.0
Composite 75	EB1914214005	Vulcan	134813	VSW089_C	Clay 100%	Overburden	28.0	30.2	2.2
Composite 76	EB1914214006	Vulcan	134814	VSW090_C	Soil 100%	Overburden	0.0	1.0	1.0
Composite 77	EB1914214007	Vulcan	134815	VSW090_C	Clay 100%	Overburden	1.0	5.0	4.0
Composite 78	EB1914214008	Vulcan	134816 - 134818	VSW090_C	Clay 100%	Overburden	5.0	10.0	5.0
Composite 79	EB1914214009	Vulcan	134819	VSW090_C	Clay 78%, Claystone 22%	Overburden	10.0	19.0	9.0
Composite 85	EB1914214015	Vulcan	134833	VSW092_C	Clay 100%	Overburden	1.0	6.0	5.0
Composite 86	EB1914214016	Vulcan	134834 - 134835	VSW092_C	Clay 100%	Overburden	6.0	12.0	6.0
Composite 92	EB1914214022	Vulcan	163039 - 163040	VSW095_C	Clay 100%	Overburden	3.0	8.0	5.0
Composite 102	EB1914214032	Vulcan	163252	VSW099_C	Clay 100%	Overburden	1.0	3.0	2.0
Composite 110	EB1914214040	Vulcan	163234 - 163235	VSW104_C	Clay 100%	Overburden	1.0	4.0	3.0
Composite 12	EB1914213012	Vulcan	145308	VSW070_C	Claystone 100%	Overburden	25.0	26.0	1.0
Composite 42	EB1914213042	Vulcan	163126	VSW084_C	Claystone 100%	Overburden	26.0	27.0	1.0
Composite 80	EB1914214010	Vulcan	134820	VSW090_C	Claystone 100%	Overburden	19.0	20.0	1.0
Composite 96	EB1914214026	Vulcan	163045	VSW095_C	Claystone 100%	Overburden	14.0	15.0	1.0
Composite 100	EB1914214030	Vulcan	163202	VSW095_C	Claystone 100%	Overburden	25.0	25.8	0.8

Table B1: List of Waste Rock and Coal Reject Samples

RGS Sample No.	ALS ID	Deposit	Vitronite Sample ID	Drillhole ID	Sample Lithology	Sample Type	From	To	Interval
							(m)		
Interburden									
Composite 16	EB1914213016	Vulcan	145312	VSW070_C	Sandstone 100%	Interburden	32.0	37.0	5.0
Composite 17	EB1914213017	Vulcan	145313	VSW070_C	Sandstone 100%	Interburden	37.0	41.0	4.0
Composite 25	EB1914213025	Vulcan	134788	VSW082_C	Sandstone 100%	Interburden	20.0	26.1	6.1
Composite 33	EB1914213033	Vulcan	134796	VSW083_C	Sandstone 100%	Interburden	25.0	30.9	5.9
Composite 115	EB1914214045	Vulcan	163242	VSW104_C	Sandstone 100%	Interburden	21.0	28.0	7.0
Composite 116	EB1914214046	Vulcan	163243	VSW104_C	Sandstone 100%	Interburden	28.0	30.0	2.0
Composite 24	EB1914213024	Vulcan	134787	VSW082_C	Siltstone 100%	Interburden	18.7	20.0	1.3
Composite 32	EB1914213032	Vulcan	134795	VSW083_C	Siltstone 100%	Interburden	24.0	25.0	1.0
Composite 82	EB1914214012	Vulcan	134822	VSW090_C	Claystone 100%	Interburden	26.0	27.0	1.0
Composite 83	EB1914214013	Vulcan	134823	VSW090_C	Claystone 100%	Interburden	27.0	30.9	3.9
Composite 90	EB1914214020	Vulcan	134839	VSW092_C	Claystone 100%	Interburden	21.0	23.2	2.2
Composite 108	EB1914214038	Vulcan	163262	VSW099_C	Carb Sandstone 100%	Interburden	24.0	29.6	5.6
Roof, floor and partings									
Composite 15	EB1914213015	Vulcan	145311	VSW070_C	Sandstone 100%	Floor (Alex)	28.0	32.0	4.0
Composite 31	EB1914213031	Vulcan	134794	VSW083_C	Sandstone 100%	Floor (Alex)	22.0	24.0	2.0
Composite 23	EB1914213023	Vulcan	134786	VSW082_C	Weathered Coal 25%, Siltstone 75%	Floor (Alex)	17.7	18.7	1.0
Composite 62	EB1914213062	Vulcan	163013	VSW087_C	Carb Siltstone 100%	Floor (Alex)	24.9	29.0	4.1
Composite 29	EB1914213029	Vulcan	134792	VSW083_C	Sandstone 100%	Roof (Alex)	20.0	21.8	1.8
Composite 44	EB1914213044	Vulcan	163129 - 163131	VSW084_C	Sandstone 100%	Roof (Alex)	37.0	42.8	5.8
Composite 60	EB1914213060	Vulcan	163011	VSW087_C	Sandstone 100%	Roof (Alex)	21.0	24.0	3.0
Composite 106	EB1914214036	Vulcan	163259 - 163260	VSW099_C	Sandstone 100%	Roof (Alex)	19.0	22.8	3.8
Composite 69	EB1914213069	Vulcan	163024	VSW088_C	Siltstone 100%	Roof (Alex)	29.0	30.0	1.0
Composite 22	EB1914213022	Vulcan	134785	VSW082_C	Claystone 100%	Roof (Alex)	16.0	17.7	1.7
Composite 13	EB1914213013	Vulcan	145309	VSW070_C	Carb Sandstone 100%	Roof (Alex)	26.0	27.5	1.5
Composite 87	EB1914214017	Vulcan	134836	VSW092_C	Clay 100%	Roof (Dysart LL)	12.0	13.0	1.0
Composite 81	EB1914214011	Vulcan	134821	VSW090_C	Claystone 98%, Carb Claystone 2%	Roof/Seam/Floor (Alex)	20.0	26.0	6.0
Composite 14	EB1914213014	Vulcan	145310	VSW070_C	Weathered Coal 100%	Seam (Alex)	27.5	28.0	0.5
Composite 30	EB1914213030	Vulcan	134793	VSW083_C	Weathered Coal 100%	Seam (Alex)	21.8	22.0	0.2
Composite 114	EB1914214044	Vulcan	163241	VSW104_C	Sandstone 80%, Carb Siltstone 20%	Seam (Alex)	20.0	21.0	1.0
Composite 45	EB1914213045	Vulcan	163132	VSW084_C	Carb Claystone/Sandstone (38%/62%)	Seam (Alex) / Floor (Alex)	42.8	43.7	0.9
Composite 88	EB1914214018	Vulcan	134837	VSW092_C	Clay 99%, Weathered Coal 1%	Seam (Dysant LL)	13.0	17.7	4.7
Composite 107	EB1914214037	Vulcan	163261	VSW099_C	Claystone 89%, Carb Claystone 11%	Seam/Floor (Alex)	22.8	24.0	1.2
Composite 89	EB1914214019	Vulcan	134838	VSW092_C	Claystone 35%, Weathered Coal 51%, Carb Claystone 14%	Seam/Floor (Dysart LL)	17.7	21.0	3.3
Jupiter Prospect									
Overburden									
Composite 117	EB1914214047	Jupiter	335480	VSW017_C	Sand 100%	Overburden	0.1	1.0	0.9
Composite 121	EB1914214051	Jupiter	335477	VSW019_C	Sand 97%, Soil 3%	Overburden	0.0	3.0	3.0
Composite 129	EB1914214059	Jupiter	134772	VSW077_C	Sand 50%, Sandstone 50%	Overburden	0.0	1.0	1.0
Composite 134	EB1914214064	Jupiter	134770	VSW080_C	Sand 100%	Overburden	0.0	1.0	1.0
Composite 118	EB1914214048	Jupiter	335481	VSW017_C	Sandstone 100%	Overburden	1.0	3.0	2.0
Composite 119	EB1914214049	Jupiter	335482	VSW017_C	Sandstone 100%	Overburden	3.0	6.0	3.0
Composite 120	EB1914214050	Jupiter	335483	VSW017_C	Sandstone 100%	Overburden	6.0	7.6	1.6
Composite 130	EB1914214060	Jupiter	134773	VSW077_C	Sandstone 100%	Overburden	1.0	3.0	2.0
Composite 135	EB1914214065	Jupiter	134770	VSW080_C	Sandstone 100%	Overburden	1.0	2.9	1.9
Composite 125	EB1914214055	Jupiter	145152	VSW022_C	Shale 100%	Overburden	1.0	10.0	9.0
Composite 137	EB1914214067	Jupiter	134872	VSW103_C	Siltstone 100%	Overburden	2.0	5.0	3.0
Composite 138	EB1914214068	Jupiter	134873	VSW103_C	Siltstone 100%	Overburden	5.0	8.0	3.0
Composite 139	EB1914214069	Jupiter	134874	VSW103_C	Siltstone 100%	Overburden	8.0	11.0	3.0
Composite 124	EB1914214054	Jupiter	145151	VSW022_C	Clay 100%	Overburden	0.0	1.0	1.0
Composite 136	EB1914214066	Jupiter	134871	VSW103_C	Clay 50%, Claystone 50%	Overburden	0.0	2.0	2.0
Composite 122	EB1914214052	Jupiter	335478	VSW019_C	Coaly Shale 100%	Overburden	3.0	7.5	4.5
Composite 131	EB1914214061	Jupiter	134774	VSW077_C	Carbonaceous Siltstone 100%	Overburden	3.0	4.0	1.0
Interburden, roof, floor and partings									
Composite 123	EB1914214053	Jupiter	335479	VSW019_C	Sandstone 100%	Interburden	14.3	24.9	10.6
Composite 133	EB1914214063	Jupiter	134767	VSW078_C	Siltstone 100%	Floor (Alex)	4.5	6.0	1.6
Composite 127	EB1914214057	Jupiter	145154	VSW022_C	Sandstone 100%, Carb Claystone <1%	Floor (Dysart LL) / Roof (May)	20.0	33.0	13.0
Composite 128	EB1914214058	Jupiter	145155	VSW022_C	Siltstone 100%, Carb Claystone <1%	Floor (May)	33.0	43.2	10.2
Composite 132	EB1914214062	Jupiter	134764	VSW078_C	Sand 16%, Sandstone 84%	Roof (Alex)	0.0	3.2	3.2
Composite 126	EB1914214056	Jupiter	145153	VSW022_C	Carb Siltstone 100%	Roof (Dysart LL Ply4)	10.0	12.0	2.0
Coal Rejects									
1	EB1929251001	Vulcan	IP19006604R005	VSW069_C	Coarse (Wash 2, -50+2mm) reject	Coarse Reject			
2	EB1929251003	Vulcan	IP1900410R298	VSW086_C	Coarse (Wash 2, -50+2mm) reject	Coarse Reject			
5	EB1932449003	Jupiter	IP19002032R587	VSW019_C	Coarse (Wash 2, -50+2mm) reject	Coarse Reject			
6	EB1932449005	Jupiter	IP19003592R466	VSW022_C	Coarse (Wash 2, -50+2mm) reject	Coarse Reject			
7	EB1932449001	Vulcan	IP19004096R302	VSW079_C	Coarse (Wash 2, -50+2mm) reject	Coarse Reject			
3	EB1929251004	Vulcan	IP1900410R299	VSW086_C	Fine (Wash 3, -2+0.25 & -0.25+0mm)	Fine Reject			
4	EB1929251002	Vulcan	IP19006604R006	VSW069_C	Fine (Wash 3, -2+0.25 & -0.25+0mm)	Fine Reject			
8	EB1932449007	Vulcan	IP19004601R298	VSW096_C	Fine (Wash 3, -2+0.25 & -0.25+0mm)	Fine Reject			
9	EB1932449002	Vulcan	IP19004096R303	VSW079_C	Fine (Wash 3, -2+0.25 & -0.25+0mm)	Fine Reject			
10	EB1932449004	Jupiter	IP19002032R588	VSW019_C	Fine (Wash 3, -2+0.25 & -0.25+0mm)	Fine Reject			
11	EB1932449006	Jupiter	IP19003592R467	VSW022_C	Fine (Wash 3, -2+0.25 & -0.25+0mm)	Fine Reject			

Table B2: Acid Base Account (ABA) Test Results for Waste Rock Samples

RGS Sample ID	ALS Sample ID	Deposit	Vitronite Sample ID	Drill Hole ID	Sample Lithology	Sample Type	From	To	Interval	pH[1]	EC[1]	Total S	Scr	MPA[2]	ANC[2]	NAPP[2]	ANC:MPA Ratio	Sample Classification[3]
							(m)				(µS/cm)	(%)		(kgH_2SO_4/t)				
1	EB1914213018	Vulcan	134781	VSW082_C	Soil 100%	Soil	0.00	1.00	1.00	7.38	368	0.02		0.6	18.3	-17.7	29.9	Non Acid Forming (Barren)
2	EB1914213026	Vulcan	134789	VSW083_C	Soil 100%	Soil	0.00	1.00	1.00	8.61	229	0.005		0.2	17.6	-17.4	114.9	Non Acid Forming (Barren)
3	EB1914213034	Vulcan	163117	VSW084_C	Soil 100%	Soil	0.00	3.00	3.00	8.3	839	0.02		0.6	16.9	-16.3	27.6	Non Acid Forming (Barren)
4	EB1914213036	Vulcan	163119	VSW084_C	Sand 100%	Soil	7.00	11.00	4.00	9.19	433	0.005		0.2	27.2	-27.0	177.6	Non Acid Forming (Barren)
5	EB1914213053	Vulcan	163001	VSW087_C	Soil 100%	Soil	0.00	1.00	1.00	8.41	178	0.005		0.2	12.6	-12.4	82.3	Non Acid Forming (Barren)
6	EB1914213054	Vulcan	163002	VSW087_C	Soil 100%	Soil	1.00	3.00	2.00	9.00	672	0.03		0.9	27.9	-27.0	30.4	Non Acid Forming (Barren)
7	EB1914213063	Vulcan	163014	VSW088_C	Soil 100%	Soil	0.00	3.00	3.00	8.54	475	0.005		0.2	15.8	-15.6	103.2	Non Acid Forming (Barren)
8	EB1914213070	Vulcan	134807	VSW089_C	Soil 100%	Soil	0.00	1.00	1.00	8.13	196	0.005		0.2	32.7	-32.5	213.6	Non Acid Forming (Barren)
9	EB1914214014	Vulcan	134832	VSW092_C	Soil 100%	Soil	0.00	1.00	1.00	9.05	401	0.02		0.6	81.2	-80.6	132.6	Non Acid Forming (Barren)
10	EB1914214021	Vulcan	163038	VSW095_C	Soil 100%	Soil	0.00	3.00	3.00	8.60	878	0.02		0.6	23.0	-22.4	37.6	Non Acid Forming (Barren)
11	EB1914214031	Vulcan	163251	VSW099_C	Soil 100%	Soil	0.00	1.00	1.00	7.17	123	0.02		0.6	7.5	-6.9	12.2	Non Acid Forming (Barren)
12	EB1914214039	Vulcan	163233	VSW104_C	Soil 100%	Soil	0.00	1.00	1.00	8.66	205	0.04		1.2	22.8	-21.6	18.6	Non Acid Forming (Barren)
13	EB1914214006	Vulcan	134814	VSW090_C	Soil 100%	Soil	0.00	1.00	1.00	8.82	307	0.005		0.2	29.8	-29.8	194.6	Non Acid Forming (Barren)
14	EB1914213055	Vulcan	163003	VSW087_C	Alluvium 100%	Alluvium	3.00	4.00	1.00	8.61	525	0.02		0.6	15.6	-15.0	25.5	Non Acid Forming (Barren)
15	EB1914214023	Vulcan	163041	VSW095_C	Alluvium 100%	Alluvium	8.00	9.00	1.00	8.09	658	0.03		0.9	16.5	-15.6	18.0	Non Acid Forming (Barren)
16	EB1914213008	Vulcan	145303	VSW070_C	Calcrete 100%	Calcrete	6.00	7.00	1.00	9.72	430	0.02		0.6	307.0	-306.4	501.2	Non Acid Forming (Barren)
17	EB1914213037	Vulcan	163120	VSW084_C	Gravel 100%	Gravel	11.00	14.00	3.00	9.16	329	0.005		0.2	19.2	-19.0	125.4	Non Acid Forming (Barren)
18	EB1914213039	Vulcan	163122	VSW084_C	Gravel 100%	Gravel	16.00	18.00	2.00	8.48	441	0.005		0.2	13.4	-13.2	87.5	Non Acid Forming (Barren)
19	EB1914213004	Vulcan	145166	VSW052_C	Conglomerate 100%	Conglomerate	30.00	32.40	2.40	8.92	126	0.005		0.2	3.8	-3.6	24.8	Non Acid Forming (Barren)
20	EB1914213005	Vulcan	145167	VSW052_C	Conglomerate 100%	Conglomerate	32.40	37.40	5.00	8.18	222	0.005		0.2	6.1	-5.9	39.8	Non Acid Forming (Barren)
21	EB1914213009	Vulcan	145304	VSW070_C	Sandstone 100%	Sandstone	7.00	16.00	9.00	9.03	127	0.005		0.2	3.2	-3.0	20.9	Non Acid Forming (Barren)
22	EB1914213010	Vulcan	145305 - 145306	VSW070_C	Sandstone 100%	Sandstone	16.00	23.00	7.00	9.59	176	0.005		0.2	10.6	-10.4	69.2	Non Acid Forming (Barren)
23	EB1914213011	Vulcan	145307	VSW070_C	Sandstone 100%	Sandstone	23.00	25.00	2.00	8.45	131	0.02		0.6	0.9	-0.3	1.5	Non Acid Forming (Barren)
24	EB1914213015	Vulcan	145311	VSW070_C	Sandstone 100%	Sandstone	27.99	32.00	4.01	8.74	234	0.09		2.8	12.6	-9.8	4.6	Non Acid Forming (Barren)
25	EB1914213016	Vulcan	145312	VSW070_C	Sandstone 100%	Sandstone	32.00	37.00	5.00	9.12	174	0.04		1.2	13.9	-12.7	11.3	Non Acid Forming (Barren)
26	EB1914213017	Vulcan	145313	VSW070_C	Sandstone 100%	Sandstone	37.00	41.00	4.00	9.11	187	0.05		1.5	17.2	-15.7	11.2	Non Acid Forming (Barren)
27	EB1914213021	Vulcan	134784	VSW082_C	Sandstone 100%	Sandstone	5.00	16.00	11.00	8.28	754	0.005		0.2	8.0	-7.8	52.2	Non Acid Forming (Barren)
28	EB1914213025	Vulcan	134788	VSW082_C	Sandstone 100%	Sandstone	20.00	26.08	6.08	8.24	279	0.03		0.9	10.5	-9.6	11.4	Non Acid Forming (Barren)
29	EB1914213028	Vulcan	134791	VSW083_C	Sandstone 100%	Sandstone	4.00	20.00	16.00	9.11	555	0.005		0.2	7.8	-7.6	50.9	Non Acid Forming (Barren)
30	EB1914213029	Vulcan	134792	VSW083_C	Sandstone 100%	Sandstone	20.00	21.77	1.77	8.83	172	0.02		0.6	8.6	-8.0	14.0	Non Acid Forming (Barren)
31	EB1914213031	Vulcan	134794	VSW083_C	Sandstone 100%	Sandstone	21.97	24.00	2.03	7.83	522	0.005		0.2	11.2	-11.0	73.1	Non Acid Forming (Barren)
32	EB1914213033	Vulcan	134796	VSW083_C	Sandstone 100%	Sandstone	25.00	30.86	5.86	8.00	213	0.005		0.2	8.2	-8.0	53.6	Non Acid Forming (Barren)
33	EB1914213041	Vulcan	163124 - 163125	VSW084_C	Sandstone 100%	Sandstone	19.00	26.00	7.00	9.07	417	0.02		0.6	9.1	-8.5	14.9	Non Acid Forming (Barren)
34	EB1914213043	Vulcan	163127 - 163128	VSW084_C	Sandstone 100%	Sandstone	27.00	37.00	10.00	8.64	132	0.02		0.6	6.8	-6.2	11.1	Non Acid Forming (Barren)
35	EB1914213044	Vulcan	163129 - 163131	VSW084_C	Sandstone 100%	Sandstone	37.00	42.84	5.84	8.39	98	0.005		0.2	2.4	-2.2	15.7	Non Acid Forming (Barren)
36	EB1914213056	Vulcan	163004	VSW087_C	Sandstone 100%	Sandstone	4.00	9.00	5.00	9.57	460	0.02		0.6	92.1	-91.5	150.4	Non Acid Forming (Barren)
37	EB1914213057	Vulcan	163005 - 163006	VSW087_C	Sandstone 100%	Sandstone	9.00	13.00	4.00	8.98	481	0.02		0.6	26.9	-26.3	43.9	Non Acid Forming (Barren)
38	EB1914213058	Vulcan	163007 - 163009	VSW087_C	Sandstone 100%	Sandstone	13.00	18.00	5.00	9.11	273	0.005		0.2	6.9	-6.7	45.1	Non Acid Forming (Barren)
39	EB1914213059	Vulcan	163010	VSW087_C	Sandstone 100%	Sandstone	18.00	21.00	3.00	8.60	224	0.02		0.6	5.3	-4.7	8.7	Non Acid Forming (Barren)
40	EB1914213060	Vulcan	163011	VSW087_C	Sandstone 100%	Sandstone	21.00	24.02	3.02	8.71	111	0.02		0.6	3.0	-2.4	4.9	Non Acid Forming (Barren)
41	EB1914213066	Vulcan	163018 - 163019	VSW088_C	Sandstone 100%	Sandstone	12.00	18.00	6.00	9.73	270	0.005		0.2	52.0	-51.8	339.6	Non Acid Forming (Barren)
42	EB1914213067	Vulcan	163020 - 163022	VSW088_C	Sandstone 100%	Sandstone	18.00	23.00	5.00	9.34	132	0.005		0.2	6.4	-6.2	41.8	Non Acid Forming (Barren)
43	EB1914213068	Vulcan	163023	VSW088_C	Sandstone 100%	Sandstone	23.00	29.00	6.00	9.08	85	0.005		0.2	3.5	-3.3	22.9	Non Acid Forming (Barren)
44	EB1914214024	Vulcan	163042 - 163043	VSW095_C	Sandstone 100%	Sandstone	9.00	12.00	3.00	8.37	570	0.03		0.9	28.3	-27.4	30.8	Non Acid Forming (Barren)
45	EB1914214025	Vulcan	163044	VSW095_C	Sandstone 100%	Sandstone	12.00	14.00	2.00	8.84	553	0.03		0.9	63.9	-63.0	69.6	Non Acid Forming (Barren)
46	EB1914214027	Vulcan	163046 - 163047	VSW095_C	Sandstone 100%	Sandstone	15.00	18.00	3.00	8.60	591	0.03		0.9	16.8	-15.9	18.3	Non Acid Forming (Barren)
47	EB1914214028	Vulcan	163048 - 163050	VSW095_C	Sandstone 100%	Sandstone	18.00	24.00	6.00	8.89	194	0.02		0.6	15.9	-15.3	26.0	Non Acid Forming (Barren)
48	EB1914214029	Vulcan	163201	VSW095_C	Sandstone 100%	Sandstone	24.00	25.00	1.00	8.56	124	0.02		0.6	6.4	-5.8	10.4	Non Acid Forming (Barren)
49	EB1914214033	Vulcan	163253 - 163254	VSW099_C	Sandstone 100%	Sandstone	3.00	7.00	4.00	7.98	224	0.04		1.2	0.25	1.0	0.2	Non Acid Forming (Barren)
50	EB1914214034	Vulcan	163255 - 163256	VSW099_C	Sandstone 100%	Sandstone	7.00	14.00	7.00	8.97	253	0.005		0.2	5.1	-5.1	33.3	Non Acid Forming (Barren)
51	EB1914214035	Vulcan	163257 - 163258	VSW099_C	Sandstone 100%	Sandstone	14.00	19.00	5.00	8.61	212	0.02		0.6	6.6	-6.0	10.8	Non Acid Forming (Barren)
52	EB1914214036	Vulcan	163259 - 163260	VSW099_C	Sandstone 100%	Sandstone	19.00	22.80	3.80	8.28	214	0.005		0.2	0.25	-0.1	1.6	Non Acid Forming (Barren)
53	EB1914214041	Vulcan	163236	VSW104_C	Sandstone 100%	Sandstone	4.00	7.00	3.00	9.46	375	0.005		0.2	45.6	-45.6	297.8	Non Acid Forming (Barren)
54	EB1914214042	Vulcan	163237	VSW104_C	Sandstone 100%	Sandstone	7.00	14.00	7.00	8.98	240	0.03		0.9	13.2	-12.3	14.4	Non Acid Forming (Barren)
55	EB1914214043	Vulcan	163238 - 163240	VSW104_C	Sandstone 100%	Sandstone	14.00	20.00	6.00	8.67	283	0.005		0.2	10.1	-10.1	66.0	Non Acid Forming (Barren)
56	EB1914214045	Vulcan	163242	VSW104_C	Sandstone 100%	Sandstone	21.00	28.00	7.00	8.27	276	0.005		0.2	8.1	-8.1	52.9	Non Acid Forming (Barren)
57	EB1914214046	Vulcan	163243	VSW104_C	Sandstone 100%	Sandstone	28.00	30.00	2.00	9.03	163	0.02		0.6	12.9	-12.3	21.1	Non Acid Forming (Barren)
58	EB1914213024	Vulcan	134787	VSW082_C	Siltstone 100%	Siltstone	18.70	20.00	1.30	7.76	820	0.02		0.6	9.7	-9.1	15.8	Non Acid Forming (Barren)
59	EB1914213032	Vulcan	134795	VSW083_C	Siltstone 100%	Siltstone	24.00	25.00	1.00	7.93	355	0.02		0.6	11.1	-10.5	18.1	Non Acid Forming (Barren)
60	EB1914213069	Vulcan	163024	VSW088_C	Siltstone 100%	Siltstone	29.00	30.00	1.00	8.16	129	0.02		0.6	9.2	-8.6	15.0	Non Acid Forming (Barren)
61	EB1914213001	Vulcan	145163	VSW052_C	Clay 100%	Clay	0.10	5.00	4.90	8.92	607	0.02		0.6	21.1	-20.5	34.4	Non Acid Forming (Barren)
62	EB1914213002	Vulcan	145164	VSW052_C	Clay 100%	Clay	5.00	10.00	5.00	8.98	687	0.02		0.6	92.0	-91.4	150.2	Non Acid Forming (Barren)
63	EB1914213003	Vulcan	145165	VSW052_C	Clay 100%	Clay	25.00	30.00	5.00	8.47	342	0.02		0.6	5.8	-5.2	9.5	Non Acid Forming (Barren)
64	EB1914213006	Vulcan	145301	VSW070_C	Clay 100%	Clay	0.00	3.00	3.00	8.62	675	0.02		0.6	23.4	-22.8	38.2	Non Acid Forming (Barren)
65	EB1914213007	Vulcan	145302	VSW070_C	Clay 100%	Clay	3.00	6.00	3.00	6.44	644	0.02		0.6	11.7	-11.1	19.1	Non Acid Forming (Barren)
66	EB1914213019	Vulcan	134782	VSW082_C	Clay 100%	Clay	1.00	2.00	1.00	8.54	818	0.005		0.2	38.7	-38.5	252.7	Non Acid Forming (Barren)
67	EB1914213020	Vulcan	134783	VSW082_C	Clay 100%	Clay	2.00	5.00	3.00	8.22	655	0.005		0.2	25.6	-25.4	167.2	Non Acid Forming (Barren)
68	EB1914213027	Vulcan	134790	VSW083_C	Clay 100%	Clay	1.00	4.00	3.00	8.45	250	0.02		0.6	66.2	-65.6	108.1	Non Acid Forming (Barren)
69	EB1914213035	Vulcan	163118	VSW084_C	Clay 100%	Clay	3.00	7.00	4.00	8.68	879	0.005		0.2	85.6	-85.4	559.0	Non Acid Forming (Barren)
70	EB1914213038	Vulcan	163121	VSW084_C	Clay 100%	Clay	14.00	16.00	2.00	8.29	725	0.02		0.6	20.4	-19.8	33.3	Non Acid Forming (Barren)
71	EB1914213040	Vulcan	163123	VSW084_C	Clay 100%	Clay	18.00	19.00	1.00	7.88	776	0.02		0.6	9.6	-9.0	15.7	Non Acid Forming (Barren)

Table B2: Acid Base Account (ABA) Test Results for Waste Rock Samples

RGS Sample ID	ALS Sample ID	Deposit	Vitronite Sample ID	Drill Hole ID	Sample Lithology	Sample Type	From	To	Interval	pH[1]	EC[1]	Total S	Scr	MPA[2]	ANC[2]	NAPP[2]	ANC:MPA Ratio	Sample Classification[3]
							(m)				(µS/cm)	(%)		(kgH_2SO_4/t)				
72	EB1914213046	Vulcan	134797	VSW085_C	Clay 100%	Clay	0.00	2.00	2.00	8.41	313	0.02		0.6	27.1	-26.5	44.2	Non Acid Forming (Barren)
73	EB1914213047	Vulcan	134798 - 134799	VSW085_C	Clay 100%	Clay	2.00	8.00	6.00	8.43	755	0.005		0.2	127.0	-126.8	829.4	Non Acid Forming (Barren)
74	EB1914213048	Vulcan	1347800	VSW085_C	Clay 100%	Clay	8.00	14.00	6.00	8.34	674	0.005		0.2	50.4	-50.2	329.1	Non Acid Forming (Barren)
75	EB1914213049	Vulcan	1347801 - 1347802	VSW085_C	Clay 100%	Clay	14.00	18.00	4.00	8.03	662	0.005		0.2	33.8	-33.6	220.7	Non Acid Forming (Barren)
76	EB1914213050	Vulcan	1347803 - 1347804	VSW085_C	Clay 100%	Clay	18.00	25.00	7.00	8.15	440	0.02		0.6	23.7	-23.1	38.7	Non Acid Forming (Barren)
77	EB1914213051	Vulcan	1347805	VSW085_C	Clay 100%	Clay	25.00	29.00	4.00	7.94	255	0.02		0.6	8.5	-7.9	13.9	Non Acid Forming (Barren)
78	EB1914213052	Vulcan	1347806	VSW085_C	Clay 100%	Clay	29.00	30.71	1.71	8.05	291	0.03		0.9	5.9	-5.0	6.4	Non Acid Forming (Barren)
79	EB1914213064	Vulcan	163015 - 163016	VSW088_C	Clay 100%	Clay	3.00	7.00	4.00	8.87	944	0.02		0.6	106.0	-105.4	173.1	Non Acid Forming (Barren)
80	EB1914213065	Vulcan	163017	VSW088_C	Clay 100%	Clay	7.00	12.00	5.00	9.16	342	0.02		0.6	91.5	-90.9	149.4	Non Acid Forming (Barren)
81	EB1914214001	Vulcan	134808 - 134809	VSW089_C	Clay 100%	Clay	1.00	3.00	2.00	8.65	696	0.005		0.2	218.0	-218.0	1423.7	Non Acid Forming (Barren)
82	EB1914214002	Vulcan	134810	VSW089_C	Clay 100%	Clay	3.00	14.00	11.00	8.3	614	0.03		0.9	26.5	-25.6	28.8	Non Acid Forming (Barren)
83	EB1914214003	Vulcan	134811	VSW089_C	Clay 100%	Clay	14.00	16.00	2.00	8.61	492	0.005		0.2	18.9	-18.9	123.4	Non Acid Forming (Barren)
84	EB1914214004	Vulcan	134812	VSW089_C	Clay 100%	Clay	16.00	28.00	12.00	7.97	401	0.02		0.6	22.1	-21.5	36.1	Non Acid Forming (Barren)
85	EB1914214005	Vulcan	134813	VSW089_C	Clay 100%	Clay	28.00	30.23	2.23	8.40	107	0.005		0.2	7.1	-7.1	46.4	Non Acid Forming (Barren)
86	EB1914214007	Vulcan	134815	VSW090_C	Clay 100%	Clay	1.00	5.00	4.00	8.08	713	0.005		0.2	11.3	-11.3	73.8	Non Acid Forming (Barren)
87	EB1914214008	Vulcan	134816 - 134818	VSW090_C	Clay 100%	Clay	5.00	10.00	5.00	8.52	869	0.02		0.6	107.0	-106.0	174.7	Non Acid Forming (Barren)
88	EB1914214009	Vulcan	134819	VSW090_C	Clay 78%, Claystone 22%	Clay	10.00	19.00	9.00	8.56	972	0.02		0.6	70.1	-69.5	114.4	Non Acid Forming (Barren)
89	EB1914214015	Vulcan	134833	VSW092_C	Clay 100%	Clay	1.00	6.00	5.00	8.49	694	0.005		0.2	29.6	-29.6	193.3	Non Acid Forming (Barren)
90	EB1914214016	Vulcan	134834 - 134835	VSW092_C	Clay 100%	Clay	6.00	12.00	6.00	8.88	517	0.005		0.2	111.0	-111.0	724.9	Non Acid Forming (Barren)
91	EB1914214017	Vulcan	134836	VSW092_C	Clay 100%	Clay	12.00	13.00	1.00	8.32	486	0.005		0.2	49.4	-49.4	322.6	Non Acid Forming (Barren)
92	EB1914214022	Vulcan	163039 - 163040	VSW095_C	Clay 100%	Clay	3.00	8.00	5.00	6.73	430	0.02		0.6	10.3	-9.7	16.8	Non Acid Forming (Barren)
93	EB1914214032	Vulcan	163252	VSW099_C	Clay 100%	Clay	1.00	3.00	2.00	9.08	510	0.02		0.6	18.8	-18.2	30.7	Non Acid Forming (Barren)
94	EB1914214040	Vulcan	163234 - 163235	VSW104_C	Clay 100%	Clay	1.00	4.00	3.00	9.21	583	0.005		0.2	158.0	-158.0	1031.8	Non Acid Forming (Barren)
95	EB1914213012	Vulcan	145308	VSW070_C	Claystone 100%	Claystone	25.00	26.00	1.00	8.55	244	0.02		0.6	2.4	-1.8	3.9	Non Acid Forming (Barren)
96	EB1914213022	Vulcan	134785	VSW082_C	Claystone 100%	Claystone	16.00	17.70	1.70	8.61	243	0.02		0.6	5.4	-4.8	8.8	Non Acid Forming (Barren)
97	EB1914213042	Vulcan	163126	VSW084_C	Claystone 100%	Claystone	26.00	27.00	1.00	7.95	251	0.02		0.6	8.4	-7.8	13.7	Non Acid Forming (Barren)
98	EB1914214010	Vulcan	134820	VSW090_C	Claystone 100%	Claystone	19.00	20.00	1.00	9.19	430	0.02		0.6	74.0	-73.4	120.8	Non Acid Forming (Barren)
99	EB1914214012	Vulcan	134822	VSW090_C	Claystone 100%	Claystone	26.00	27.00	1.00	9.13	220	0.005		0.2	12.2	-12.2	79.7	Non Acid Forming (Barren)
100	EB1914214013	Vulcan	134823	VSW090_C	Claystone 100%	Claystone	27.00	30.85	3.85	8.77	112	0.005		0.2	7.0	-7.0	45.7	Non Acid Forming (Barren)
101	EB1914214020	Vulcan	134839	VSW092_C	Claystone 100%	Claystone	21.00	23.20	2.20	7.95	458	0.02		0.6	12.1	-11.5	19.8	Non Acid Forming (Barren)
102	EB1914214026	Vulcan	163045	VSW095_C	Claystone 100%	Claystone	14.00	15.00	1.00	7.89	634	0.03		0.9	10.6	-9.7	11.5	Non Acid Forming (Barren)
103	EB1914214030	Vulcan	163202	VSW095_C	Claystone 100%	Claystone	25.00	25.84	0.84	8.73	147	0.005		0.2	6.7	-6.7	43.8	Non Acid Forming (Barren)
104	EB1914213013	Vulcan	145309	VSW070_C	Carb. Sandstone 100%	Carbonaceous	26.00	27.53	1.53	9.19	224	0.08		2.5	14.7	-12.3	6.0	Non Acid Forming (Barren)
105	EB1914213014	Vulcan	145310	VSW070_C	Weathered Coal 100%	Carbonaceous	27.53	27.99	0.46	8.29	270	0.30	0.15	4.7	5.8	-1.1	1.2	Uncertain
106	EB1914213023	Vulcan	134786	VSW082_C	Weathered Coal 25%, Siltstone 75%	Carbonaceous	17.70	18.70	1.00	8.19	333	0.03		0.9	13.3	-12.4	14.5	Non Acid Forming (Barren)
107	EB1914213030	Vulcan	134793	VSW083_C	Weathered Coal 100%	Carbonaceous	21.77	21.97	0.20	7.31	682	0.04		1.2	16.0	-14.8	13.1	Non Acid Forming (Barren)
108	EB1914213045	Vulcan	163132	VSW084_C	Carb Claystone 38%, Carb Sandstone 62%	Carbonaceous	42.84	43.74	0.90	8.26	232	0.005		0.2	8.3	-8.1	54.2	Non Acid Forming (Barren)
109	EB1914213062	Vulcan	163013	VSW087_C	Carb Siltstone 100%	Carbonaceous	24.88	28.95	4.07	8.80	172	0.02		0.6	7.0	-6.4	11.4	Non Acid Forming (Barren)
110	EB1914214011	Vulcan	134821	VSW090_C	Claystone 98%, Carb Claystone 2%	Carbonaceous	20.00	26.00	6.00	8.38	467	0.005		0.2	18.5	-18.3	120.8	Non Acid Forming (Barren)
111	EB1914214018	Vulcan	134837	VSW092_C	Clay 99%, Weathered Coal 1%	Carbonaceous	13.00	17.69	4.69	8.00	560	0.02		0.6	18.3	-17.7	29.9	Non Acid Forming (Barren)
112	EB1914214019	Vulcan	134838	VSW092_C	Claystone 35%, Weathered Coal 51%, Carb Claystone 14%	Carbonaceous	17.69	21.00	3.31	8.24	648	0.02		0.6	14.8	-14.2	24.2	Non Acid Forming (Barren)
113	EB1914214037	Vulcan	163261	VSW099_C	Claystone 89%, Carb Claystone 11%	Carbonaceous	22.80	24.00	1.20	8.26	365	0.005		0.2	6.2	-6.0	40.5	Non Acid Forming (Barren)
114	EB1914214038	Vulcan	163262	VSW099_C	Carb Sandstone 100%	Carbonaceous	24.00	29.60	5.60	9.30	220	0.02		0.6	13.6	-13.0	22.2	Non Acid Forming (Barren)
115	EB1914214044	Vulcan	163241	VSW104_C	Sandstone 80%, Carb Siltstone 20%	Carbonaceous	20.00	21.00	1.00	7.84	481	0.005		0.2	7.1	-6.9	46.4	Non Acid Forming (Barren)
1	EB1914214047	Jupiter	335480	VSW017_C	Sand 100%	Soil	0.10	1.00	0.90	6.91	166	0.02		0.6	0.25	0.4	0.4	Non Acid Forming (Barren)
2	EB1914214051	Jupiter	335477	VSW019_C	Sand 97%, Soil 3%	Soil	0.00	3.00	3.00	6.12	81	0.005		0.2	1.7	-1.5	11.1	Non Acid Forming (Barren)
3	EB1914214059	Jupiter	134772	VSW077_C	Sand 50%, Sandstone 50%	Soil	0.00	1.00	1.00	6.59	43	0.02		0.6	0.25	0.4	0.4	Non Acid Forming (Barren)
4	EB1914214064	Jupiter	134770	VSW080_C	Sand 100%	Soil	0.00	1.00	1.00	6.17	109	0.02		0.6	5.9	-5.3	9.6	Non Acid Forming (Barren)
5	EB1914214054	Jupiter	145151	VSW022_C	Clay 100%	Clay	0.00	1.00	1.00	6.57	152	0.02		0.6	1.6	-1.0	2.6	Non Acid Forming (Barren)
6	EB1914214066	Jupiter	134871	VSW103_C	Clay 50%, Claystone 50%	Clay	0.00	2.00	2.00	6.63	192	0.005		0.2	5.1	-4.9	33.3	Non Acid Forming (Barren)
7	EB1914214048	Jupiter	335481	VSW017_C	Sandstone 100%	Sandstone	1.00	3.00	2.00	8.22	120	0.005		0.2	0.25	-0.1	1.6	Non Acid Forming (Barren)
8	EB1914214049	Jupiter	335482	VSW017_C	Sandstone 100%	Sandstone	3.00	6.00	3.00	7.07	151	0.005		0.2	1.2	-1.0	7.8	Non Acid Forming (Barren)
9	EB1914214050	Jupiter	335483	VSW017_C	Sandstone 100%	Sandstone	6.00	7.59	1.59	6.14	159	0.11	0.08	2.5	2.2	0.3	0.9	Non Acid Forming (Barren)
10	EB1914214053	Jupiter	335479	VSW019_C	Sandstone 100%	Sandstone	14.26	24.86	10.60	7.22	136	0.08		2.5	6.0	-3.6	2.4	Non Acid Forming (Barren)
11	EB1914214057	Jupiter	145154	VSW022_C	Sandstone 100%, Carb Claystone <1%	Sandstone	20.00	33.01	13.01	8.60	225	0.09		2.8	12.8	-10.0	4.6	Non Acid Forming (Barren)
12	EB1914214060	Jupiter	134773	VSW077_C	Sandstone 100%	Sandstone	1.00	3.00	2.00	6.11	110	0.02		0.6	0.25	0.4	0.4	Non Acid Forming (Barren)
13	EB1914214062	Jupiter	134764	VSW078_C	Sand 16%, Sandstone 84%	Sandstone	0.00	3.17	3.17	6.25	52	0.03		0.9	11.0	-10.1	12.0	Non Acid Forming (Barren)
14	EB1914214065	Jupiter	134770	VSW080_C	Sandstone 100%	Sandstone	1.00	2.94	1.94	7.46	187	0.02		0.6	7.2	-6.6	11.8	Non Acid Forming (Barren)
15	EB1914214055	Jupiter	145152	VSW022_C	Shale 100%	Siltstone	1.00	10.00	9.00	7.01	331	0.02		0.6	8.8	-8.2	14.4	Non Acid Forming (Barren)
16	EB1914214058	Jupiter	145155	VSW022_C	Siltstone 100%, Carb Claystone <1%	Siltstone	33.01	43.21	10.20	8.78	145	0.04		1.2	6.6	-5.4	5.4	Non Acid Forming (Barren)
17	EB1914214063	Jupiter	134767	VSW078_C	Siltstone 100%	Siltstone	4.45	6.00	1.55	5.05	112	0.08		2.5	7.7	-5.3	3.1	Non Acid Forming (Barren)
18	EB1914214067	Jupiter	134872	VSW103_C	Siltstone 100%	Siltstone	2.00	5.00	3.00	7.92	266	0.005		0.2	7.8	-7.6	50.9	Non Acid Forming (Barren)
19	EB1914214068	Jupiter	134873	VSW103_C	Siltstone 100%	Siltstone	5.00	8.00	3.00	9.01	152	0.02		0.6	15.4	-14.8	25.1	Non Acid Forming (Barren)
20	EB1914214069	Jupiter	134874	VSW103_C	Siltstone 100%	Siltstone	8.00	11.00	3.00	8.86	154	0.02		0.6	14.2	-13.6	23.2	Non Acid Forming (Barren)
21	EB1914214052	Jupiter	335478	VSW019_C	Coaly Shale 100%	Carbonaceous	3.00	7.53	4.53	7.26	312	0.03		0.9	11.1	-10.2	12.1	Non Acid Forming (Barren)
22	EB1914214056	Jupiter	145153	VSW022_C	Carb Siltstone 100%	Carbonaceous	10.00	12.02	2.02	8.03	243	0.02		0.6	9.4	-8.8	15.3	Non Acid Forming (Barren)
23	EB1914214061	Jupiter	134774	VSW077_C	Carb Siltstone 100%	Carbonaceous	3.00	4.00	1.00	6.27	65	0.03		0.9	5.7	-4.8	6.2	Non Acid Forming (Barren)

1. Current pH, EC, Alkalinity and Acidity provided for 1:5 sample:water extracts
2. Scr = Chromium Reducible Sulfur; MPA = Maximum Potential Acidity; ANC = Acid Neutralising Capacity; and NAPP = Net Acid Producing Potential.
3. Sample classification criteria detail provided in report text.

* Where total sulfur or ANC results are less than the laboratory LoR a value of half of the LoR is used in Table B2.

Table B3: Acid Base Account (ABA) Test Results for Coal Reject Samples

RGS Sample ID	ALS ID	Prospect	Drill Hole	Vulcan Sample ID	Sample Description	Reject Type	From (mm)	To (mm)	pH[1]	EC[1] (µS/cm)	Total S (%)	Scr (%)	MPA[2] (kgH_2SO_4/t)	ANC[2] (kgH_2SO_4/t)	NAPP[2] (kgH_2SO_4/t)	ANC: MPA Ratio	Sample Classification[3]
1	EB1929251001	Vulcan	VSW069_C	IP19006604R005	Coarse (Wash 2, -50+2mm) reject	Coarse	-50	2	8.4	176	0.72	0.388	11.9	8.4	3.5	0.7	Uncertain
2	EB1929251003	Vulcan	VSW086_C	IP1900410R298	Coarse (Wash 2, -50+2mm) reject	Coarse	-50	2	8.0	401	0.28	0.047	1.4	1.8	-0.4	1.3	Non Acid Forming (Barren)
3	EB1932449003	Jupiter	VSW019_C	IP19002032R587	Coarse (Wash 2, -50+2mm) reject	Coarse	-50	2	4.5	454	0.31	0.049	1.5	10.9	-9.4	7.3	Non Acid Forming (Barren)
4	EB1932449005	Jupiter	VSW022_C	IP19003592R466	Coarse (Wash 2, -50+2mm) reject	Coarse	-50	2	7.6	213	0.20	0.055	1.7	22.8	-21.1	13.5	Non Acid Forming (Barren)
5	EB1932449001	Vulcan	VSW079_C	IP19004096R302	Coarse (Wash 2, -50+2mm) reject	Coarse	-50	2	8.3	116	0.82	0.569	17.4	11.3	6.1	0.6	Potentially Acid Forming
6	EB1929251004	Vulcan	VSW086_C	IP1900410R299	Fine (Wash 3 & Fines, -2+0.25 & -0.25+0mm) reject	Fine	-2	0.25	7.0	595	0.38	0.220	6.7	7.2	-0.5	1.1	Uncertain
7	EB1929251002	Vulcan	VSW069_C	IP19006604R006	Fine (Wash 3 & Fines, -2+0.25 & -0.25+0mm) reject	Fine	-2	0.25	7.3	484	0.41	0.190	5.8	8.5	-2.7	1.5	Uncertain
8	EB1932449007	Vulcan	VSW096_C	IP19004601R298	Fine (Wash 3 & Fines, -2+0.25 & -0.25+0mm) reject	Fine	-2	0.25	6.8	398	0.12	0.018	0.6	36.0	-35.4	65.3	Non Acid Forming (Barren)
9	EB1932449002	Vulcan	VSW079_C	IP19004096R303	Fine (Wash 3 & Fines, -2+0.25 & -0.25+0mm) reject	Fine	-2	0.25	7.4	564	0.60	0.382	11.7	13.5	-1.8	1.2	Uncertain
10	EB1932449004	Jupiter	VSW019_C	IP19002032R588	Fine (Wash 3 & Fines, -2+0.25 & -0.25+0mm) reject	Fine	-2	0.25	5.6	193	0.41	0.027	0.8	16.9	-16.1	20.4	Non Acid Forming (Barren)
11	EB1932449006	Jupiter	VSW022_C	IP19003592R467	Fine (Wash 3 & Fines, -2+0.25 & -0.25+0mm) reject	Fine	-2	0.25	7.6	466	0.22	0.152	4.7	23.3	-18.6	5.0	Non Acid Forming

Notes

1. Current pH, EC, Alkalinity and Acidity provided for 1:5 sample:water extracts
2. Scr = Chromium Reducible Sulfur; MPA = Maximum Potential Acidity; ANC = Acid Neutralising Capacity; and NAPP = Net Acid Producing Potential
3. Sample classification criteria detail provided in report text.

Table B4: Multi-Element Test Results for Waste Rock and Coal Reject Samples

		RGS Sample Number →	Composite 1	Composite 2	Composite 3	Composite 4	Composite 5	Composite 6	Composite 7	Composite 8	Composite 9	Composite 10
		ALS Laboratory ID →	EB1916203003	EB1916203004	EB1916203005	EB1916203006	EB1916203007	EB1916203008	EB1931850005	EB1931850006	EB1933850008	EB1933850009
		Sample description →	Vulcan Soil	Vulcan Sandstone	Vulcan Clay	Vulcan Claystone	Jupiter Sandstone	Jupiter Siltstone	Vulcan Coarse Reject	Vulcan Fine Reject	Jupiter/Vulcan Coarse Reject	Jupiter/Vulcan Fine Reject
Parameters	Limit of Reporting	NEPC[1] Health-Based Investigation Level (HILs)-C										
Major Cations			All units mg/kg									
Calcium (Ca)	50	-	5,710	2,420	9,470	1,890	370	460	2,650	2,090	1600	4780
Magnesium (Mg)	50	-	4,080	2,140	8,890	2,320	760	1,430	2,160	1,120	680	2700
Potassium (K)	50	-	270	680	290	950	1,180	2,200	500	720	1270	1280
Sodium (Na)	50	-	950	490	1,670	730	260	770	120	150	410	470
Major, Minor & Trace Elements			All units mg/kg									
Aluminium (Al)	50	-	9,520	2,090	10,900	5,120	2,280	3,000	1,100	1,790	2770	3360
Antimony (Sb)	5	-	<5	<5	<5	<5	<5	<5	<5	<5	0.1	0.1
Arsenic (As)	5	300	<5	<5	<5	<5	<5	5	7	12	16	11
Barium (Ba)	10	-	150	50	170	80	70	50	80	230	313	256
Beryllium (Be)	1	90	<1	<1	<1	1	<1	2	<1	1	1	1
Boron (B)	50	20,000	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cadmium (Cd)	1	90	<1	<1	<1	<1	<1	<1	<1	<1	0.1	0.1
Chromium (Cr) - hexavalent	2	300 **	46	38	53	34	69	24	<2	<2	0.6	2.1
Cobalt (Co)	2	300	17	3	19	11	4	10	5	22	5	6
Copper (Cu)	5	17,000	7	6	11	13	8	27	23	44	55	46
Iron (Fe)	50	-	17,200	8,640	25,400	17,700	12,200	22,200	46,900	11,200	7,940	6,340
Lead (Pb)	5	600	6	6	<5	10	12	30	6	15	14	19
Manganese (Mn)	5	19,000	538	103	466	188	126	331	1,100	179	85	74
Mercury (Hg)	0.1	80	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.1	<0.1	0.1
Molybdenum (Mp)	2	2	<2	<2	<2	<2	<2	<2	1	3	1	1
Nickel (Ni)	2	1,200	24	6	34	18	10	18	6	23	7	12.9
Reactive Phosphorus (P)	0.1	-	<0.1	<0.1	0	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1
Selenium (Se)	5	700	<5	<5	<5	<5	<5	<5	<5	<5	2	2
Thallium (Tl)	5	-	<5	<5	<5	<5	<5	6	<5	<5	<5	<5
Thorium (Th)	0.1	-	-	-	-	-	-	-	-	-	1.9	2.0
Uranium (U)	0.1	-	0.3	0.3	0.8	0.7	0.3	0.8	0.6	1.0	0.8	5.4
Zinc (Zn)	5	30,000	14	17	31	50	31	91	62	145	49	72
Exchangable Cations			All units meq/100g (except Exchangable Sodium & Moisture Content (%))									
Exch. Calcium	0.1		6.2	0.9	3.0	1.0	0.8	0.9	-	-	-	-
Exch. Magnesium	0.1		9.1	3.1	12.3	3.4	1.9	5.3	-	-	-	-
Exch. Potassium	0.1		0.2	1.1	0.2	0.4	1.0	1.4	-	-	-	-
Exch. Sodium	0.1		1.9	0.7	3.0	0.7	0.9	2.5	-	-	-	-
Cation Exchange Capacity	0.1		17.4	5.8	18.6	5.6	4.8	10.2	-	-	-	-
Calcium:Magnesium Ratio	-		0.7	0.3	0.2	0.3	0.4	0.2	-	-	-	-
Magnesium:Potassium Ratio	-		37.6	2.7	60.5	8.8	1.8	3.8	-	-	-	-
Exchangable Sodium Percentage	0.1%		10.8	12.1	16.3	13.0	20.4	24.6	-	-	-	-
Moisture content	1.0%		4.0	<1.0	4.8	1.6	<1.0	<1.0	-	-	-	-

Notes: < indicates less than the laboratory limit of reporting. Shaded cells exceed applied guideline limit.

** Guideline level for Cr(VI) = 300 mg/kg. Guideline level for Cr(III) = 24% of total Cr.

1. NEPC (2013). National Environmental Protection Council (NEPC). *National Environmental Protection (Assessment of Site Contamination) Measure (NEPM)* , Amendment of Schedule B1-B7 of 1999 version. Guideline on Investigation Levels for Soil and Groundwater. Health-Based Investigation Level - HIL(C); public open spaces - recreational use.

Table B5: Geochemical Abundance Index (GAI) Results for Waste Rock and Coal Reject Samples

	RGS Sample Number →		Composite 1	Composite 2	Composite 3	Composite 4	Composite 5	Composite 6	Composite 7	Composite 8	Composite 9	Composite 10
	ALS Laboratory ID →		EB1916203003	EB1916203004	EB1916203005	EB1916203006	EB1916203007	EB1916203008	EB1931850005	EB1931850006	EB1933850008	EB1933850009
	Sample description →		Vulcan Soil	Vulcan Sandstone	Vulcan Clay	Vulcan Claystone	Jupiter Sandstone	Jupiter Siltstone	Vulcan Coarse Reject	Vulcan Fine Reject	Jupiter/Vulcan Coarse Reject	Jupiter/Vulcan Fine Reject
Parameters	Limit of Reporting	Average Crustal Abundance[1]										
Major Elements	all units mg/kg		Geochemical Abundance Index									
Calcium (Ca)	50	15,000	0	0	0	0	0	0	0	0	0	0
Magnesium (Mg)	50	5,000	0	0	0	0	0	0	0	0	0	0
Potassium (K)	50	14,000	0	0	0	0	0	0	0	0	0	0
Sodium (Na)	50	5,000	0	0	0	0	0	0	0	0	0	0
Major, Minor & Trace Elements	all units mg/kg		Geochemical Abundance Index									
Aluminium (Al)	50	71,000	0	0	0	0	0	0	0	0	0	0
Antimony (Sb)	5	5	0	0	0	0	0	0	0	0	0	0
Arsenic (As)	5	6	0	0	0	0	0	0	0	0	1	0
Barium (Ba)	10	500	0	0	0	0	0	0	0	0	0	0
Beryllium (Be)	1	6	0	0	0	0	0	0	0	0	0	0
Boron (B)	50	100	0	0	0	0	0	0	0	0	0	0
Cadmium (Cd)	1	0.35	0	0	0	0	0	0	0	0	0	0
Chromium (Cr) - hexavalent	2	70	0	0	0	0	0	0	0	0	0	0
Cobalt (Co)	2	8	1	0	1	0	0	0	0	1	0	0
Copper (Cu)	5	30	0	0	0	0	0	0	0	0	0	0
Iron (Fe)	50	40,000	0	0	0	0	0	0	0	0	0	0
Lead (Pb)	5	35	0	0	0	0	0	0	0	0	0	0
Manganese (Mn)	5	1000	0	0	0	0	0	0	0	0	0	0
Mercury (Hg)	0.1	0.06	0	0	0	0	0	0	0	0	0	0
Molybdenum (Mo)	2	2	0	0	0	0	0	0	0	0	0	0
Nickel (Ni)	2	50	0	0	0	0	0	0	0	0	0	0
Reactive Phosphorus (P)		800	0	0	0	0	0	0	0	0	0	0
Selenium (Se)	5	0.4	2	2	2	2	2	2	2	2	2	2
Thallium (Tl)	5	2.5	0	0	0	0	0	1	0	0	0	0
Thorium (Th)	0.1	9	-	-	-	-	-	-	-	-	0	0
Uranium (U)	0.1	2	0	0	0	0	0	0	0	0	0	1
Zinc (Zn)	5	90	0	0	0	0	0	0	0	0	0	0

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

1. Average Crustal Abundance values sourced from the "GARD Guide", Chapter 5 (INAP, 2009). When no GARD Guide value is available for a particular element, then values are taken from Bowen H.J.M.(1979) Environmental Chemistry of the Elements, pages 60-61.

Table B6: Multi-Element Test Results for Water Extracts from Waste Rock and Coal Reject Samples

		RGS Sample Number →		Composite 1	Composite 2	Composite 3	Composite 4	Composite 5	Composite 6	Composite 7	Composite 8	Composite 9	Composite 10
		ALS Laboratory ID →		EB1916203003	EB1916203004	EB1916203005	EB1916203006	EB1916203007	EB1916203008	EB1931850005	EB1931850006	EB1933850008	EB1933850009
		Sample description →		Vulcan Soil	Vulcan Sandstone	Vulcan Clay	Vulcan Claystone	Jupiter Sandstone	Jupiter Siltstone	Vulcan Coarse Reject	Vulcan Fine Reject	Jupiter/Vulcan Coarse Reject	Jupiter/Vulcan Fine Reject
		Water Quality Guidelines:											
Parameters	Limit of Reporting	Aquatic Ecosystems (freshwater)[1]	Livestock Drinking Water[2]										
pH	0.01 pH unit	6 to 9	-	8.2	8.6	8.5	8.2	6.8	7.1	8.6	7.4	5.8	6.2
Electrical Conductivity	1 µS/cm	<1,000#	3,580^	552	346	788	490	167	264	86	154	96	54
Carbonate Alkalinity ($mgCaCO_3/L$)	1 mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate Alkalinity ($mgCaCO_3/L$)	1 mg/L	-	-	1,768	564	2,980	546	35	144	24	33	56	1,032
Total Alkalinity ($mgCaCO_3/L$)	1 mg/L	-	-	1,768	564	2,980	546	35	144	24	33	56	1,032
Acidity ($mgCaCO_3/L$)	1 mg/L	-	-	2	<1	<1	3	8	5	19	48	46	178
Net Alkalinity ($mgCaCO_3/L$)	1 mg/L	-	-	1,766	564	2,980	543	27	139	6	33	56	854
Major Ions	All units mg/L			All units mg/L									
Calcium (Ca)	2	-	1,000	12	2	4	4	<2	<2	<2	4	<2	2
Magnesium (Mg)	2	-	-	12	6	10	8	<2	<2	<2	4	<2	4
Potassium (K)	2	-	-	<2	6	<2	8	12	8	<2	<2	<2	4
Sodium (Na)	2	-	-	92	54	146	84	26	52	26	26	24	24
Chloride (Cl)	2	-	-	60	48	140	82	18	36	8	24	10	26
Fluoride (F)	0.2	-	2	0.8	0.4	1.8	0.8	<0.2	0.2	<0.2	1.0	0.2	0.4
Sulfate (SO_4)	2	-	1,000	30	28	46	44	30	24	18	32	24	20
Trace Metals/Metalloids	All units mg/L			All units mg/L									
Aluminium (Al)	0.02	0.055	5	<0.02	0.06	0.04	0.04	0.36	0.48	0.14	<0.02	<0.02	<0.02
Antimony (Sb)	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	0.004	<0.002
Arsenic (As) - pentavalent	0.002	0.013 **	0.5	<0.002	0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002	<0.002
Barium (Ba)	0.002	-	-	0.028	0.012	0.016	0.008	0.004	0.002	<0.002	0.002	<0.002	0.004
Beryllium (Be)	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Boron (B)	0.2	0.37	5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cadmium (Cd)	0.002	0.0002	0.01	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr) - total	0.002	0.001 (hex)*	1 (total)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cobalt (Co)	0.002	-	1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Copper (Cu)	0.002	0.0014	1	0.006	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.004	<0.002	<0.002
Iron (Fe)	0.2	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Lead (Pb)	0.002	0.0034	0.1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Manganese (Mn)	0.002	1.90	-	0.008	<0.002	<0.002	<0.002	0.004	0.004	<0.002	0.004	<0.002	<0.002
Mercury (Hg)	0.0001	0.0006	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Molybdenum (Mo)	0.002	-	0.15	0.002	0.004	0.002	0.004	<0.002	0.006	0.034	0.020	0.008	0.002
Nickel (Ni)	0.002	0.011	1	0.006	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002	<0.002
Selenium (Se)	0.02	0.011	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Silica (SiO_2)	0.2	-	-	10.2	9.0	10.4	10.0	12.8	14.4	<0.2	<0.2	16.2	8.6
Thorium (Th)	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Uranium (U)	0.002	-	0.2	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Vanadium (V)	0.02	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Zinc (Zn)	0.01	0.008	20	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

* Cr (VI) = hexavalent. ** 0.024 mg/Lfor trivalent Arsenic (III).

for still water bodies only, moving rivers at low flow rates should not exceed 2,200µS/cm

^ calculated based on total dissolved solids (TDS) conversion rate of 0.67% of EC. TDS is an approximate measure of inorganic dissolved salts and should not exceed 2,400mg/L for livestock drinking water.

Notes: < indicates concentration less than the detection limit. Shaded cells exceed applied guideline values.

1. ANZECC & ARMCANZ (2000). Trigger values for aquatic ecosystems (95% species protection level)

2. ANZECC & ARMCANZ (2000). Recommended guideline limits for Livestock Drinking Water.

Table B7: Waste Rock and Coal Reject Samples Selected for KLC Tests

RGS Sample ID	ALS ID	Deposit	Vitronite Sample ID	Drillhole ID	Sample Lithology	From	To	Interval	RGS KLC No.
						(m)			
9	EB1914213009	Vulcan	145304	VSW070_C	Sandstone 100%	7.00	16.00	9.00	KLC1
10	EB1914213010	Vulcan	145305 - 145306	VSW070_C	Sandstone 100%	16.00	23.00	7.00	
11	EB1914213011	Vulcan	145307	VSW070_C	Sandstone 100%	23.00	25.00	2.00	
15	EB1914213015	Vulcan	145311	VSW070_C	Sandstone 100%	27.99	32.00	4.01	
16	EB1914213016	Vulcan	145312	VSW070_C	Sandstone 100%	32.00	37.00	5.00	
17	EB1914213017	Vulcan	145313	VSW070_C	Sandstone 100%	37.00	41.00	4.00	
21	EB1914213021	Vulcan	134784	VSW082_C	Sandstone 100%	5.00	16.00	11.00	
25	EB1914213025	Vulcan	134788	VSW082_C	Sandstone 100%	20.00	26.08	6.08	
28	EB1914213028	Vulcan	134791	VSW083_C	Sandstone 100%	4.00	20.00	16.00	
29	EB1914213029	Vulcan	134792	VSW083_C	Sandstone 100%	20.00	21.77	1.77	
31	EB1914213031	Vulcan	134794	VSW083_C	Sandstone 100%	21.97	24.00	2.03	
33	EB1914213033	Vulcan	134796	VSW083_C	Sandstone 100%	25.00	30.86	5.86	
41	EB1914213041	Vulcan	163124 - 163125	VSW084_C	Sandstone 100%	19.00	26.00	7.00	
43	EB1914213043	Vulcan	163127 - 163128	VSW084_C	Sandstone 100%	27.00	37.00	10.00	
44	EB1914213044	Vulcan	163129 - 163131	VSW084_C	Sandstone 100%	37.00	42.84	5.84	
56	EB1914213056	Vulcan	163004	VSW087_C	Sandstone 100%	4.00	9.00	5.00	
57	EB1914213057	Vulcan	163005 - 163006	VSW087_C	Sandstone 100%	9.00	13.00	4.00	
58	EB1914213058	Vulcan	163007 - 163009	VSW087_C	Sandstone 100%	13.00	18.00	5.00	
59	EB1914213059	Vulcan	163010	VSW087_C	Sandstone 100%	18.00	21.00	3.00	
60	EB1914213060	Vulcan	163011	VSW087_C	Sandstone 100%	21.00	24.02	3.02	
66	EB1914213066	Vulcan	163018 - 163019	VSW088_C	Sandstone 100%	12.00	18.00	6.00	
67	EB1914213067	Vulcan	163020 - 163022	VSW088_C	Sandstone 100%	18.00	23.00	5.00	
68	EB1914213068	Vulcan	163023	VSW088_C	Sandstone 100%	23.00	29.00	6.00	
94	EB1914214024	Vulcan	163042 - 163043	VSW095_C	Sandstone 100%	9.00	12.00	3.00	
95	EB1914214025	Vulcan	163044	VSW095_C	Sandstone 100%	12.00	14.00	2.00	
97	EB1914214027	Vulcan	163046 - 163047	VSW095_C	Sandstone 100%	15.00	18.00	3.00	
98	EB1914214028	Vulcan	163048 - 163050	VSW095_C	Sandstone 100%	18.00	24.00	6.00	
99	EB1914214029	Vulcan	163201	VSW095_C	Sandstone 100%	24.00	25.00	1.00	
103	EB1914214033	Vulcan	163253 - 163254	VSW099_C	Sandstone 100%	3.00	7.00	4.00	
104	EB1914214034	Vulcan	163255 - 163256	VSW099_C	Sandstone 100%	7.00	14.00	7.00	
105	EB1914214035	Vulcan	163257 - 163258	VSW099_C	Sandstone 100%	14.00	19.00	5.00	
106	EB1914214036	Vulcan	163259 - 163260	VSW099_C	Sandstone 100%	19.00	22.80	3.80	
111	EB1914214041	Vulcan	163236	VSW104_C	Sandstone 100%	4.00	7.00	3.00	
112	EB1914214042	Vulcan	163237	VSW104_C	Sandstone 100%	7.00	14.00	7.00	
113	EB1914214043	Vulcan	163238 - 163240	VSW104_C	Sandstone 100%	14.00	20.00	6.00	
115	EB1914214045	Vulcan	163242	VSW104_C	Sandstone 100%	21.00	28.00	7.00	
116	EB1914214046	Vulcan	163243	VSW104_C	Sandstone 100%	28.00	30.00	2.00	
12	EB1914213012	Vulcan	145308	VSW070_C	Claystone 100%	25.00	26.00	1.00	KLC2
13	EB1914213013	Vulcan	145309	VSW070_C	Carbonaceous Sandstone 100%	26.00	27.53	1.53	
14	EB1914213014	Vulcan	145310	VSW070_C	Weathered Coal 100%	27.53	27.99	0.46	
22	EB1914213022	Vulcan	134785	VSW082_C	Claystone 100%	16.00	17.70	1.70	
23	EB1914213023	Vulcan	134786	VSW082_C	Weathered Coal 25%, Siltstone 75%	17.70	18.70	1.00	
30	EB1914213030	Vulcan	134793	VSW083_C	Weathered Coal 100%	21.77	21.97	0.20	
42	EB1914213042	Vulcan	163126	VSW084_C	Claystone 100%	26.00	27.00	1.00	
45	EB1914213045	Vulcan	163132	VSW084_C	Carbonaceous Claystone 38%, Carbonaceous Sandstone 62%	42.84	43.74	0.90	
62	EB1914213062	Vulcan	163013	VSW087_C	Carbonaceous Siltstone 100%	24.88	28.95	4.07	
80	EB1914214010	Vulcan	134820	VSW090_C	Claystone 100%	19.00	20.00	1.00	
81	EB1914214011	Vulcan	134821	VSW090_C	Claystone 98%, Carbonaceous Claystone 2%	20.00	26.00	6.00	
82	EB1914214012	Vulcan	134822	VSW090_C	Claystone 100%	26.00	27.00	1.00	
83	EB1914214013	Vulcan	134823	VSW090_C	Claystone 100%	27.00	30.85	3.85	
88	EB1914214018	Vulcan	134837	VSW092_C	Clay 99%, Weathered Coal 1%	13.00	17.69	4.69	
89	EB1914214019	Vulcan	134838	VSW092_C	Claystone 35%, Weathered Coal 51%, Carbonaceous Claystone 14%	17.69	21.00	3.31	
90	EB1914214020	Vulcan	134839	VSW092_C	Claystone 100%	21.00	23.20	2.20	
96	EB1914214026	Vulcan	163045	VSW095_C	Claystone 100%	14.00	15.00	1.00	
100	EB1914214030	Vulcan	163202	VSW095_C	Claystone 100%	25.00	25.84	0.84	
107	EB1914214037	Vulcan	163261	VSW099_C	Claystone 89%, Carbonaceous Claystone 11%	22.80	24.00	1.20	
108	EB1914214038	Vulcan	163262	VSW099_C	Carbonaceous Sandstone 100%	24.00	29.60	5.60	
114	EB1914214044	Vulcan	163241	VSW104_C	Sandstone 80%, Carbonaceous Siltstone 20%	20.00	21.00	1.00	
118	EB1914214048	Jupiter	335481	VSW017_C	Sandstone 100%	1.00	3.00	2.00	KLC3
119	EB1914214049	Jupiter	335482	VSW017_C	Sandstone 100%	3.00	6.00	3.00	
120	EB1914214050	Jupiter	335483	VSW017_C	Sandstone 100%	6.00	7.59	1.59	
123	EB1914214053	Jupiter	335479	VSW019_C	Sandstone 100%	14.26	24.86	10.60	
127	EB1914214057	Jupiter	145154	VSW022_C	Sandstone 100%, Carbonaceous Claystone <1%	20.00	33.01	13.01	
130	EB1914214060	Jupiter	134773	VSW077_C	Sandstone 100%	1.00	3.00	2.00	
132	EB1914214062	Jupiter	134764	VSW078_C	Sand 16%, Sandstone 84%	0.00	3.17	3.17	
135	EB1914214065	Jupiter	134770	VSW080_C	Sandstone 100%	1.00	2.94	1.94	
122	EB1914214052	Jupiter	335478	VSW019_C	Coaly Shale 100%	3.00	7.53	4.53	KLC4
125	EB1914214055	Jupiter	145152	VSW022_C	Shale 100%	1.00	10.00	9.00	
126	EB1914214056	Jupiter	145153	VSW022_C	Carbonaceous Siltstone 100%	10.00	12.02	2.02	
128	EB1914214058	Jupiter	145155	VSW022_C	Siltstone 100%, Carbonaceous Claystone <1%	33.01	43.21	10.20	
131	EB1914214061	Jupiter	134774	VSW077_C	Carbonaceous Siltstone 100%	3.00	4.00	1.00	
133	EB1914214063	Jupiter	134767	VSW078_C	Siltstone 100%	4.45	6.00	1.55	
137	EB1914214067	Jupiter	134872	VSW103_C	Siltstone 100%	2.00	5.00	3.00	
138	EB1914214068	Jupiter	134873	VSW103_C	Siltstone 100%	5.00	8.00	3.00	
139	EB1914214069	Jupiter	134874	VSW103_C	Siltstone 100%	8.00	11.00	3.00	
140	IP19006604 R006	Vulcan	134725_28 + 162507_09	VSW069_C	Fine Rejects				KLC 5
141	IP19004101 R299	Vulcan	145437-442 to 145447-448	VSW086_C	Fine Rejects				
142	IP19006604 R005	Vulcan	134725_28 + 162507_09	VSW069_C	Coarse Rejects				KLC 6
143	IP19004101 R298	Vulcan	145437-442 to 145447-448	VSW086_C	Coarse Rejects				

Notes

1. Current pH, EC, Alkalinity and Acidity provided for 1:5 sample:water extracts
2. CRS = Chromium Reducible Sulfur; MPA = Maximum Potential Acidity; ANC = Acid Neutralising Capacity; NAPP = Net Acid Producing Potential; and NAG = Net Acid Generation
3. Sample classification criteria detail provided in report text.

* Where total sulfur or ANC results are less than the laboratory LoR a value of half of the LoR is used in Table B5.

Attachment C Kinetic Geochemical Test Results

Vulcan Sandstone

KLC 1

Weight (kg)	2.00	**Total S (%)**	0.02	**ANC**	15.1
pH (1:5)	8.79	**Scr (%)**	0.020	**NAPP**	-14.6
EC (µS/cm)	283	**MPA**	0.6	**ANC:MPA**	26.5

Date			**25-Jun-19**	**22-Jul-19**	**27-Aug-19**	**25-Sep-19**	**22-Oct-19**	**26-Nov-19**	**24-Dec-19**
Number of Weeks			**0**	**4**	**9**	**13**	**17**	**22**	**26**
Leach Number			**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number			EB1916412001	EB1918957001	EB1922363001	EB1925267001	EB1927981001	EB1931659001	EB1934601001
Volume On (L)			1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)			0.609	0.580	0.512	0.454	0.467	0.375	0.281
Cum. Volume (L)			0.61	1.19	1.70	2.15	2.62	3.00	3.28
Pore Volumes			0.5	0.9	1.3	1.6	1.9	2.2	2.4
pH (RGS Measurement)			8.21	6.74	6.91	7.77	7.75	8.06	7.66
pH (ALS Measurement)			6.87	7.02	7.25	7.45	7.15	7.85	8.03
pH (deionised water used in test)			5.45	5.46	6.01	5.89	5.67	5.87	5.95
EC (RGS Measurement) (µS/cm)			54	150	268	848	1,156	1,796	442
EC (ALS Measurement) (µS/cm)			56	171	282	930	1,150	1750	462
Acidity (mg/L)*			1	1	1	7	2	5	<1
Alkalinity (mg/L)*			7	5	8	26	25	47	80
Net Alkalinity (mg/L)*			6	4	7	19	23	42	80
Major Ions (mg/L)	**LoR**	**WQ Guidelines#**							
Calcium (Ca)	1	1,000	0.5	2	3	7	12	16	3
Potassium (K)	1	-	<1	<1	<1	1	<1	2	1
Magnesium (Mg)	1	-	0.5	5	7	22	38	49	8
Sodium (Na)	1	-	12	22	44	146	142	258	91
Chloride (Cl)	1	-	10	33	52	222	318	456	64
Fluoride (F)	0.1	2	<0.1	<0.1	0.1	0.5	0.3	0.7	0.9
Sulfate (SO_4)	1	1,000	3	20	39	107	95	186	47
Trace metals/ metalloids (mg/L)	**LoR**								
Aluminium (Al)	0.01	5	1.09	0.22	0.13	0.01	<0.01	<0.01	0.77
Arsenic (As)	0.001	0.5	<0.001	<0.001	<0.001	0.002	0.001	0.006	0.004
Boron (B)	0.05	5	<0.05	<0.05	<0.05	0.06	<0.05	0.09	0.14
Cadmium (Cd)	0.0001	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt (Co)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (Cr)	0.001	1	<0.001	<0.001	<0.001	<0.001	0.021	<0.001	0.001
Copper (Cu)	0.001	1	<0.001	0.001	<0.001	<0.001	0.002	0.002	0.005
Iron (Fe)	0.05	1	0.21	<0.05	<0.05	<0.05	0.16	<0.05	0.10
Manganese (Mn)	0.001	2	0.002	0.02	0.005	0.009	0.024	0.035	0.003
Molybdenum (Mo)	0.001	0.15	<0.001	<0.001	0.001	0.008	0.005	0.012	0.013
Nickel (Ni)	0.001	1	<0.001	<0.001	<0.001	0.001	0.002	0.002	0.001
Lead (Pb)	0.001	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Antimony (Sb)	0.001	-	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
Selenium (Se)	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium (V)	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc (Zn)	0.005	20	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calculations**									
SO_4 Release Rate			1	6	10	24	22	35	7
Cumulative SO_4 Release			1	7	17	41	63	98	105
Ca Release Rate			0.2	0.6	0.8	1.6	2.8	3.0	0.4
Cumulative Ca Release			0.2	0.7	1.5	3.1	5.9	8.9	9.3
Mg Release Rate			0.2	1.5	1.8	5.0	8.9	9.2	1.1
Cumulative Mg Release			0.2	1.6	3.4	8.4	17.3	26.4	27.6
Residual ANC (%)			100.0	99.9	99.9	99.7	99.4	99.2	99.1
Residual Sulfur (%)			99.8	98.8	97.0	92.7	88.7	82.5	81.3
SO_4/(Ca+Mg) molar ratio			0.9	0.8	1.1	1.0	0.5	0.8	1.2

< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.

** SO_4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity.

MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential.

ANZECC & ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, 2000, ANZECC (Australian and New Zealand Environment Conservation Council) and ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand). Livestock Drinking Water Levels (Irrigation Levels used for Fe and Mn).

Vulcan Claystone

KLC 2

Weight (kg)	2.00	**Total S (%)**	0.03	**ANC**	13.4
pH (1:5)	8.42	**Scr (%)**	0.030	**NAPP**	-12.4
EC (µS/cm)	352	**MPA**	1.0	**ANC:MPA**	13.3

Date			**25-Jun-19**	**22-Jul-19**	**27-Aug-19**	**25-Sep-19**	**22-Oct-19**	**26-Nov-19**	**24-Dec-19**
Number of Weeks			**0**	**4**	**9**	**13**	**17**	**22**	**26**
Leach Number			**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number			EB1916412002	EB1918957002	EB1922363002	EB1925267002	EB1927981002	EB1931659002	'EB1934601002
Volume On (L)			1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)			0.562	0.489	0.360	0.575	0.829	0.536	0.687
Cum. Volume (L)			0.56	1.05	1.41	1.99	2.82	3.35	4.04
Pore Volumes			0.4	0.8	1.0	1.5	2.1	2.5	3.0
pH (RGS Measurement)			7.48	6.79	6.95	7.69	7.61	7.96	8.27
pH (ALS Measurement)			6.71	6.86	6.94	6.99	6.85	7.17	7.00
pH (deionised water used in test)			5.45	5.46	6.01	5.89	5.67	5.87	7.39
EC (RGS Measurement) (µS/cm)			69	259	395	219	152	122	89
EC (ALS Measurement) (µS/cm)			76	299	414	251	150	119	94
Acidity (mg/L)*			1	2	1	8	<1	<1	2
Alkalinity (mg/L)*			6	4	8	7	8	6	11
Net Alkalinity (mg/L)*			5	2	7	-1	8	6	9
Major Ions (mg/L)	**LoR**	**WQ Guidelines#**							
Calcium (Ca)	1	1,000	0.5	3	7	2	2	2	0.5
Potassium (K)	1	-	<1	<1	1	<1	<1	<1	<1
Magnesium (Mg)	1	-	0.5	9	13	6	4	3	2
Sodium (Na)	1	-	15	39	57	36	18	15	15
Chloride (Cl)	1	-	13	63	68	44	23	18	13
Fluoride (F)	0.1	2	0.1	0.1	0.2	0.2	0.1	0.1	0.1
Sulfate (SO_4)	1	1,000	6	34	71	37	22	18	12
Trace metals/ metalloids (mg/L)	**LoR**								
Aluminium (Al)	0.01	5	1.07	0.05	0.04	0.26	0.22	0.22	0.29
Arsenic (As)	0.001	0.5	<0.001	<0.001	<0.001	<0.001	0.002	0.004	<0.001
Boron (B)	0.05	5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium (Cd)	0.0001	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt (Co)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (Cr)	0.001	1	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001
Copper (Cu)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (Fe)	0.05	1	0.40	<0.05	<0.05	0.13	0.14	0.09	0.09
Manganese (Mn)	0.001	2	0.007	0.008	0.004	0.003	0.003	0.002	0.003
Molybdenum (Mo)	0.001	0.15	<0.001	<0.001	0.001	0.002	<0.001	0.001	<0.001
Nickel (Ni)	0.001	1	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
Lead (Pb)	0.001	0.1	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Antimony (Sb)	0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium (V)	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc (Zn)	0.005	20	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calculations**									
SO_4 Release Rate			2	8	13	11	9	5	4
Cumulative SO_4 Release			2	10	23	33	43	47	51
Ca Release Rate			0.1	0.7	1.3	0.6	0.8	0.5	0.2
Cumulative Ca Release			0.1	0.9	2.1	2.7	3.5	4.1	4.2
Mg Release Rate			0.1	2.2	2.3	1.7	1.7	0.8	0.7
Cumulative Mg Release			0.1	2.3	4.7	6.4	8.1	8.9	9.6
Residual ANC (%)			100.0	99.9	99.8	99.8	99.7	99.7	99.6
Residual Sulfur (%)			99.8	99.0	97.7	96.6	95.7	95.2	94.8
SO_4/(Ca+Mg) molar ratio			1.9	0.8	1.0	1.3	1.1	1.1	1.3

< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.

** SO_4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity.

MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential.

ANZECC & ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, 2000, ANZECC (Australian and New Zealand Environment Conservation Council) and ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand). Livestock Drinking Water Levels (Irrigation Levels used for Fe and Mn).

Jupiter Sandstone

KLC 3

Weight (kg)	1.95	**Total S (%)**	0.05	**ANC**	5.1
pH (1:5)	7.13	**Scr (%)**	0.050	**NAPP**	-3.7
EC (µS/cm)	142	**MPA**	1.4	**ANC:MPA**	3.7

Date			**25-Jun-19**	**22-Jul-19**	**27-Aug-19**	**26-Sep-19**	**22-Oct-19**	**26-Nov-19**	**24-Dec-19**
Number of Weeks			**0**	**4**	**9**	**13**	**17**	**22**	**26**
Leach Number			**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number			EB1916412003	EB1918957003	EB1922363003	EB1925267003	EB1927981003	EB1931659003	EB1934601003
Volume On (L)			1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)			0.578	0.662	0.613	0.576	0.586	0.549	0.624
Cum. Volume (L)			0.58	1.24	1.85	2.43	3.01	3.56	4.19
Pore Volumes			0.4	0.9	1.4	1.8	2.2	2.6	3.1
pH (RGS Measurement)			5.55	6.10	5.81	6.51	6.41	6.73	7.14
pH (ALS Measurement)			5.84	6.18	6.03	5.98	6.11	6.35	6.35
pH (deionised water used in test)			5.45	5.46	6.01	5.89	5.67	5.87	5.95
EC (RGS Measurement) (µS/cm)			558	128	174	255	210	184	141
EC (ALS Measurement) (µS/cm)			616	144	181	300	208	181	148
Acidity (mg/L)*			2	1	2	7	2	1	1
Alkalinity (mg/L)*			2	1	2	5	5	5	5
Net Alkalinity (mg/L)*			0	0	0	-2	3	4	4
Major Ions (mg/L)	**LoR**	**WQ Guidelines#**							
Calcium (Ca)	1	1,000	4	0.5	2	2	2	2	1
Potassium (K)	1	-	6	1	2	2	2	2	2
Magnesium (Mg)	1	-	7	2	3	4	3	2	2
Sodium (Na)	1	-	104	23	30	49	31	27	24
Chloride (Cl)	1	-	108	25	21	37	21	15	10
Fluoride (F)	0.1	2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Sulfate (SO_4)	1	1,000	111	22	40	73	51	47	41
Trace metals/ metalloids (mg/L)	**LoR**								
Aluminium (Al)	0.01	5	0.08	0.15	0.09	0.06	0.24	0.2	0.28
Arsenic (As)	0.001	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001
Boron (B)	0.05	5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium (Cd)	0.0001	0.01	0.0002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt (Co)	0.001	1	0.039	0.007	0.006	0.008	0.004	0.002	0.001
Chromium (Cr)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	0.001	1	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (Fe)	0.05	1	<0.05	0.07	<0.05	0.05	<0.05	0.08	0.09
Manganese (Mn)	0.001	2	0.153	0.101	0.134	0.229	0.121	0.098	0.058
Molybdenum (Mo)	0.001	0.15	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel (Ni)	0.001	1	0.045	0.009	0.008	0.01	0.004	0.003	0.002
Lead (Pb)	0.001	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Antimony (Sb)	0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium (V)	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc (Zn)	0.005	20	0.158	0.022	0.023	0.031	0.014	0.008	0.005
Calculations**									
SO_4 Release Rate			33	7	13	22	15	13	13
Cumulative SO_4 Release			33	40	53	75	90	103	116
Ca Release Rate			1.2	0.2	0.6	0.6	0.6	0.6	0.3
Cumulative Ca Release			1.2	1.4	2.0	2.6	3.2	3.7	4.1
Mg Release Rate			2.1	0.7	0.9	1.2	0.9	0.6	0.6
Cumulative Mg Release			2.1	2.8	3.7	4.9	5.8	6.3	7.0
Residual ANC (%)			99.8	99.7	99.6	99.5	99.4	99.3	99.3
Residual Sulfur (%)			97.6	97.0	96.1	94.5	93.3	92.4	91.4
SO_4/(Ca+Mg) molar ratio			3.0	2.4	2.4	3.5	3.1	3.7	4.0

< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.

** SO_4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity.

MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential.

ANZECC & ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, 2000, ANZECC (Australian and New Zealand Environment Conservation Council) and ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand). Livestock Drinking Water Levels (Irrigation Levels used for Fe and Mn).

Jupiter Siltstone

KLC 4

Weight (kg)	2.02	**Total S (%)**	0.03	**ANC**	9.6
pH (1:5)	7.58	**Scr (%)**	0.030	**NAPP**	-8.7
EC (µS/cm)	198	**MPA**	0.9	**ANC:MPA**	10.7

Date			**25-Jun-19**	**22-Jul-19**	**27-Aug-19**	**25-Sep-19**	**22-Oct-19**	**26-Nov-19**	**24-Dec-19**
Number of Weeks			**0**	**4**	**9**	**13**	**17**	**22**	**26**
Leach Number			**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number			EB1916412004	EB1918957004	EB1922363004	EB1925267004	EB1927981004	EB1931659004	EB1934601004
Volume On (L)			1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)			0.570	0.557	0.636	0.594	0.591	0.576	0.708
Cum. Volume (L)			0.57	1.13	1.76	2.36	2.95	3.52	4.23
Pore Volumes			0.4	0.8	1.3	1.7	2.2	2.6	3.1
pH (RGS Measurement)			6.62	6.59	6.36	6.86	6.67	6.88	6.96
pH (ALS Measurement)			6.45	6.51	6.41	6.45	6.43	6.62	6.70
pH (deionised water used in test)			5.45	5.46	6.01	5.89	5.67	5.87	5.95
EC (RGS Measurement) (µS/cm)			649	490	368	384	304	414	371
EC (ALS Measurement) (µS/cm)			720	557	382	431	310	409	384
Acidity (mg/L)*			5	6	2	3	2	1	3
Alkalinity (mg/L)*			5	2	3	5	5	4	8
Net Alkalinity (mg/L)*			0	-4	1	2	3	3	5
Major Ions (mg/L)	**LoR**	**WQ Guidelines#**							
Calcium (Ca)	1	1,000	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Potassium (K)	1	-	6	3	2	3	2	3	3
Magnesium (Mg)	1	-	4	7	5	4	3	4	2
Sodium (Na)	1	-	150	89	71	75	51	70	71
Chloride (Cl)	1	-	193	130	74	76	48	67	56
Fluoride (F)	0.1	2	0.2	0.1	0.1	0.2	0.1	0.2	0.2
Sulfate (SO_4)	1	1,000	45	57	48	74	53	78	72
Trace metals/ metalloids (mg/L)	**LoR**								
Aluminium (Al)	0.01	5	0.24	0.14	0.17	0.68	0.73	0.91	1.13
Arsenic (As)	0.001	0.5	<0.001	<0.001	<0.001	<0.001	<0.001	0.003	0.002
Boron (B)	0.05	5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Cadmium (Cd)	0.0001	0.01	<0.0001	<0.0001	0.0004	<0.0001	<0.0001	<0.0001	<0.0001
Cobalt (Co)	0.001	1	0.003	0.002	0.002	0.002	0.002	0.002	0.001
Chromium (Cr)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Copper (Cu)	0.001	1	0.001	<0.001	0.004	<0.001	<0.001	<0.001	0.002
Iron (Fe)	0.05	1	0.14	0.11	0.07	0.20	<0.05	0.27	0.42
Manganese (Mn)	0.001	2	0.041	0.045	0.042	0.048	0.034	0.04	0.033
Molybdenum (Mo)	0.001	0.15	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel (Ni)	0.001	1	0.003	0.002	0.002	0.003	0.003	0.002	0.003
Lead (Pb)	0.001	0.1	0.001	0.001	<0.001	0.002	0.001	0.002	0.003
Antimony (Sb)	0.001	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium (V)	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc (Zn)	0.005	20	0.01	<0.005	0.137	<0.005	<0.005	0.008	0.005
Calculations**									
SO_4 Release Rate			12.7	15.8	15.2	21.8	16	22	25
Cumulative SO_4 Release			12.7	28.5	43.6	65.4	81	103	129
Ca Release Rate			0.1	0.1	0.2	0.1	0.1	0.1	0.2
Cumulative Ca Release			0.1	0.3	0.4	0.6	0.7	0.9	1.1
Mg Release Rate			1.1	1.9	1.6	1.2	0.9	1.1	0.7
Cumulative Mg Release			1.1	3.1	4.6	5.8	6.7	7.8	8.5
Residual ANC (%)			99.9	99.9	99.8	99.7	99.7	99.6	99.6
Residual Sulfur (%)			98.6	96.8	95.1	92.6	90.8	88.3	85.4
SO_4/(Ca+Mg) molar ratio			2.6	2.0	2.3	4.4	4.1	4.6	7.9

< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.

** SO_4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity.

MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential.

ANZECC & ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, 2000, ANZECC (Australian and New Zealand Environment Conservation Council) and ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand). Livestock Drinking Water Levels (Irrigation Levels used for Fe and Mn).

Vulcan Fine Rejects

KLC 5

Weight (kg)	1.38	**Total S (%)**	0.50	**ANC**	5.1
pH (1:5)	8.20	**Scr (%)**	0.218	**NAPP**	1.6
EC (µS/cm)	289	**MPA**	6.7	**ANC:MPA**	0.8

Date			**03-Dec-19**	**07-Jan-20**	**04-Feb-20**	**04-Mar-20**	**04-Apr-20**	**04-May-20**	**04-Jun-20**
Number of Weeks			**0**	**4**	**9**	**13**	**17**	**22**	**26**
Leach Number			**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number			EB1932471005	EB2000205001	EB2002875001	EB2005904001	EB2009682001	EB2011988001	EB2014636001
Volume On (L)			1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)			0.530	0.551	0.596	0.505	0.633	0.539	0.534
Cum. Volume (L)			0.53	1.08	1.68	2.18	2.82	3.35	3.89
Pore Volumes			0.4	0.8	1.2	1.6	2.1	2.5	2.9
pH (RGS Measurement)			7.38	7.30	5.75	6.04	5.96	6.79	7.22
pH (ALS Measurement)			7.35	6.69	5.77	5.59	6.03	6.58	6.48
pH (deionised water used in test)			6.38	6.43	5.20	5.71	6.43	6.35	6.75
EC (RGS Measurement) (µS/cm)			822	496	928	998	634	495	389
EC (ALS Measurement) (µS/cm)			833	504	980	1,060	660	504	426
Acidity (mg/L)*			3	1	5	6	5	2	2
Alkalinity (mg/L)*			32	9	14	3	6	8	4
Net Alkalinity (mg/L)*			29	8	9	-3	1	6	2
Major Ions (mg/L)	**LoR**	**WQ Guidelines#**							
Calcium (Ca)	1	1,000	35	22	50	64	31	26	21
Potassium (K)	1	-	5	5	8	8	6	5	4
Magnesium (Mg)	1	-	31	18	42	54	30	28	21
Sodium (Na)	1	-	70	45	73	86	51	39	26
Chloride (Cl)	1	-	158	40	56	36	17	8	6
Fluoride (F)	0.1	2	1.2	0.6	0.5	0.4	0.5	0.4	0.4
Sulfate (SO_4)	1	1,000	150	143	374	487	291	215	180
Trace metals/ metalloids (mg/L)	**LoR**								
Aluminium (Al)	0.01	5	0.02	<0.01	0.04	0.01	0.05	<0.01	<0.01
Arsenic (As)	0.001	0.5	0.002	<0.001	0.001	0.001	<0.001	<0.001	<0.001
Boron (B)	0.05	5	0.11	0.09	0.16	0.18	0.15	0.06	0.08
Cadmium (Cd)	0.0001	0.01	0.0021	0.0015	0.0068	0.0088	0.0064	0.0058	0.0052
Cobalt (Co)	0.001	1	0.07	0.099	0.423	0.552	0.346	0.320	0.262
Chromium (Cr)	0.001	1	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	0.001	1	0.006	0.006	0.020	0.025	0.029	0.018	0.016
Iron (Fe)	0.05	1	<0.05	<0.05	0.10	<0.05	0.07	<0.05	<0.05
Manganese (Mn)	0.001	2	0.016	0.023	0.108	0.198	0.195	0.202	0.174
Molybdenum (Mo)	0.001	0.15	0.05	0.013	0.010	0.007	0.006	0.005	0.002
Nickel (Ni)	0.001	1	0.046	0.072	0.271	0.352	0.233	0.221	0.184
Lead (Pb)	0.001	0.1	<0.001	<0.001	0.020	<0.001	<0.001	<0.001	<0.001
Antimony (Sb)	0.001	-	0.002	0.001	0.001	<0.001	<0.001	<0.001	<0.001
Selenium (Se)	0.01	0.02	0.05	0.02	0.05	0.05	0.04	0.03	0.02
Vanadium (V)	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc (Zn)	0.005	20	0.067	0.098	0.554	0.971	0.777	0.862	0.796
Calculations**									
SO_4 Release Rate			57.7	57.2	161.9	178.6	133.8	84.2	69.8
Cumulative SO_4 Release			57.7	115.0	276.8	455.4	589.2	673.4	743.2
Ca Release Rate			13.5	8.8	21.6	23.5	14.3	10.2	8.1
Cumulative Ca Release			13.5	22.3	43.9	67.4	81.6	91.8	100.0
Mg Release Rate			11.9	7.2	18.2	19.8	13.8	11.0	8.1
Cumulative Mg Release			11.9	19.1	37.3	57.1	70.9	81.9	90.0
Residual ANC (%)			98.4	97.4	94.9	92.2	90.5	89.1	88.1
Residual Sulfur (%)			99.6	99.2	98.2	97.0	96.1	95.5	95.0
SO_4/(Ca+Mg) molar ratio			0.7	1.2	1.3	1.3	1.5	1.2	1.4

< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.

** SO_4, Ca and Mg release rates calculated in mg/kg/flush.

Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity.

MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential.

ANZECC & ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, 2000, ANZECC (Australian and New Zealand Environment Conservation Council) and ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand). Livestock Drinking Water Levels (Irrigation Levels used for Fe and Mn).

Vulcan Coarse Rejects

KLC 6

Weight (kg)	1.28	**Total S (%)**	0.40	**ANC**	7.8
pH (1:5)	7.15	**Scr (%)**	0.205	**NAPP**	-1.5
EC (µS/cm)	540	**MPA**	6.3	**ANC:MPA**	1.2

Date			**03-Dec-19**	**07-Jan-20**	**04-Feb-20**	**04-Mar-20**	**04-Apr-20**	**04-May-20**	**04-Jun-20**
Number of Weeks			**0**	**4**	**9**	**13**	**17**	**22**	**26**
Leach Number			**1**	**2**	**3**	**4**	**5**	**6**	**7**
ALS Laboratory Number			EB1932471006	EB2000205002	EB2002875002	EB2005904002	EB2009682002	EB2011988002	EB2014636002
Volume On (L)			1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)			0.755	0.690	0.794	0.680	0.654	0.673	0.633
Cum. Volume (L)			0.76	1.45	2.24	2.92	3.57	4.25	4.88
Pore Volumes			0.6	1.1	1.7	2.2	2.7	3.2	3.6
pH (RGS Measurement)			7.32	7.43	6.67	7.09	6.94	7.37	7.56
pH (ALS Measurement)			7.01	6.90	6.66	6.68	6.98	7.15	7.28
pH (deionised water used in test)			6.38	6.43	5.20	5.71	6.43	6.35	6.75
EC (RGS Measurement) (µS/cm)			148	205	247	252	218	220	163
EC (ALS Measurement) (µS/cm)			151	205	263	275	225	215	173
Acidity (mg/L)*			1	1	2	2	2	<1	<1
Alkalinity (mg/L)*			12	14	23	18	17	17	21
Net Alkalinity (mg/L)*			11	13	21	16	15	17	21
Major Ions (mg/L)	**LoR**	**WQ Guidelines#**							
Calcium (Ca)	1	1,000	2	2	2	3	2	2	2
Potassium (K)	1	-	1	2	2	2	2	2	2
Magnesium (Mg)	1	-	2	2	4	4	3	4	3
Sodium (Na)	1	-	23	33	42	44	36	39	27
Chloride (Cl)	1	-	19	14	13	11	8	6	4
Fluoride (F)	0.1	2	0.4	0.5	0.9	0.6	0.8	0.7	0.6
Sulfate (SO_4)	1	1,000	32	52	78	76	77	69	48
Trace metals/ metalloids (mg/L)	**LoR**								
Aluminium (Al)	0.01	5	0.09	0.14	0.33	0.16	0.24	0.32	0.33
Arsenic (As)	0.001	0.5	0.002	0.002	0.002	0.001	<0.001	0.001	0.002
Boron (B)	0.05	5	<0.05	<0.05	0.13	0.18	0.06	<0.05	0.05
Cadmium (Cd)	0.0001	0.01	<0.0001	0.0002	0.0003	0.0004	0.0004	0.0004	0.0004
Cobalt (Co)	0.001	1	0.006	0.016	0.023	0.021	0.020	0.019	0.016
Chromium (Cr)	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (Cu)	0.001	1	0.002	0.003	0.005	0.006	0.009	0.005	0.007
Iron (Fe)	0.05	1	<0.05	0.07	0.15	0.06	<0.05	<0.05	<0.05
Manganese (Mn)	0.001	2	0.002	0.004	0.004	0.006	0.010	0.007	0.007
Molybdenum (Mo)	0.001	0.15	0.036	0.046	0.052	0.058	0.035	0.054	0.027
Nickel (Ni)	0.001	1	0.005	0.015	0.023	0.024	0.020	0.018	0.014
Lead (Pb)	0.001	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Antimony (Sb)	0.001	-	<0.001	0.001	0.002	0.001	0.002	0.002	0.002
Selenium (Se)	0.01	0.02	0.02	0.03	0.04	0.04	0.03	0.03	0.02
Vanadium (V)	0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc (Zn)	0.005	20	<0.005	0.009	0.016	0.026	0.036	0.040	0.038
Calculations**									
SO_4 Release Rate			18.9	28.1	48.6	40.5	39.5	36.4	23.8
Cumulative SO_4 Release			18.9	47.1	95.7	136.2	175.7	212.1	235.9
Ca Release Rate			1.2	1.1	1.2	1.6	1.0	1.1	1.0
Cumulative Ca Release			1.2	2.3	3.5	5.1	6.1	7.2	8.2
Mg Release Rate			1.2	1.1	2.5	2.1	1.5	2.1	1.5
Cumulative Mg Release			1.2	2.3	4.8	6.9	8.4	10.5	12.0
Residual ANC (%)			99.9	99.8	99.6	99.5	99.4	99.2	99.1
Residual Sulfur (%)			99.8	99.6	99.2	98.9	98.5	98.2	98.0
SO_4/(Ca+Mg) molar ratio			2.5	4.1	3.8	3.3	4.6	3.3	2.9

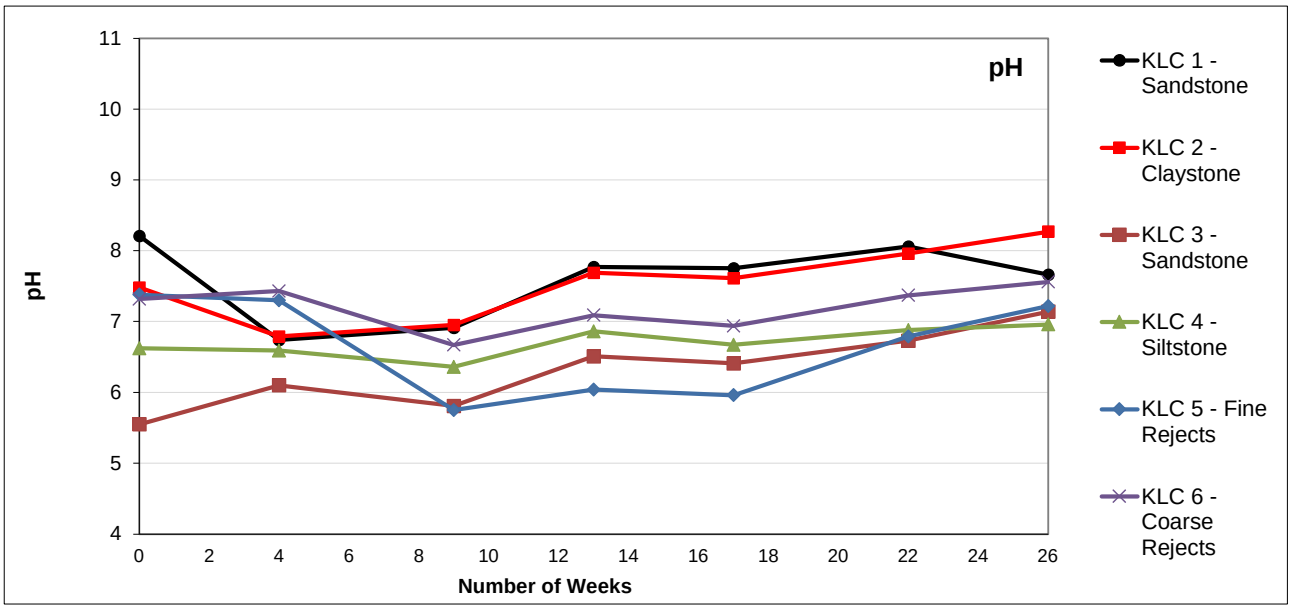
< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.

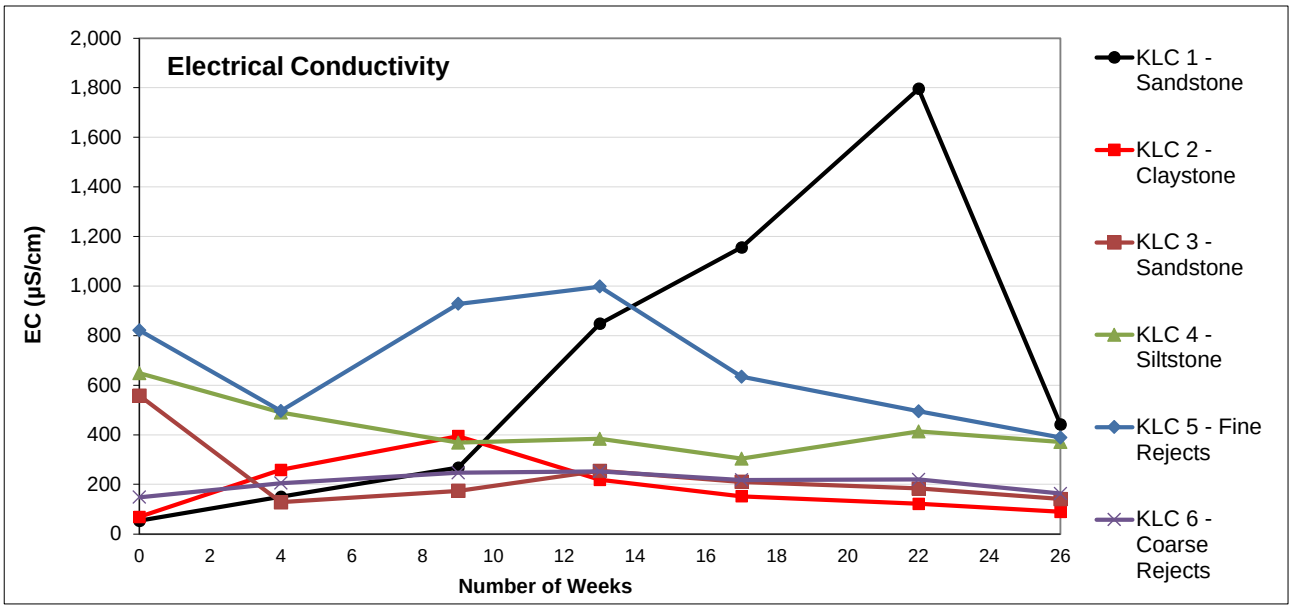
** SO_4, Ca and Mg release rates calculated in mg/kg/flush.

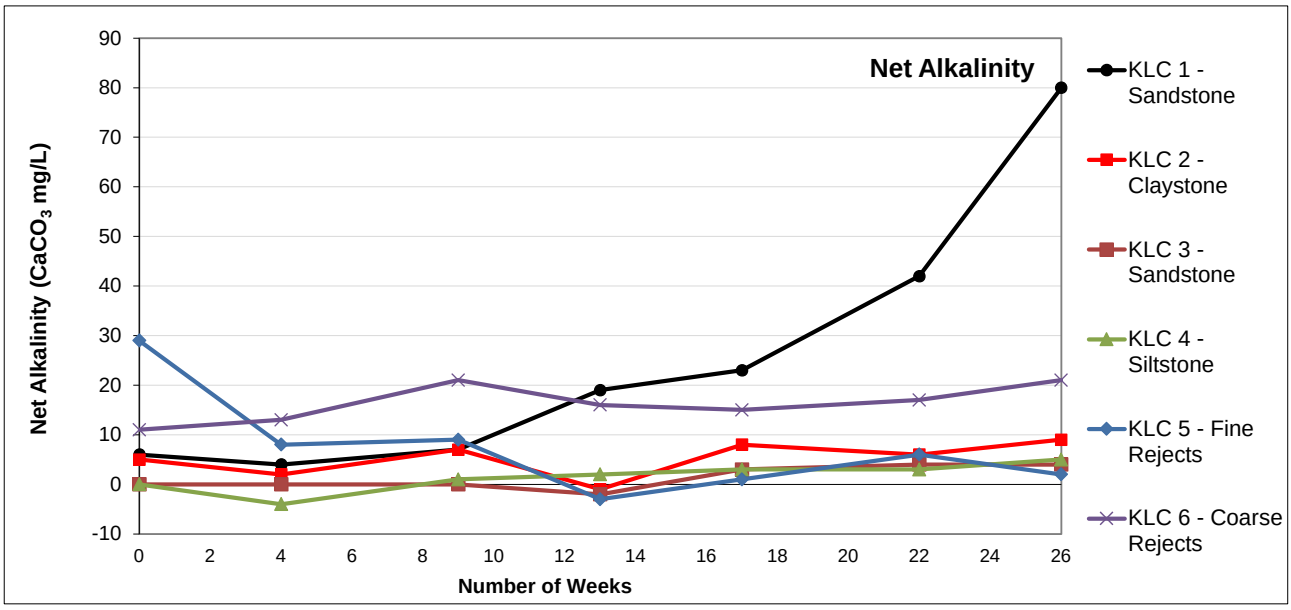
Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity.

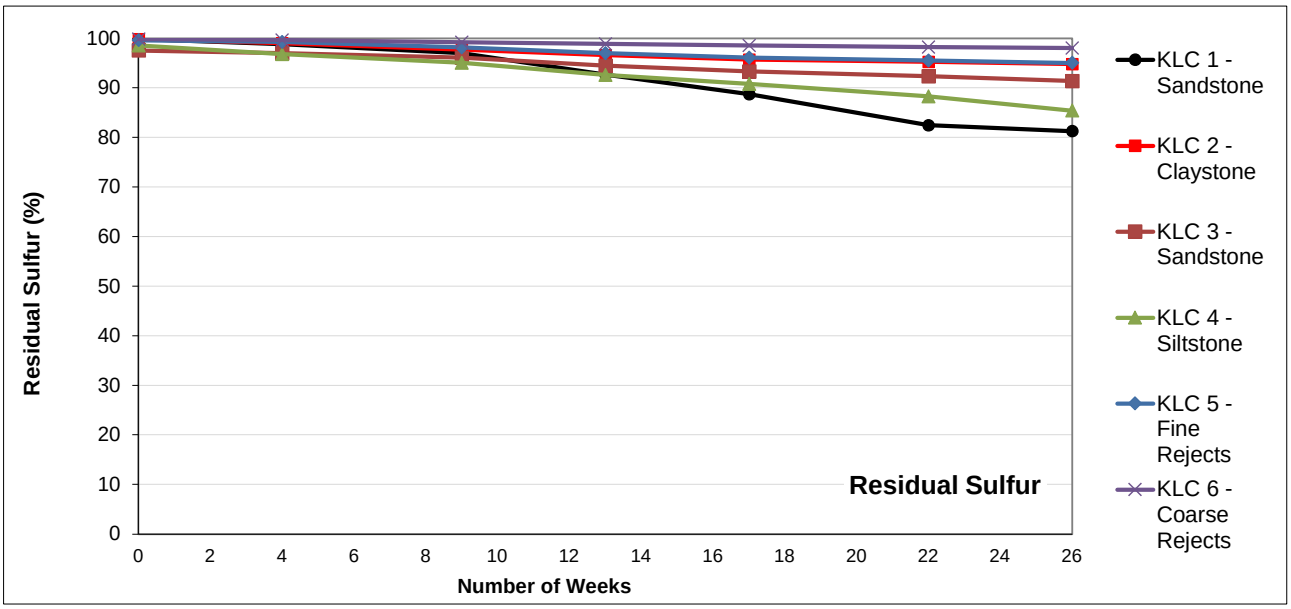
MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential.

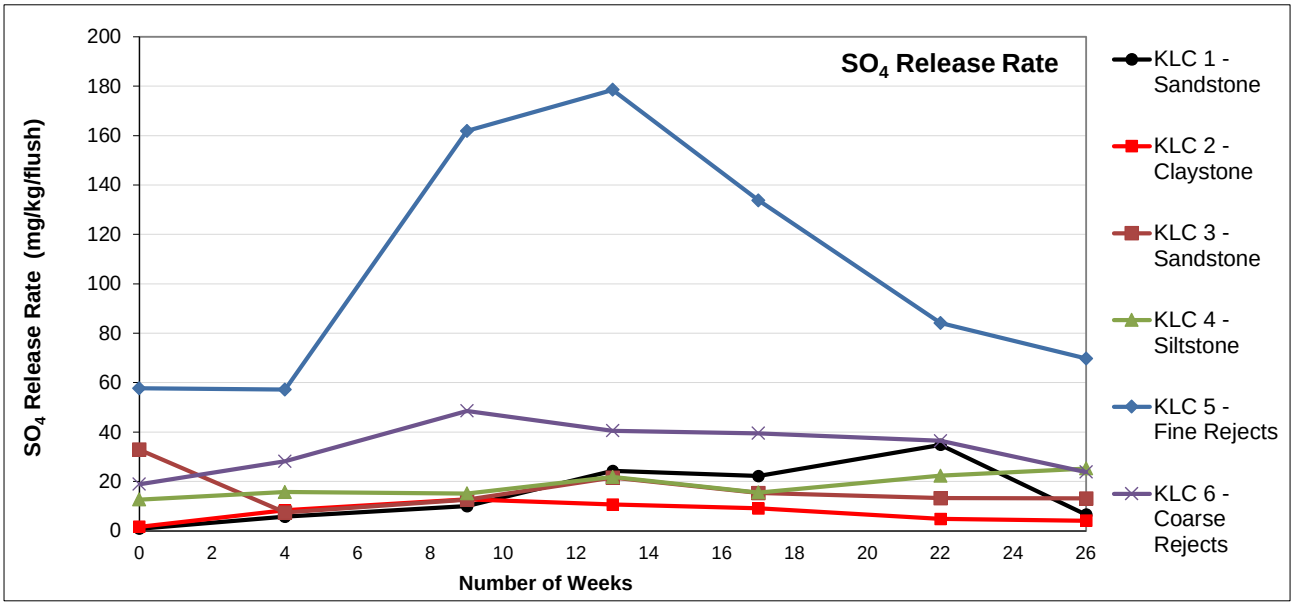
ANZECC & ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, National Water Quality Management Strategy, 2000, ANZECC (Australian and New Zealand Environment Conservation Council) and ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand). Livestock Drinking Water Levels (Irrigation Levels used for Fe and Mn).

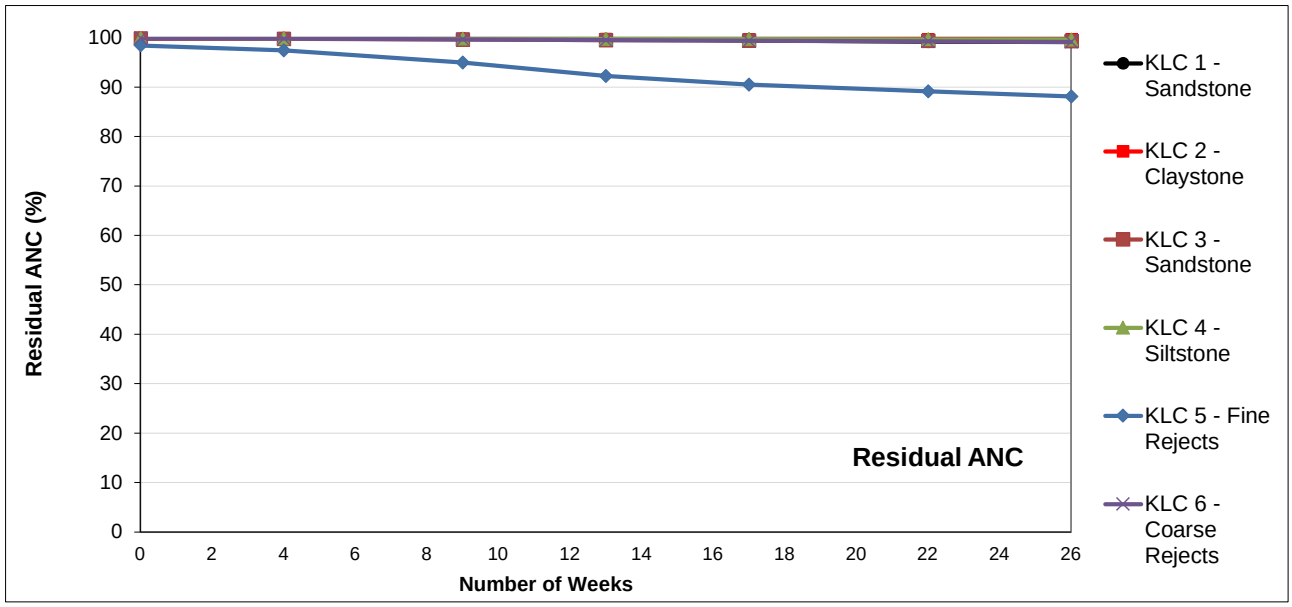

pH
pH
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects

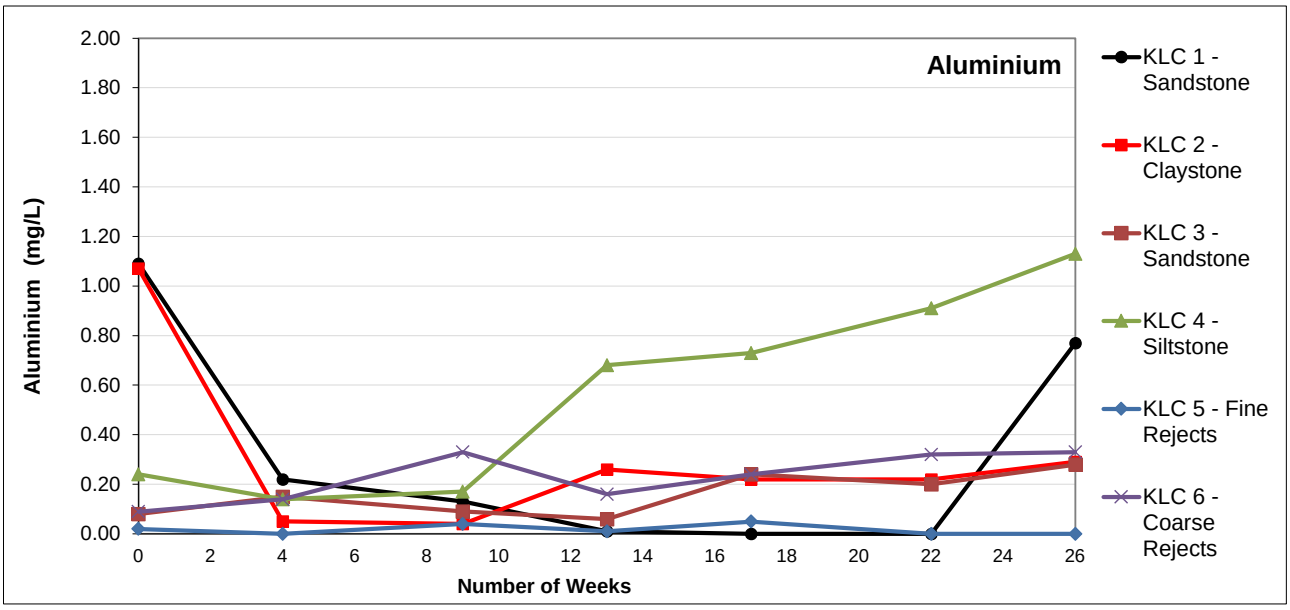

Electrical Conductivity
EC (µS/cm)
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects

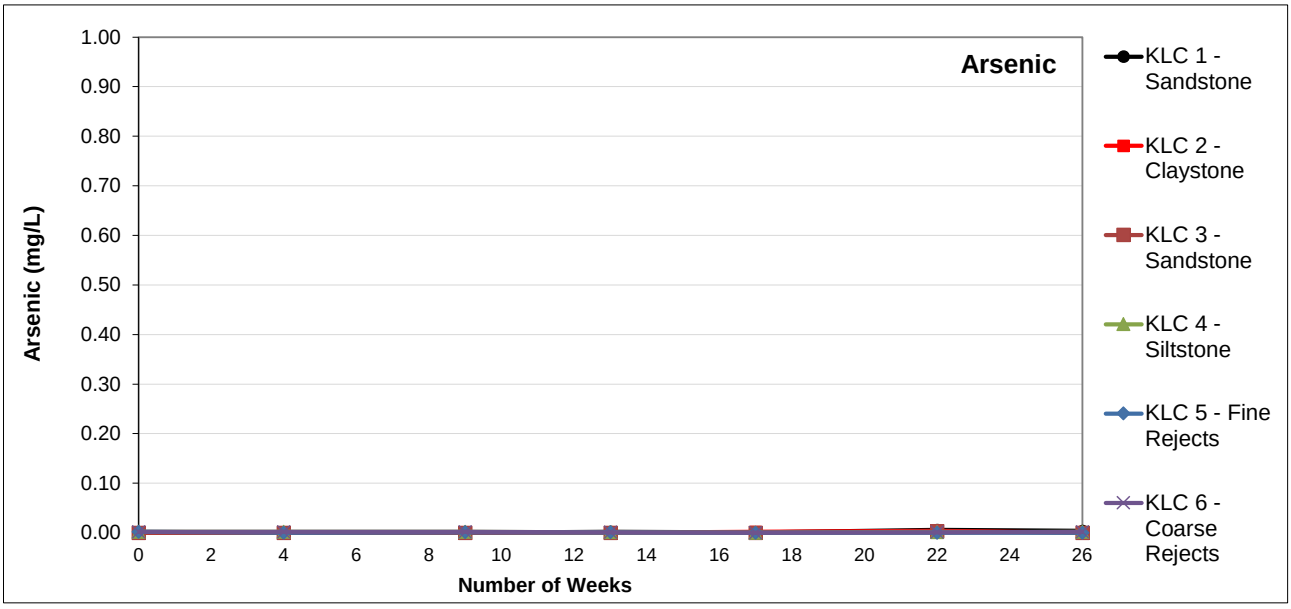

Net Alkalinity
Net Alkalinity (CaCO3 mg/L)
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects

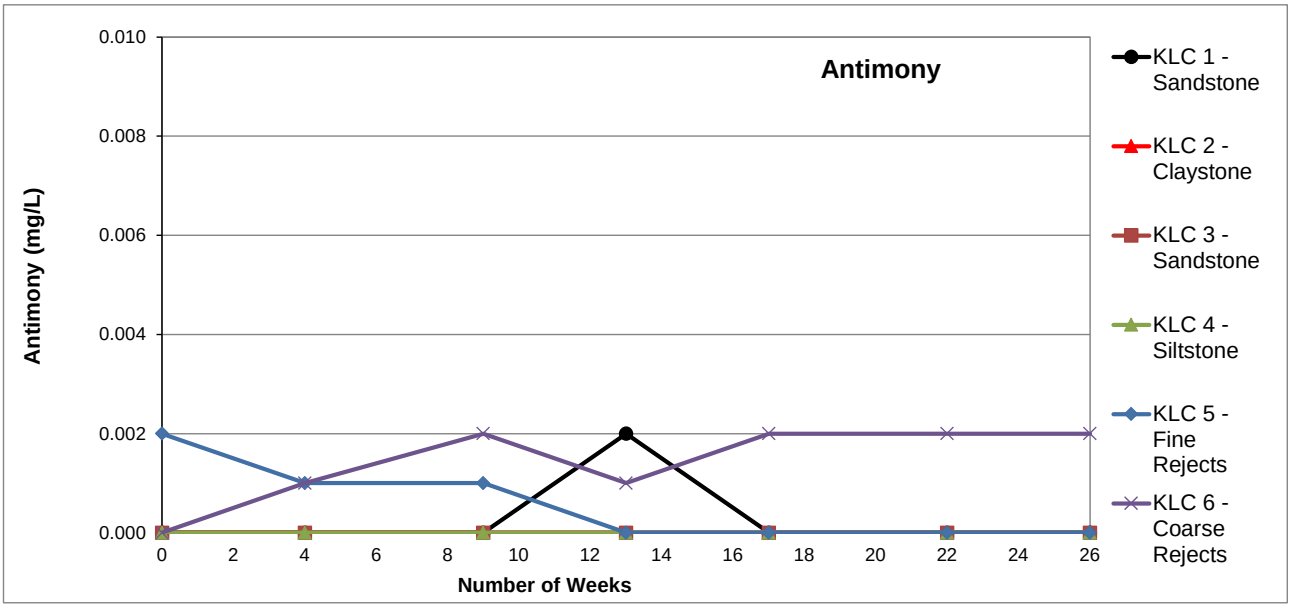

Residual Sulfur (%)
Number of Weeks
Residual Sulfur
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects

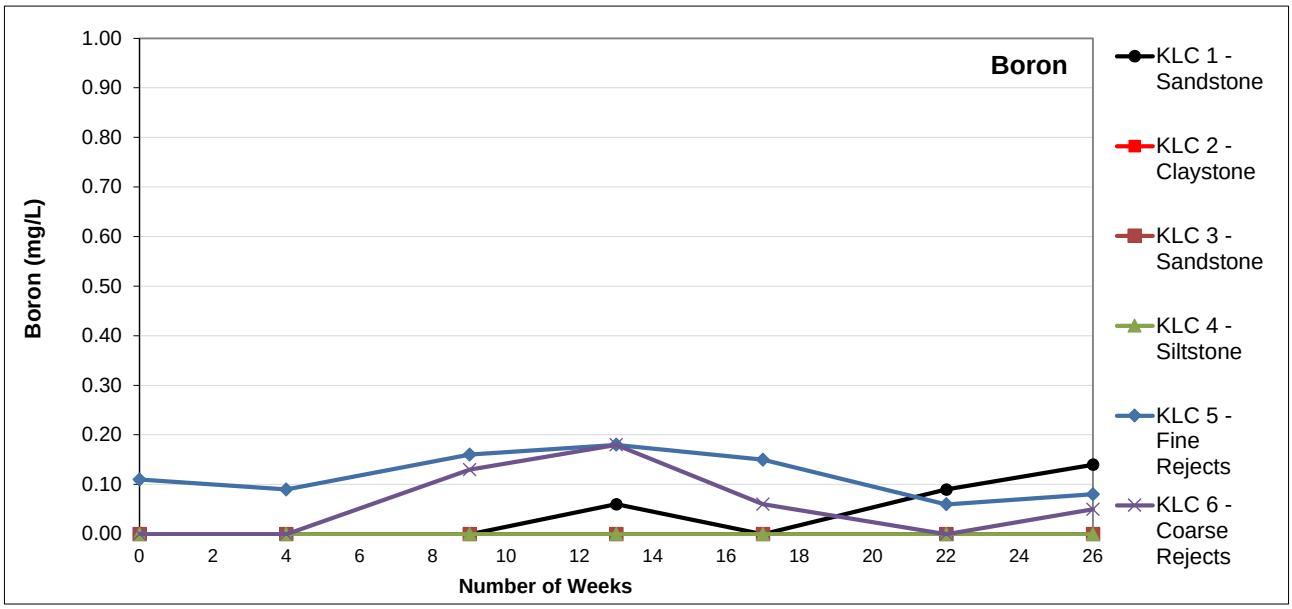

SO4 Release Rate (mg/kg/flush)
Number of Weeks
SO4 Release Rate
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects

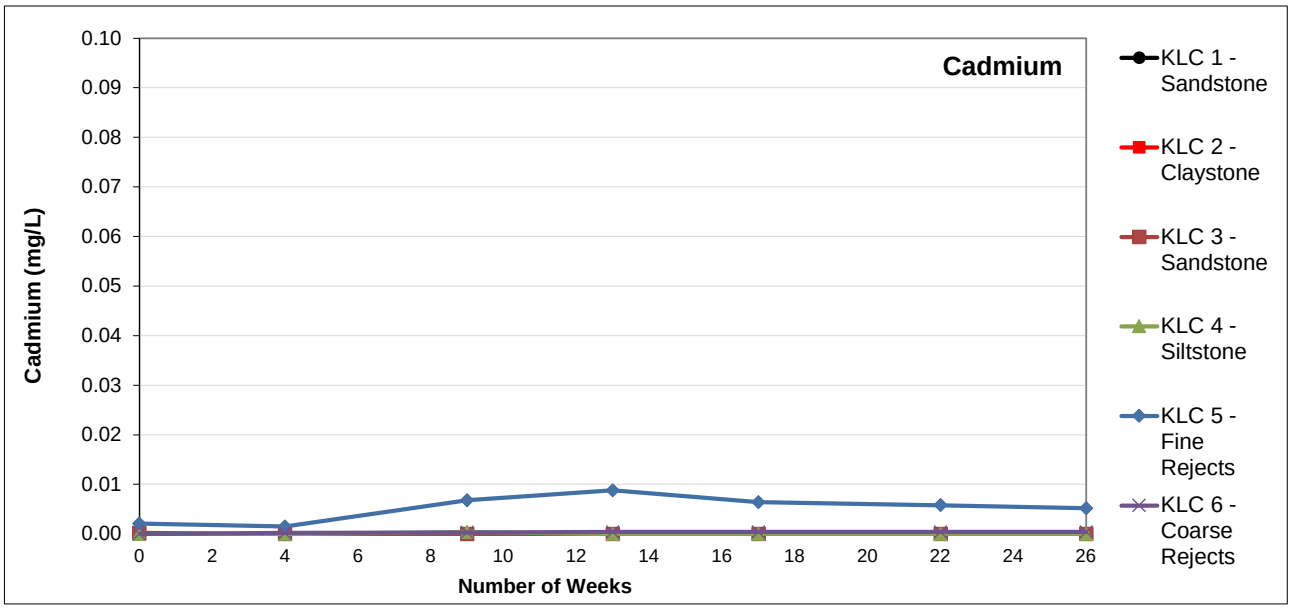

Residual ANC (%)
Number of Weeks
Residual ANC
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects

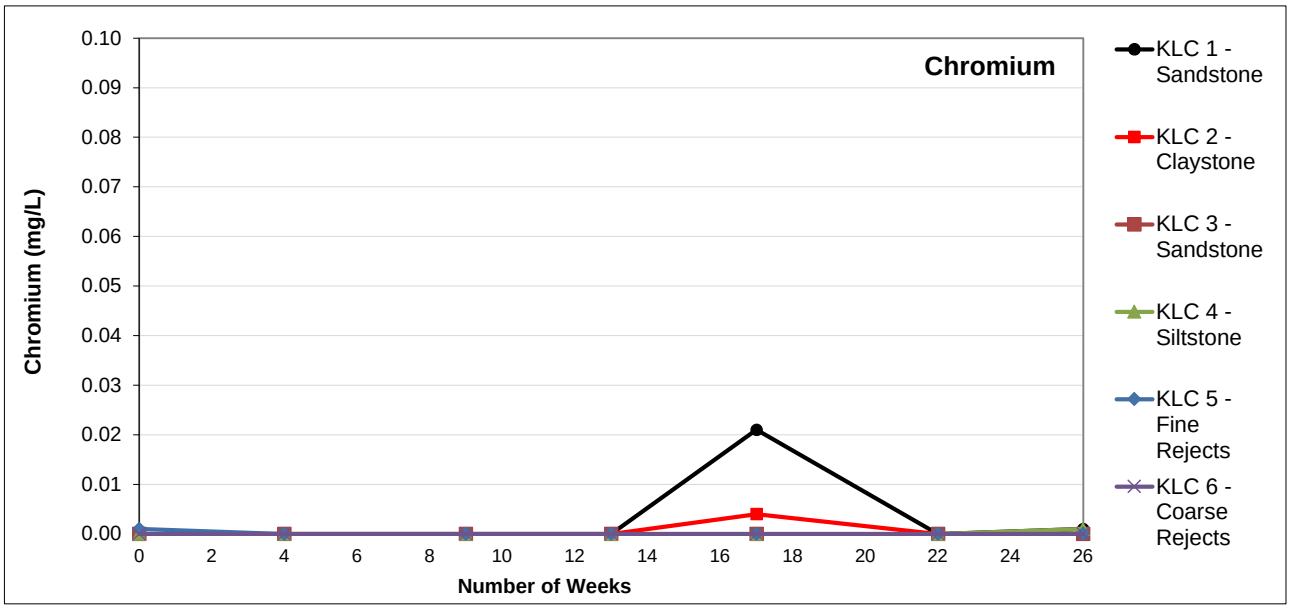

Aluminium
Aluminium (mg/L)
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects

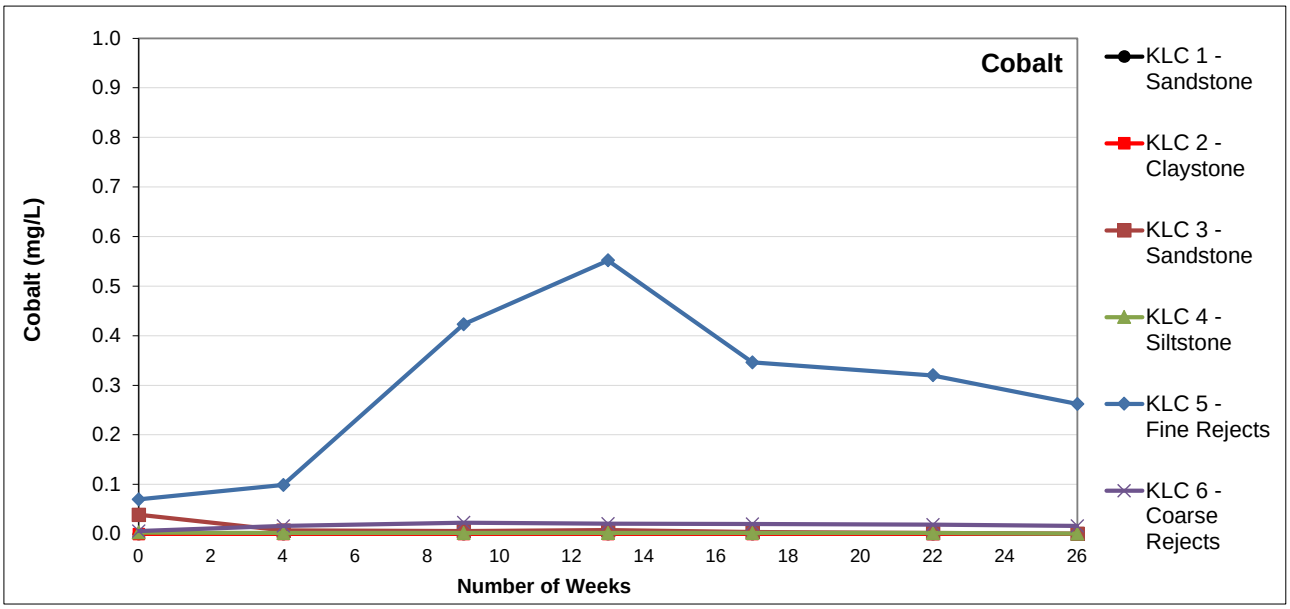

Arsenic
Arsenic (mg/L)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects

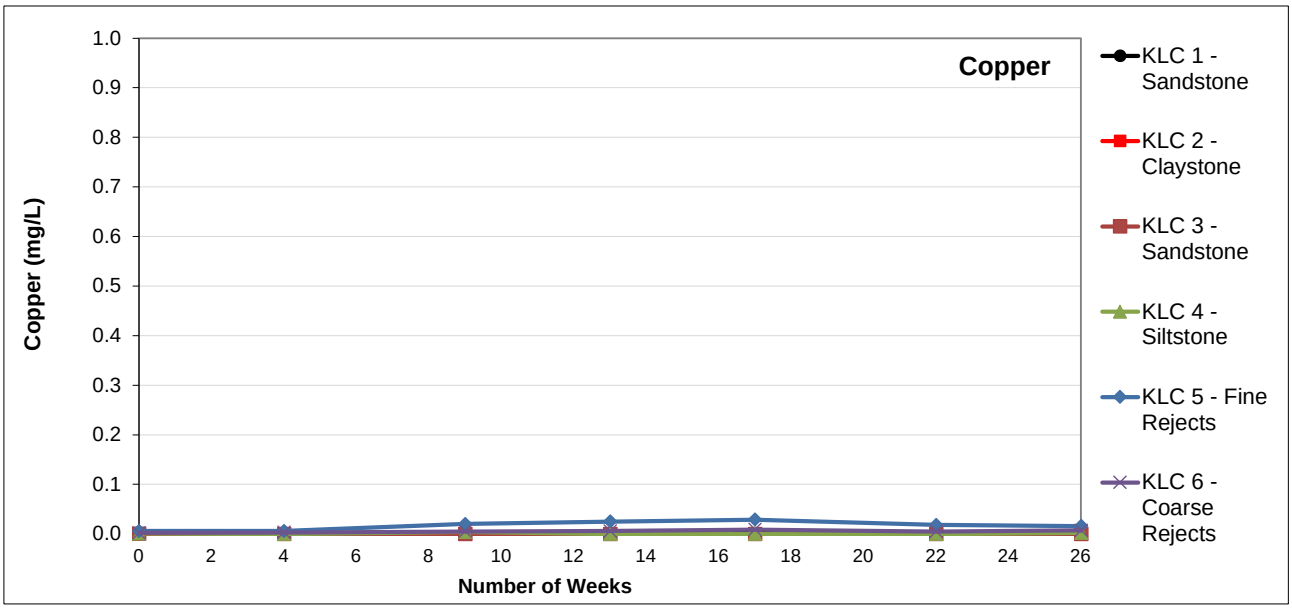

Antimony
Antimony (mg/L)
0.010
0.008
0.006
0.004
0.002
0.000
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects

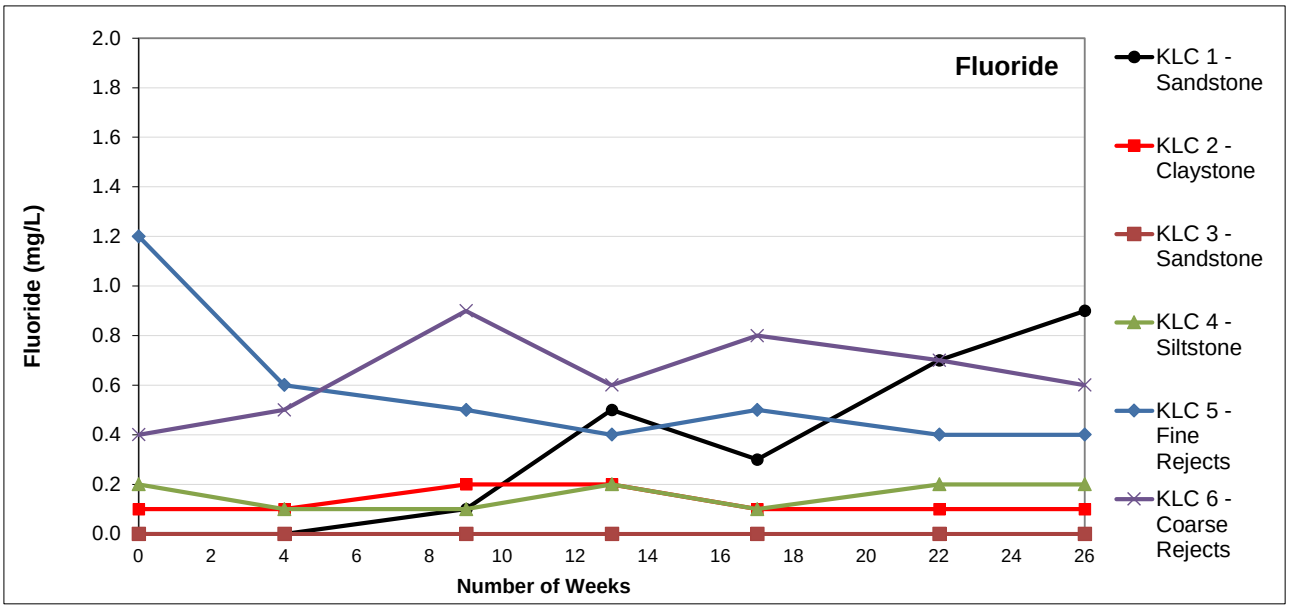

Boron
Boron (mg/L)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects

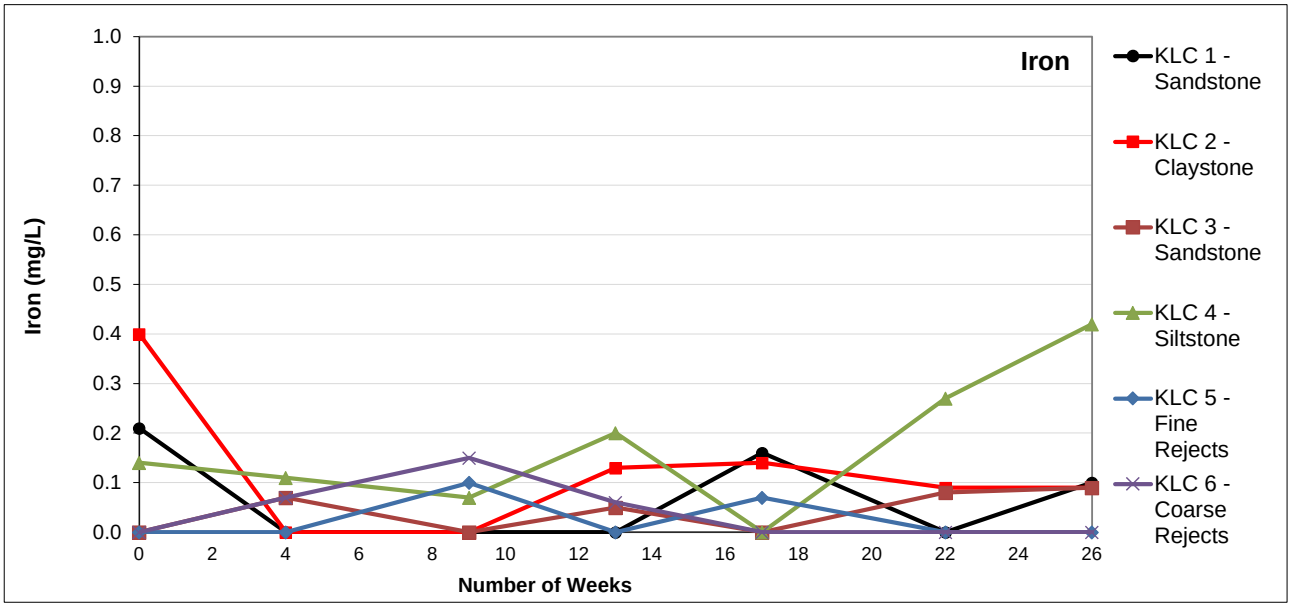

Cadmium
Cadmium (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects

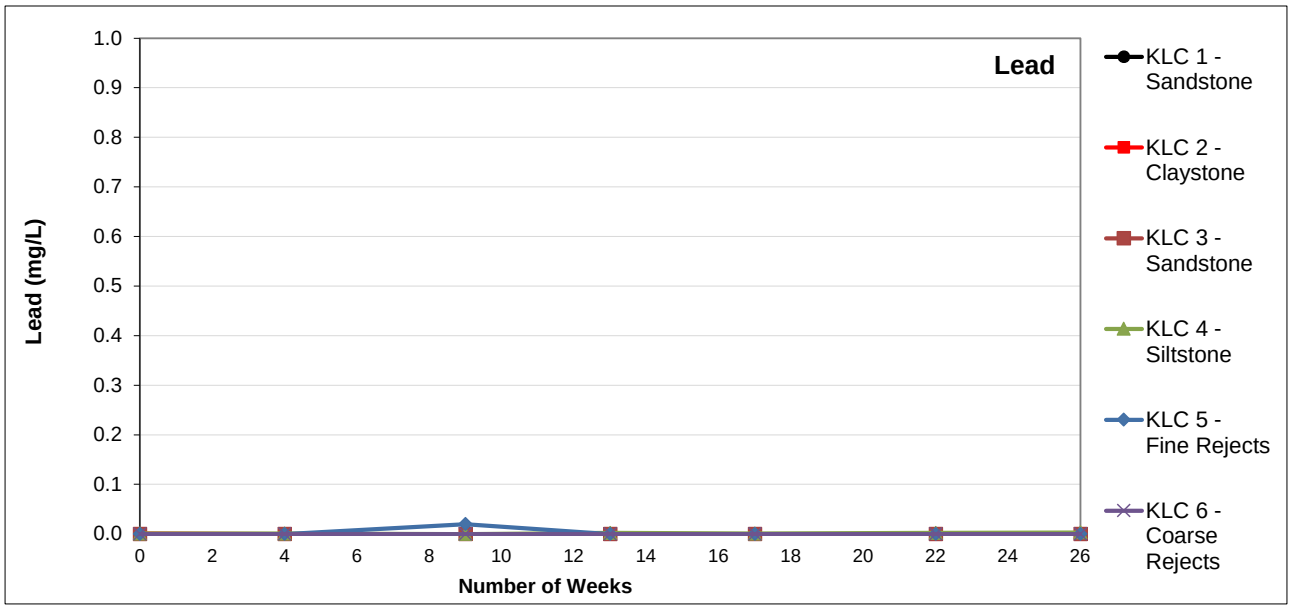

Chromium
Chromium (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects

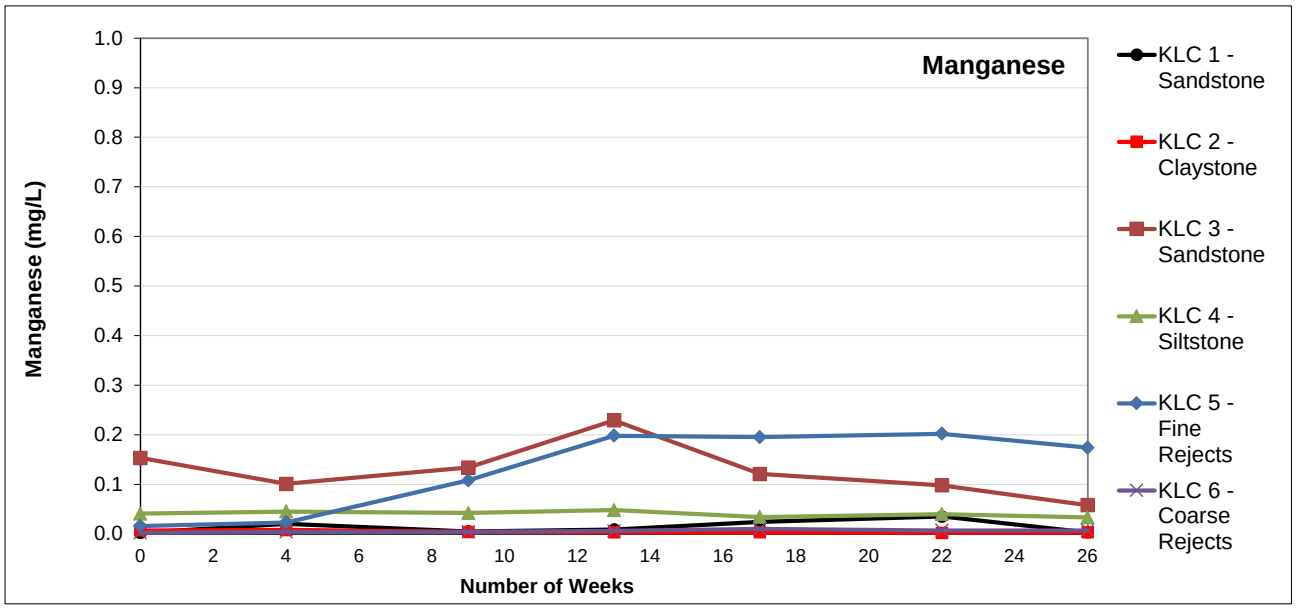

Cobalt
Cobalt (mg/L)
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects


Copper
Copper (mg/L)
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects


Fluoride
Fluoride (mg/L)
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects


Iron
Iron (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects


Lead
Lead (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects


Manganese
Manganese (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0 2 4 6 8 10 12 14 16 18 20 22 24 26
Number of Weeks
KLC 1 - Sandstone
KLC 2 - Claystone
KLC 3 - Sandstone
KLC 4 - Siltstone
KLC 5 - Fine Rejects
KLC 6 - Coarse Rejects

Attachment D ALS Laboratory Results

(certificates of analysis)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1914213**	Page	: 1 of 16
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2019010 Vulcan Complex (Saraji West)	Date Samples Received	: 03-Jun-2019 15:00
Order number	:	Date Analysis Commenced	: 03-Jun-2019
C-O-C number	: ----	Issue Date	: 17-Jun-2019 12:41
Sampler	: AMANDA CLEMENTS		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 70		
No. of samples analysed	: 70		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA031 (Saturated Paste pH): NATA accreditation does not cover the performance of this service.
- EA032 (Saturated Paste EC): NATA accreditation does not cover the performance of this service.
- ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 1	Composite 2	Composite 3	Composite 4	Composite 5
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-001	EB1914213-002	EB1914213-003	EB1914213-004	EB1914213-005
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-20.5**	**-91.4**	**-5.2**	**-3.8**	**-6.1**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**21.1**	**92.0**	**5.8**	**3.8**	**6.1**
ANC as CaCO3	----	0.1	% CaCO3	**2.2**	**9.4**	**0.6**	**0.4**	**0.6**
Fizz Rating	----	0	Fizz Unit	**1**	**2**	**1**	**0**	**1**
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	**8.1**	**8.1**	**8.0**	**8.1**	**7.6**
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	**2580**	**2220**	**1350**	**401**	**753**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.02**	**0.02**	**0.02**	<0.01	<0.01

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 6	Composite 7	Composite 8	Composite 9	Composite 10
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-006	EB1914213-007	EB1914213-008	EB1914213-009	EB1914213-010
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-22.8	-11.1	-306	-3.2	-10.6
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	23.4	11.7	307	3.2	10.6
ANC as CaCO3	----	0.1	% CaCO3	2.4	1.2	31.3	0.3	1.1
Fizz Rating	----	0	Fizz Unit	1	1	4	0	1
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	7.6	6.8	8.6	8.5	8.0
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	2340	3720	1210	652	655
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.02	<0.01	<0.01

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 11	Composite 12	Composite 13	Composite 14	Composite 15
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-011	EB1914213-012	EB1914213-013	EB1914213-014	EB1914213-015
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-0.3**	**-1.8**	**-12.2**	**3.4**	**-9.8**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**0.9**	**2.4**	**14.7**	**5.8**	**12.6**
ANC as CaCO3	----	0.1	% CaCO3	<0.1	**0.2**	**1.5**	**0.6**	**1.3**
Fizz Rating	----	0	Fizz Unit	**0**	**0**	**1**	**1**	**1**
EA031: pH (saturated paste)								
ø **pH (Saturated Paste)**	----	0.1	pH Unit	**7.8**	**7.8**	**8.4**	**7.4**	**8.3**
EA032: Electrical Conductivity (saturated paste)								
ø **Electrical Conductivity (Saturated Paste)**	----	1	µS/cm	**580**	**852**	**951**	**888**	**898**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.02**	**0.02**	**0.08**	**0.30**	**0.09**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 16	Composite 17	Composite 18	Composite 19	Composite 20
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-016	EB1914213-017	EB1914213-018	EB1914213-019	EB1914213-020
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-12.7**	**-15.7**	**-17.7**	**-38.7**	**-25.6**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**13.9**	**17.2**	**18.3**	**38.7**	**25.6**
ANC as CaCO3	----	0.1	% CaCO3	**1.4**	**1.8**	**1.9**	**3.9**	**2.6**
Fizz Rating	----	0	Fizz Unit	**1**	**1**	**1**	**2**	**1**
EA031: pH (saturated paste)								
ø **pH (Saturated Paste)**	----	0.1	pH Unit	**8.4**	**8.4**	**6.8**	**8.0**	**7.8**
EA032: Electrical Conductivity (saturated paste)								
ø **Electrical Conductivity (Saturated Paste)**	----	1	µS/cm	**789**	**1090**	**1840**	**3200**	**3320**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.04**	**0.05**	**0.02**	<0.01	<0.01

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 21	Composite 22	Composite 23	Composite 24	Composite 25
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-021	EB1914213-022	EB1914213-023	EB1914213-024	EB1914213-025
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-8.0	-4.8	-12.4	-9.1	-9.6
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	8.0	5.4	13.3	9.7	10.5
ANC as CaCO3	----	0.1	% CaCO3	0.8	0.6	1.4	1.0	1.1
Fizz Rating	----	0	Fizz Unit	1	1	1	1	1
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	8.3	7.7	7.2	7.4	8.2
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	874	1210	2930	1210	961
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	0.02	0.03	0.02	0.03

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 26	Composite 27	Composite 28	Composite 29	Composite 30
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-026	EB1914213-027	EB1914213-028	EB1914213-029	EB1914213-030
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-17.6**	**-65.6**	**-7.8**	**-8.0**	**-14.8**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**17.6**	**66.2**	**7.8**	**8.6**	**16.0**
ANC as CaCO3	----	0.1	% CaCO3	**1.8**	**6.8**	**0.8**	**0.9**	**1.6**
Fizz Rating	----	0	Fizz Unit	**1**	**2**	**1**	**1**	**1**
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	**7.8**	**8.4**	**8.4**	**7.8**	**7.4**
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	**864**	**2090**	**679**	**1810**	**2080**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	**0.02**	<0.01	**0.02**	**0.04**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 31	Composite 32	Composite 33	Composite 34	Composite 35
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-031	EB1914213-032	EB1914213-033	EB1914213-034	EB1914213-035
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-11.2**	**-10.5**	**-8.2**	**-16.3**	**-85.6**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**11.2**	**11.1**	**8.2**	**16.9**	**85.6**
ANC as CaCO3	----	0.1	% CaCO3	**1.1**	**1.1**	**0.8**	**1.7**	**8.7**
Fizz Rating	----	0	Fizz Unit	**1**	**1**	**1**	**1**	**2**
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	**7.8**	**7.6**	**7.6**	**7.7**	**8.0**
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	**1700**	**1340**	**1040**	**2550**	**2820**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	**0.02**	<0.01	**0.02**	<0.01

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 36	Composite 37	Composite 38	Composite 39	Composite 40
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-036	EB1914213-037	EB1914213-038	EB1914213-039	EB1914213-040
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-27.2	-19.2	-19.8	-13.4	-9.0
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	27.2	19.2	20.4	13.4	9.6
ANC as CaCO3	----	0.1	% CaCO3	2.8	2.0	2.1	1.4	1.0
Fizz Rating	----	0	Fizz Unit	1	1	1	1	1
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	8.4	8.2	7.8	7.8	8.0
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	1520	1580	2930	2080	1950
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	0.02	<0.01	0.02

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 41	Composite 42	Composite 43	Composite 44	Composite 45
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-041	EB1914213-042	EB1914213-043	EB1914213-044	EB1914213-045
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-8.5**	**-7.8**	**-6.2**	**-2.4**	**-8.3**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**9.1**	**8.4**	**6.8**	**2.4**	**8.3**
ANC as CaCO3	----	0.1	% CaCO3	**0.9**	**0.8**	**0.7**	**0.2**	**0.8**
Fizz Rating	----	0	Fizz Unit	**1**	**1**	**1**	**0**	**1**
EA031: pH (saturated paste)								
ø **pH (Saturated Paste)**	----	0.1	pH Unit	**8.4**	**8.0**	**8.0**	**7.9**	**8.1**
EA032: Electrical Conductivity (saturated paste)								
ø **Electrical Conductivity (Saturated Paste)**	----	1	µS/cm	**1390**	**1030**	**480**	**305**	**885**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.02**	**0.02**	**0.02**	<0.01	<0.01

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 46	Composite 47	Composite 48	Composite 49	Composite 50
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-046	EB1914213-047	EB1914213-048	EB1914213-049	EB1914213-050
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-26.5**	**-127**	**-50.4**	**-33.8**	**-23.1**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**27.1**	**127**	**50.4**	**33.8**	**23.7**
ANC as CaCO3	----	0.1	% CaCO3	**2.8**	**12.9**	**5.1**	**3.4**	**2.4**
Fizz Rating	----	0	Fizz Unit	**1**	**2**	**2**	**1**	**1**
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	**7.8**	**8.1**	**7.7**	**7.8**	**8.1**
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	**1630**	**2680**	**2440**	**2470**	**1120**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.02**	<0.01	<0.01	<0.01	**0.02**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 51	Composite 52	Composite 53	Composite 54	Composite 55
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-051	EB1914213-052	EB1914213-053	EB1914213-054	EB1914213-055
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-7.9**	**-5.0**	**-12.6**	**-27.0**	**-15.0**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**8.5**	**5.9**	**12.6**	**27.9**	**15.6**
ANC as CaCO3	----	0.1	% CaCO3	**0.9**	**0.6**	**1.3**	**2.8**	**1.6**
Fizz Rating	----	0	Fizz Unit	**1**	**1**	**1**	**1**	**1**
EA031: pH (saturated paste)								
ø **pH (Saturated Paste)**	----	0.1	pH Unit	**7.9**	**7.8**	**8.0**	**8.2**	**8.0**
EA032: Electrical Conductivity (saturated paste)								
ø **Electrical Conductivity (Saturated Paste)**	----	1	µS/cm	**857**	**934**	**658**	**2430**	**2000**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.02**	**0.03**	<0.01	**0.03**	**0.02**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 56	Composite 57	Composite 58	Composite 59	Composite 60
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-056	EB1914213-057	EB1914213-058	EB1914213-059	EB1914213-060
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-91.5	-26.3	-6.9	-4.7	-2.4
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	92.1	26.9	6.9	5.3	3.0
ANC as CaCO3	----	0.1	% CaCO3	9.4	2.7	0.7	0.5	0.3
Fizz Rating	----	0	Fizz Unit	2	1	1	0	0
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	8.6	8.2	8.2	8.3	8.3
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	1260	1920	1220	1050	419
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	<0.01	0.02	0.02

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 62	Composite 63	Composite 64	Composite 65	Composite 66
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-062	EB1914213-063	EB1914213-064	EB1914213-065	EB1914213-066
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-6.4**	**-15.8**	**-105**	**-90.9**	**-52.0**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**7.0**	**15.8**	**106**	**91.5**	**52.0**
ANC as CaCO3	----	0.1	% CaCO3	**0.7**	**1.6**	**10.9**	**9.3**	**5.3**
Fizz Rating	----	0	Fizz Unit	**1**	**1**	**2**	**2**	**2**
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	**8.0**	**7.6**	**8.0**	**8.2**	**8.6**
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	**682**	**2300**	**3290**	**3520**	**696**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.02**	<0.01	**0.02**	**0.02**	<0.01

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 67	Composite 68	Composite 69	Composite 70	pH and EC - DI Water
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914213-067	EB1914213-068	EB1914213-069	EB1914213-070	EB1914213-071
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	----	----	----	----	5.6
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-6.4	-3.5	-8.6	-32.7	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	----	----	----	----	<1
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	6.4	3.5	9.2	32.7	----
ANC as CaCO3	----	0.1	% CaCO3	0.6	0.4	0.9	3.3	----
Fizz Rating	----	0	Fizz Unit	1	0	1	1	----
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	8.4	8.5	7.6	7.7	----
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	308	224	514	884	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	0.02	<0.01	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1914214**	Page	: 1 of 16
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2019010 Vulcan Complex (Saraji West)	Date Samples Received	: 03-Jun-2019 15:00
Order number	:	Date Analysis Commenced	: 03-Jun-2019
C-O-C number	: ----	Issue Date	: 17-Jun-2019 17:17
Sampler	: AMANDA CLEMENTS		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 70		
No. of samples analysed	: 70		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Tom Maloney	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Tom Maloney	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA031 (Saturated Paste pH): NATA accreditation does not cover the performance of this service.
- EA032 (Saturated Paste EC): NATA accreditation does not cover the performance of this service.
- ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 71	Composite 72	Composite 73	Composite 74	Composite 75
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-001	EB1914214-002	EB1914214-003	EB1914214-004	EB1914214-005
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-218	-25.6	-18.9	-21.5	-7.1
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	218	26.5	18.9	22.1	7.1
ANC as CaCO3	----	0.1	% CaCO3	22.3	2.7	1.9	2.2	0.7
Fizz Rating	----	0	Fizz Unit	3	1	1	1	1
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	8.1	8.0	7.9	8.0	8.2
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	2420	2230	1710	1260	375
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	0.03	<0.01	0.02	<0.01

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 76	Composite 77	Composite 78	Composite 79	Composite 80
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-006	EB1914214-007	EB1914214-008	EB1914214-009	EB1914214-010
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-29.8**	**-11.3**	**-106**	**-69.5**	**-73.4**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**29.8**	**11.3**	**107**	**70.1**	**74.0**
ANC as CaCO3	----	0.1	% CaCO3	**3.0**	**1.2**	**10.9**	**7.1**	**7.6**
Fizz Rating	----	0	Fizz Unit	**1**	**1**	**3**	**2**	**2**
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	**8.2**	**7.7**	**8.0**	**8.0**	**8.3**
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	**1120**	**2280**	**2780**	**2910**	**1430**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	**0.02**	**0.02**	**0.02**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 81	Composite 82	Composite 83	Composite 84	Composite 85
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-011	EB1914214-012	EB1914214-013	EB1914214-014	EB1914214-015
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-18.5	-12.2	-7.0	-80.6	-29.6
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	18.5	12.2	7.0	81.2	29.6
ANC as CaCO3	----	0.1	% CaCO3	1.9	1.2	0.7	8.3	3.0
Fizz Rating	----	0	Fizz Unit	1	1	1	2	1
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	8.3	8.3	8.2	8.4	8.5
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	1350	565	443	450	957
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	<0.01	0.02	<0.01

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 86	Composite 87	Composite 88	Composite 89	Composite 90
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-016	EB1914214-017	EB1914214-018	EB1914214-019	EB1914214-020
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-111	-49.4	-17.7	-14.2	-11.5
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	111	49.4	18.3	14.8	12.1
ANC as CaCO3	----	0.1	% CaCO3	11.3	5.0	1.9	1.5	1.2
Fizz Rating	----	0	Fizz Unit	2	2	1	1	1
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	8.1	7.7	7.8	7.7	7.9
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	2100	2490	2540	2540	1350
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	0.02	0.02	0.02

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 91	Composite 92	Composite 93	Composite 94	Composite 95
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-021	EB1914214-022	EB1914214-023	EB1914214-024	EB1914214-025
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-22.4	-9.7	-15.6	-27.4	-63.0
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	23.0	10.3	16.5	28.3	63.9
ANC as CaCO3	----	0.1	% CaCO3	2.3	1.0	1.7	2.9	6.5
Fizz Rating	----	0	Fizz Unit	1	1	1	1	2
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	7.5	5.3	7.2	7.5	7.7
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	2140	2320	2160	2250	2110
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.03	0.03	0.03

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 96	Composite 97	Composite 98	Composite 99	Composite 100
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-026	EB1914214-027	EB1914214-028	EB1914214-029	EB1914214-030
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-9.7	-15.9	-15.3	-5.8	-6.7
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	10.6	16.8	15.9	6.4	6.7
ANC as CaCO3	----	0.1	% CaCO3	1.1	1.7	1.6	0.6	0.7
Fizz Rating	----	0	Fizz Unit	1	1	1	1	1
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	7.2	7.8	8.2	7.7	7.9
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	2440	1680	548	559	596
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.03	0.03	0.02	0.02	<0.01

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 101	Composite 102	Composite 103	Composite 104	Composite 105
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-031	EB1914214-032	EB1914214-033	EB1914214-034	EB1914214-035
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-6.9**	**-18.2**	**1.2**	**-5.1**	**-6.0**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**7.5**	**18.8**	<0.5	**5.1**	**6.6**
ANC as CaCO3	----	0.1	% CaCO3	**0.8**	**1.9**	<0.1	**0.5**	**0.7**
Fizz Rating	----	0	Fizz Unit	**1**	**1**	**0**	**1**	**1**
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	**7.0**	**8.4**	**6.1**	**7.9**	**7.9**
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	**551**	**1100**	**771**	**787**	**869**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.02**	**0.02**	**0.04**	<0.01	**0.02**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 106	Composite 107	Composite 108	Composite 109	Composite 110
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-036	EB1914214-037	EB1914214-038	EB1914214-039	EB1914214-040
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	<0.5	**-6.2**	**-13.0**	**-21.6**	**-158**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	<0.5	**6.2**	**13.6**	**22.8**	**158**
ANC as CaCO3	----	0.1	% CaCO3	<0.1	**0.6**	**1.4**	**2.3**	**16.1**
Fizz Rating	----	0	Fizz Unit	**0**	**1**	**1**	**1**	**3**
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	**7.7**	**7.7**	**8.4**	**8.1**	**8.2**
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	**748**	**1340**	**873**	**635**	**1800**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	**0.02**	**0.04**	<0.01

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 111	Composite 112	Composite 113	Composite 114	Composite 115
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-041	EB1914214-042	EB1914214-043	EB1914214-044	EB1914214-045
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-45.6**	**-12.3**	**-10.1**	**-7.1**	**-8.1**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**45.6**	**13.2**	**10.1**	**7.1**	**8.1**
ANC as CaCO3	----	0.1	% CaCO3	**4.6**	**1.3**	**1.0**	**0.7**	**0.8**
Fizz Rating	----	0	Fizz Unit	**2**	**1**	**1**	**1**	**1**
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	**8.3**	**8.3**	**8.0**	**7.8**	**7.5**
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	**1120**	**1010**	**1150**	**1820**	**1340**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	**0.03**	<0.01	<0.01	<0.01

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 116	Composite 117	Composite 118	Composite 119	Composite 120
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-046	EB1914214-047	EB1914214-048	EB1914214-049	EB1914214-050
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-12.3**	**0.6**	<0.5	**-1.2**	**1.2**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**12.9**	<0.5	<0.5	**1.2**	**2.2**
ANC as CaCO3	----	0.1	% CaCO3	**1.3**	<0.1	<0.1	**0.1**	**0.2**
Fizz Rating	----	0	Fizz Unit	**1**	**0**	**0**	**0**	**0**
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	**8.2**	**6.3**	**8.0**	**5.9**	**5.1**
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	**777**	**370**	**247**	**693**	**686**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.02**	**0.02**	<0.01	<0.01	**0.11**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 121	Composite 122	Composite 123	Composite 124	Composite 125
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-051	EB1914214-052	EB1914214-053	EB1914214-054	EB1914214-055
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-1.7	-10.2	-3.6	-1.0	-8.2
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	1.7	11.1	6.0	1.6	8.8
ANC as CaCO3	----	0.1	% CaCO3	0.2	1.1	0.6	0.2	0.9
Fizz Rating	----	0	Fizz Unit	0	1	1	0	1
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	6.0	7.6	7.4	6.7	6.6
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	240	1540	578	408	1500
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	0.03	0.08	0.02	0.02

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 126	Composite 127	Composite 128	Composite 129	Composite 130
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-056	EB1914214-057	EB1914214-058	EB1914214-059	EB1914214-060
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-8.8**	**-10.0**	**-5.4**	**0.6**	**0.6**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**9.4**	**12.8**	**6.6**	<0.5	<0.5
ANC as CaCO3	----	0.1	% CaCO3	**1.0**	**1.3**	**0.7**	<0.1	<0.1
Fizz Rating	----	0	Fizz Unit	**1**	**1**	**1**	**0**	**0**
EA031: pH (saturated paste)								
ø **pH (Saturated Paste)**	----	0.1	pH Unit	**7.7**	**8.3**	**8.4**	**6.4**	**5.7**
EA032: Electrical Conductivity (saturated paste)								
ø **Electrical Conductivity (Saturated Paste)**	----	1	µS/cm	**970**	**1240**	**4180**	**48**	**335**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.02**	**0.09**	**0.04**	**0.02**	**0.02**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 131	Composite 132	Composite 133	Composite 134	Composite 135
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-061	EB1914214-062	EB1914214-063	EB1914214-064	EB1914214-065
				Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-4.8	-10.1	-5.2	-5.3	-6.6
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	5.7	11.0	7.7	5.9	7.2
ANC as CaCO3	----	0.1	% CaCO3	0.6	1.1	0.8	0.6	0.7
Fizz Rating	----	0	Fizz Unit	1	1	1	1	1
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	6.0	6.6	5.7	6.5	7.4
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	216	106	405	345	826
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.03	0.03	0.08	0.02	0.02

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite 136	Composite 137	Composite 138	Composite 139	pH and EC - DI Water
			Client sampling date / time	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00	03-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1914214-066	EB1914214-067	EB1914214-068	EB1914214-069	EB1914214-070
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	----	----	----	----	5.5
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-5.1	-7.8	-14.8	-13.6	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	----	----	----	----	<1
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	5.1	7.8	15.4	14.2	----
ANC as CaCO3	----	0.1	% CaCO3	0.5	0.8	1.6	1.4	----
Fizz Rating	----	0	Fizz Unit	1	1	1	1	----
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	6.8	7.7	8.5	8.6	----
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	521	895	695	1360	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	<0.01	<0.01	0.02	0.02	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1916203**	Page	: 1 of 9
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2019010 Vulcan Complex (Saraji West)	Date Samples Received	: 21-Jun-2019 17:05
Order number	:	Date Analysis Commenced	: 25-Jun-2019
C-O-C number	: ----	Issue Date	: 01-Jul-2019 12:22
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 9		
No. of samples analysed	: 9		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is 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, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED037 (Alkalinity): NATA accreditation does not cover the performance of this service.
- ED038 (Acidity): NATA accreditation does not cover the performance of this service.
- ALS is not NATA accredited for the analysis of Exchangeable Aluminium and Exchange Acidity in soils when performed under ALS Method ED005.
- ALS is not NATA accredited for the analysis of Exchangeable Cations on Alkaline Soils when performed under ALS Method ED006.
- EG005T (Total Metals by ICP-AES): Sample EB1916203 – 005 (Composite 3) shows poor matrix spike recovery due to matrix interference. Confirmed by re-extraction and re-analysis.
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Client sample ID	Sample 14	Sample 120	Composite 1	Composite 2	Composite 3
			Client sampling date / time	21-Jun-2019 00:00	21-Jun-2019 00:00	21-Jun-2019 00:00	21-Jun-2019 00:00	21-Jun-2019 00:00
Compound	CAS Number	LOR	Unit	EB1916203-001	EB1916203-002	EB1916203-003	EB1916203-004	EB1916203-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	----	----	8.2	8.6	8.5
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	----	----	552	346	788
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.153	0.083	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	----	----	4.0	<1.0	4.8
ED006: Exchangeable Cations on Alkaline Soils								
ø Exchangeable Calcium	----	0.2	meq/100g	----	----	6.2	0.9	3.0
ø Exchangeable Magnesium	----	0.2	meq/100g	----	----	9.1	3.1	12.3
ø Exchangeable Potassium	----	0.2	meq/100g	----	----	0.2	1.1	0.2
ø Exchangeable Sodium	----	0.2	meq/100g	----	----	1.9	0.7	3.0
ø Cation Exchange Capacity	----	0.2	meq/100g	----	----	17.4	5.8	18.6
ø Exchangeable Sodium Percent	----	0.2	%	----	----	10.8	12.1	16.3
ø Calcium/Magnesium Ratio	----	0.2	-	----	----	0.7	0.3	0.2
ø Magnesium/Potassium Ratio	----	0.2	-	----	----	37.6	2.7	60.5
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	----	----	8840	2820	14900
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	----	8840	2820	14900
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	----	<5	<5	<5
ED038A: Acidity								
Acidity	----	1	mg/kg	----	----	12	<5	<5
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	150	140	230
Silica	7631-86-9	1	mg/kg	----	----	51	45	52
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	----	----	300	240	700
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	----	60	10	20
Magnesium	7439-95-4	10	mg/kg	----	----	60	30	50
Sodium	7440-23-5	10	mg/kg	----	----	460	270	730
Potassium	7440-09-7	10	mg/kg	----	----	<10	30	<10
ED093T: Total Major Cations								

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Client sample ID	Sample 14	Sample 120	Composite 1	Composite 2	Composite 3
				Client sampling date / time	21-Jun-2019 00:00	21-Jun-2019 00:00	21-Jun-2019 00:00	21-Jun-2019 00:00	21-Jun-2019 00:00
Compound	CAS Number	LOR	Unit		EB1916203-001	EB1916203-002	EB1916203-003	EB1916203-004	EB1916203-005
					Result	Result	Result	Result	Result
ED093T: Total Major Cations - Continued									
Sodium	7440-23-5	50	mg/kg		----	----	**950**	**490**	**1670**
Potassium	7440-09-7	50	mg/kg		----	----	**270**	**680**	**290**
Calcium	7440-70-2	50	mg/kg		----	----	**5710**	**2420**	**9470**
Magnesium	7439-95-4	50	mg/kg		----	----	**4080**	**2140**	**8890**
EG005(ED093)S : Soluble Metals by ICPAES									
Boron	7440-42-8	1	mg/kg		----	----	<1	<1	<1
Iron	7439-89-6	1	mg/kg		----	----	<1	<1	<1
EG005(ED093)T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		----	----	**9520**	**2090**	**10900**
Antimony	7440-36-0	5	mg/kg		----	----	<5	<5	<5
Barium	7440-39-3	10	mg/kg		----	----	**150**	**50**	**170**
Beryllium	7440-41-7	1	mg/kg		----	----	<1	<1	<1
Boron	7440-42-8	50	mg/kg		----	----	<50	<50	<50
Cobalt	7440-48-4	2	mg/kg		----	----	**17**	**3**	**19**
Iron	7439-89-6	50	mg/kg		----	----	**17200**	**8640**	**25400**
Manganese	7439-96-5	5	mg/kg		----	----	**538**	**103**	**466**
Molybdenum	7439-98-7	2	mg/kg		----	----	<2	<2	<2
Selenium	7782-49-2	5	mg/kg		----	----	<5	<5	<5
Thallium	7440-28-0	5	mg/kg		----	----	<5	<5	<5
Arsenic	7440-38-2	5	mg/kg		----	----	<5	<5	<5
Cadmium	7440-43-9	1	mg/kg		----	----	<1	<1	<1
Chromium	7440-47-3	2	mg/kg		----	----	**46**	**38**	**53**
Copper	7440-50-8	5	mg/kg		----	----	**7**	**6**	**11**
Lead	7439-92-1	5	mg/kg		----	----	**6**	**6**	<5
Nickel	7440-02-0	2	mg/kg		----	----	**24**	**6**	**34**
Zinc	7440-66-6	5	mg/kg		----	----	**14**	**17**	**31**
EG020S: Soluble Metals by ICPMS									
Arsenic	7440-38-2	0.01	mg/kg		----	----	<0.01	**0.01**	<0.01
Selenium	7782-49-2	0.1	mg/kg		----	----	<0.1	<0.1	<0.1
Barium	7440-39-3	0.01	mg/kg		----	----	**0.14**	**0.06**	**0.08**
Beryllium	7440-41-7	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

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Client sample ID	Sample 14	Sample 120	Composite 1	Composite 2	Composite 3
				Client sampling date / time	21-Jun-2019 00:00	21-Jun-2019 00:00	21-Jun-2019 00:00	21-Jun-2019 00:00	21-Jun-2019 00:00
Compound	CAS Number	LOR	Unit		EB1916203-001	EB1916203-002	EB1916203-003	EB1916203-004	EB1916203-005
					Result	Result	Result	Result	Result
EG020S: Soluble Metals by ICPMS - Continued									
Thorium	7440-29-1	0.01	mg/kg		----	----	<0.01	<0.01	<0.01
Copper	7440-50-8	0.01	mg/kg		----	----	**0.03**	<0.01	<0.01
Manganese	7439-96-5	0.01	mg/kg		----	----	**0.04**	<0.01	<0.01
Molybdenum	7439-98-7	0.01	mg/kg		----	----	**0.01**	**0.02**	**0.01**
Nickel	7440-02-0	0.01	mg/kg		----	----	**0.03**	<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		----	----	<0.01	<0.01	<0.01
Uranium	7440-61-1	0.01	mg/kg		----	----	**0.01**	<0.01	<0.01
Zinc	7440-66-6	0.05	mg/kg		----	----	<0.05	<0.05	<0.05
Vanadium	7440-62-2	0.1	mg/kg		----	----	<0.1	<0.1	<0.1
Aluminium	7429-90-5	0.1	mg/kg		----	----	<0.1	**0.3**	**0.2**
EG020T: Total Metals by ICP-MS									
Uranium	7440-61-1	0.1	mg/kg		----	----	**0.3**	**0.3**	**0.8**
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		----	----	<0.0005	<0.0005	<0.0005
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		----	----	<0.1	<0.1	<0.1
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		----	----	**4**	**2**	**9**
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		----	----	<0.1	<0.1	**0.1**

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Client sample ID	Composite 4	Composite 5	Composite 6	----	----
			Client sampling date / time	21-Jun-2019 00:00	21-Jun-2019 00:00	21-Jun-2019 00:00	----	----
Compound	CAS Number	LOR	Unit	EB1916203-006	EB1916203-007	EB1916203-008	--------	--------
				Result	Result	Result	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	8.2	6.8	7.1	----	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	490	167	264	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	1.6	<1.0	<1.0	----	----
ED006: Exchangeable Cations on Alkaline Soils								
ø Exchangeable Calcium	----	0.2	meq/100g	1.0	----	----	----	----
ø Exchangeable Magnesium	----	0.2	meq/100g	3.4	----	----	----	----
ø Exchangeable Potassium	----	0.2	meq/100g	0.4	----	----	----	----
ø Exchangeable Sodium	----	0.2	meq/100g	0.7	----	----	----	----
ø Cation Exchange Capacity	----	0.2	meq/100g	5.6	----	----	----	----
ø Exchangeable Sodium Percent	----	0.2	%	13.0	----	----	----	----
ø Calcium/Magnesium Ratio	----	0.2	-	0.3	----	----	----	----
ø Magnesium/Potassium Ratio	----	0.2	-	8.8	----	----	----	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	0.8	0.9	----	----
Exchangeable Magnesium	----	0.1	meq/100g	----	1.9	5.3	----	----
Exchangeable Potassium	----	0.1	meq/100g	----	1.0	1.4	----	----
Exchangeable Sodium	----	0.1	meq/100g	----	0.9	2.5	----	----
Cation Exchange Capacity	----	0.1	meq/100g	----	4.8	10.2	----	----
Exchangeable Sodium Percent	----	0.1	%	----	20.4	24.6	----	----
Calcium/Magnesium Ratio	----	0.1	-	----	0.4	0.2	----	----
Magnesium/Potassium Ratio	----	0.1	-	----	1.8	3.8	----	----
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	2730	175	718	----	----
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	2730	175	718	----	----
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	<5	<5	<5	----	----
ED038A: Acidity								
Acidity	----	1	mg/kg	16	39	24	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	220	150	120	----	----
Silica	7631-86-9	1	mg/kg	50	64	72	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	410	90	180	----	----

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Client sample ID	Composite 4	Composite 5	Composite 6	----	----
				Client sampling date / time	21-Jun-2019 00:00	21-Jun-2019 00:00	21-Jun-2019 00:00	----	----
Compound	CAS Number	LOR	Unit		EB1916203-006	EB1916203-007	EB1916203-008	--------	--------
					Result	Result	Result	----	----
ED093S: Soluble Major Cations									
Calcium	7440-70-2	10	mg/kg		20	<10	<10	----	----
Magnesium	7439-95-4	10	mg/kg		40	<10	<10	----	----
Sodium	7440-23-5	10	mg/kg		420	130	260	----	----
Potassium	7440-09-7	10	mg/kg		40	60	40	----	----
ED093T: Total Major Cations									
Sodium	7440-23-5	50	mg/kg		730	260	770	----	----
Potassium	7440-09-7	50	mg/kg		950	1180	2200	----	----
Calcium	7440-70-2	50	mg/kg		1890	370	460	----	----
Magnesium	7439-95-4	50	mg/kg		2320	760	1430	----	----
EG005(ED093)S : Soluble Metals by ICPAES									
Boron	7440-42-8	1	mg/kg		<1	<1	<1	----	----
Iron	7439-89-6	1	mg/kg		<1	<1	<1	----	----
EG005(ED093)T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		5120	2280	3000	----	----
Antimony	7440-36-0	5	mg/kg		<5	<5	<5	----	----
Barium	7440-39-3	10	mg/kg		80	70	50	----	----
Beryllium	7440-41-7	1	mg/kg		1	<1	2	----	----
Boron	7440-42-8	50	mg/kg		<50	<50	<50	----	----
Cobalt	7440-48-4	2	mg/kg		11	4	10	----	----
Iron	7439-89-6	50	mg/kg		17700	12200	22200	----	----
Manganese	7439-96-5	5	mg/kg		188	126	331	----	----
Molybdenum	7439-98-7	2	mg/kg		<2	<2	<2	----	----
Selenium	7782-49-2	5	mg/kg		<5	<5	<5	----	----
Thallium	7440-28-0	5	mg/kg		<5	<5	6	----	----
Arsenic	7440-38-2	5	mg/kg		<5	<5	5	----	----
Cadmium	7440-43-9	1	mg/kg		<1	<1	<1	----	----
Chromium	7440-47-3	2	mg/kg		34	69	24	----	----
Copper	7440-50-8	5	mg/kg		13	8	27	----	----
Lead	7439-92-1	5	mg/kg		10	12	30	----	----
Nickel	7440-02-0	2	mg/kg		18	10	18	----	----
Zinc	7440-66-6	5	mg/kg		50	31	91	----	----
EG020S: Soluble Metals by ICPMS									
Arsenic	7440-38-2	0.01	mg/kg		<0.01	<0.01	<0.01	----	----
Selenium	7782-49-2	0.1	mg/kg		<0.1	<0.1	<0.1	----	----

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Client sample ID	Composite 4	Composite 5	Composite 6	----	----
				Client sampling date / time	21-Jun-2019 00:00	21-Jun-2019 00:00	21-Jun-2019 00:00	----	----
Compound	CAS Number	LOR	Unit		EB1916203-006	EB1916203-007	EB1916203-008	--------	--------
					Result	Result	Result	----	----
EG020S: Soluble Metals by ICPMS - Continued									
Barium	7440-39-3	0.01	mg/kg		**0.04**	**0.02**	**0.01**	----	----
Beryllium	7440-41-7	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	----	----
Thorium	7440-29-1	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	**0.02**	**0.02**	----	----
Molybdenum	7439-98-7	0.01	mg/kg		**0.02**	<0.01	**0.03**	----	----
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		<0.01	<0.01	<0.01	----	----
Uranium	7440-61-1	0.01	mg/kg		<0.01	<0.01	<0.01	----	----
Zinc	7440-66-6	0.05	mg/kg		<0.05	<0.05	<0.05	----	----
Vanadium	7440-62-2	0.1	mg/kg		<0.1	<0.1	<0.1	----	----
Aluminium	7429-90-5	0.1	mg/kg		**0.2**	**1.8**	**2.4**	----	----
EG020T: Total Metals by ICP-MS									
Uranium	7440-61-1	0.1	mg/kg		**0.7**	**0.3**	**0.8**	----	----
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		<0.1	<0.1	<0.1	----	----
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		**4**	<1	**1**	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		<0.1	<0.1	<0.1	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	pH and EC of DI water	----	----	----	----
				Client sampling date / time	24-Jun-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB1916203-009	--------	--------	--------	--------
					Result	----	----	----	----
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**5.4**	----	----	----	----
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		<1	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1929251**	Page	: 1 of 3
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2019010 Saraji West/Vulcan	Date Samples Received	: 04-Nov-2019 09:15
Order number	: ----	Date Analysis Commenced	: 04-Nov-2019
C-O-C number	: ----	Issue Date	: 08-Nov-2019 13:47
Sampler	: ALAN ROBERTSON		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 5		
No. of samples analysed	: 5		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

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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.

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LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA031 (Saturated Paste pH): NATA accreditation does not cover the performance of this service.
- EA032 (Saturated Paste EC): NATA accreditation does not cover the performance of this service.
- ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	IP19006604R005 "Coarse" (Wash 2, -50+2mm) reject	IP19006604R006 "Fine (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	IP1900410R298 "Coarse" (Wash 2, -50+2mm) reject	IP1900410R299 "Fine (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	pH and EC - DI water
				Client sampling date / time	01-Nov-2019 00:00	01-Nov-2019 00:00	01-Nov-2019 00:00	01-Nov-2019 00:00	01-Nov-2019 00:00
					EB1929251-001	EB1929251-002	EB1929251-003	EB1929251-004	EB1929251-005
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**----**	**----**	**----**	**----**	**5.0**
EA009: Nett Acid Production Potential									
Net Acid Production Potential	----	0.5	kg H2SO4/t		**13.6**	**4.0**	**6.8**	**4.4**	**----**
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		**----**	**----**	**----**	**----**	<1
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**8.4**	**8.5**	**1.8**	**7.2**	**----**
ANC as CaCO3	----	0.1	% CaCO3		**0.8**	**0.9**	**0.2**	**0.7**	**----**
Fizz Rating	----	0	Fizz Unit		**1**	**1**	**0**	**1**	**----**
EA031: pH (saturated paste)									
ø pH (Saturated Paste)	----	0.1	pH Unit		**8.4**	**7.3**	**8.0**	**7.0**	**----**
EA032: Electrical Conductivity (saturated paste)									
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm		**176**	**484**	**401**	**595**	**----**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.72**	**0.41**	**0.28**	**0.38**	**----**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1933850**	Page	: 1 of 6
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Carsten Emrich
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2019010 Saraji West/Vulcan	Date Samples Received	: 13-Dec-2019 11:55
Order number	: ----	Date Analysis Commenced	: 23-Dec-2019
C-O-C number	: ----	Issue Date	: 13-Jan-2020 08:27
Sampler	: ALAN ROBERTSON		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 10		
No. of samples analysed	: 10		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED037 (Alkalinity): NATA accreditation does not cover the performance of this service.
- ED038 (Acidity): NATA accreditation does not cover the performance of this service.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	IP19002032R587 "Coarse" (Wash 2, -50+2mm) reject	IP19003592R466 "Coarse" (Wash 2, -50+2mm) reject	IP19004096R302 "Coarse" (Wash 2, -50+2mm)reject	IP19004601R298 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	IP19004096R303 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject
			Client sampling date / time	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EB1933850-001	EB1933850-002	EB1933850-003	EB1933850-004	EB1933850-005
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	**0.049**	**0.055**	**0.569**	**0.018**	**0.382**

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

				Client sample ID	IP19002032R588 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	IP19003592R467 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	Composite 3	Composite 4	pH and EC of DI water
				Client sampling date / time	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
Compound	CAS Number	LOR	Unit		EB1933850-006	EB1933850-007	EB1933850-008	EB1933850-009	EB1933850-010
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**----**	**----**	**5.8**	**6.2**	**5.6**
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		**----**	**----**	**96**	**54**	<1
EA026 : Chromium Reducible Sulfur									
Chromium Reducible Sulphur	----	0.005	%		**0.027**	**0.152**	**----**	**----**	**----**
ED037: Alkalinity									
ø **Total Alkalinity as CaCO3**	----	1	mg/kg		**----**	**----**	**280**	**5160**	**----**
ø **Bicarbonate Alkalinity as CaCO3**	71-52-3	1	mg/kg		**----**	**----**	**280**	**5160**	**----**
ø **Carbonate Alkalinity as CaCO3**	3812-32-6	1	mg/kg		**----**	**----**	<5	<5	**----**
ED038A: Acidity									
Acidity	----	1	mg/kg		**----**	**----**	**230**	**892**	**----**
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		**----**	**----**	**120**	**100**	**----**
Silica	7631-86-9	1	mg/kg		**----**	**----**	**81**	**43**	**----**
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		**----**	**----**	**50**	**130**	**----**
ED093S: Soluble Major Cations									
Calcium	7440-70-2	10	mg/kg		**----**	**----**	<10	**10**	**----**
Magnesium	7439-95-4	10	mg/kg		**----**	**----**	<10	**20**	**----**
Sodium	7440-23-5	10	mg/kg		**----**	**----**	**120**	**120**	**----**
Potassium	7440-09-7	10	mg/kg		**----**	**----**	<10	**20**	**----**
ED093T: Total Major Cations									
Sodium	7440-23-5	50	mg/kg		**----**	**----**	**410**	**470**	**----**
Potassium	7440-09-7	50	mg/kg		**----**	**----**	**1270**	**1280**	**----**
Calcium	7440-70-2	50	mg/kg		**----**	**----**	**1600**	**4780**	**----**
Magnesium	7439-95-4	50	mg/kg		**----**	**----**	**680**	**2700**	**----**
EG005(ED093)S : Soluble Metals by ICPAES									
Boron	7440-42-8	1	mg/kg		**----**	**----**	<1	<1	**----**
Iron	7439-89-6	1	mg/kg		**----**	**----**	<1	<1	**----**
EG005(ED093)T: Total Metals by ICP-AES									

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	IP19002032R588 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	IP19003592R467 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	Composite 3	Composite 4	pH and EC of DI water
				Client sampling date / time	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
					EB1933850-006	EB1933850-007	EB1933850-008	EB1933850-009	EB1933850-010
					Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES - Continued									
Aluminium	7429-90-5	50	mg/kg		----	----	**2770**	**3360**	----
Boron	7440-42-8	50	mg/kg		----	----	<50	<50	----
Iron	7439-89-6	50	mg/kg		----	----	**7940**	**6340**	----
EG020S: Soluble Metals by ICPMS									
Arsenic	7440-38-2	0.01	mg/kg		----	----	<0.01	<0.01	----
Selenium	7782-49-2	0.1	mg/kg		----	----	<0.1	<0.1	----
Barium	7440-39-3	0.01	mg/kg		----	----	<0.01	**0.02**	----
Beryllium	7440-41-7	0.01	mg/kg		----	----	<0.01	<0.01	----
Cadmium	7440-43-9	0.01	mg/kg		----	----	<0.01	<0.01	----
Cobalt	7440-48-4	0.01	mg/kg		----	----	<0.01	<0.01	----
Chromium	7440-47-3	0.01	mg/kg		----	----	<0.01	<0.01	----
Thorium	7440-29-1	0.01	mg/kg		----	----	<0.01	<0.01	----
Copper	7440-50-8	0.01	mg/kg		----	----	<0.01	<0.01	----
Manganese	7439-96-5	0.01	mg/kg		----	----	<0.01	<0.01	----
Molybdenum	7439-98-7	0.01	mg/kg		----	----	**0.04**	**0.01**	----
Nickel	7440-02-0	0.01	mg/kg		----	----	<0.01	<0.01	----
Lead	7439-92-1	0.01	mg/kg		----	----	<0.01	<0.01	----
Antimony	7440-36-0	0.01	mg/kg		----	----	**0.02**	<0.01	----
Uranium	7440-61-1	0.01	mg/kg		----	----	<0.01	<0.01	----
Zinc	7440-66-6	0.05	mg/kg		----	----	<0.05	<0.05	----
Vanadium	7440-62-2	0.1	mg/kg		----	----	<0.1	<0.1	----
Aluminium	7429-90-5	0.1	mg/kg		----	----	<0.1	<0.1	----
EG020T: Total Metals by ICP-MS									
Arsenic	7440-38-2	0.1	mg/kg		----	----	**16.1**	**10.7**	----
Selenium	7782-49-2	1	mg/kg		----	----	**2**	**2**	----
Barium	7440-39-3	0.1	mg/kg		----	----	**313**	**256**	----
Beryllium	7440-41-7	0.1	mg/kg		----	----	**0.9**	**1.4**	----
Cadmium	7440-43-9	0.1	mg/kg		----	----	**0.1**	**0.1**	----
Cobalt	7440-48-4	0.1	mg/kg		----	----	**5.4**	**5.9**	----
Chromium	7440-47-3	0.1	mg/kg		----	----	**0.6**	**2.1**	----
Copper	7440-50-8	0.1	mg/kg		----	----	**55.3**	**45.9**	----

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	IP19002032R588 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	IP19003592R467 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	Composite 3	Composite 4	pH and EC of DI water
				Client sampling date / time	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
					EB1933850-006	EB1933850-007	EB1933850-008	EB1933850-009	EB1933850-010
					Result	Result	Result	Result	Result
EG020T: Total Metals by ICP-MS - Continued									
Thorium	7440-29-1	0.1	mg/kg		----	----	**1.9**	**2.0**	----
Manganese	7439-96-5	0.1	mg/kg		----	----	**84.6**	**73.5**	----
Molybdenum	7439-98-7	0.1	mg/kg		----	----	**1.2**	**0.9**	----
Nickel	7440-02-0	0.1	mg/kg		----	----	**7.0**	**12.9**	----
Lead	7439-92-1	0.1	mg/kg		----	----	**14.2**	**18.9**	----
Antimony	7440-36-0	0.1	mg/kg		----	----	**0.1**	**0.1**	----
Uranium	7440-61-1	0.1	mg/kg		----	----	**0.8**	**5.4**	----
Zinc	7440-66-6	0.5	mg/kg		----	----	**49.2**	**72.2**	----
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		----	----	<0.0005	<0.0005	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		----	----	<0.1	**0.1**	----
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		----	----	**1**	**2**	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		----	----	**0.1**	<0.1	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1932449**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2019010 Saraji West/Vulcan	Date Samples Received	: 03-Dec-2019 15:29
Order number	: ----	Date Analysis Commenced	: 04-Dec-2019
C-O-C number	: ----	Issue Date	: 12-Dec-2019 13:24
Sampler	: ALAN ROBERTSON		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 7		
No. of samples analysed	: 7		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

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 insufficient 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.

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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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- EA031 (Saturated Paste pH): NATA accreditation does not cover the performance of this service.
- EA032 (Saturated Paste EC): NATA accreditation does not cover the performance of this service.
- ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	IP19004096R302 "Coarse" (Wash 2, -50+2mm)reject	IP19004096R303 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	IP19002032R587 "Coarse" (Wash 2, -50+2mm) reject	IP19002032R588 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	IP19003592R466 "Coarse" (Wash 2, -50+2mm) reject
				Client sampling date / time	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
					EB1932449-001	EB1932449-002	EB1932449-003	EB1932449-004	EB1932449-005
					Result	Result	Result	Result	Result
EA009: Nett Acid Production Potential									
Net Acid Production Potential	----	0.5	kg H2SO4/t		**13.8**	**4.9**	**-1.4**	**-4.4**	**-16.7**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**11.3**	**13.5**	**10.9**	**16.9**	**22.8**
ANC as CaCO3	----	0.1	% CaCO3		**1.2**	**1.4**	**1.1**	**1.7**	**2.3**
Fizz Rating	----	0	Fizz Unit		**1**	**1**	**1**	**1**	**1**
EA031: pH (saturated paste)									
ø pH (Saturated Paste)	----	0.1	pH Unit		**8.3**	**7.4**	**4.5**	**5.6**	**7.6**
EA032: Electrical Conductivity (saturated paste)									
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm		**116**	**564**	**454**	**193**	**213**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.82**	**0.60**	**0.31**	**0.41**	**0.20**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	IP19003592R467 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	IP19004601R298 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	----	----	----
			Client sampling date / time	02-Dec-2019 00:00	02-Dec-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EB1932449-006	EB1932449-007	--------	--------	--------
				Result	Result	----	----	----
EA009: Nett Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-16.6**	**-32.3**	**----**	**----**	**----**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**23.3**	**36.0**	**----**	**----**	**----**
ANC as CaCO3	----	0.1	% CaCO3	**2.4**	**3.7**	**----**	**----**	**----**
Fizz Rating	----	0	Fizz Unit	**1**	**1**	**----**	**----**	**----**
EA031: pH (saturated paste)								
ø pH (Saturated Paste)	----	0.1	pH Unit	**7.6**	**6.8**	**----**	**----**	**----**
EA032: Electrical Conductivity (saturated paste)								
ø Electrical Conductivity (Saturated Paste)	----	1	µS/cm	**466**	**398**	**----**	**----**	**----**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.22**	**0.12**	**----**	**----**	**----**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1931850**	Page	: 1 of 8
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2019010 Vulcan Complex (Saraji West)	Date Samples Received	: 27-Nov-2019 11:33
Order number	: ----	Date Analysis Commenced	: 29-Nov-2019
C-O-C number	: ----	Issue Date	: 11-Dec-2019 16:16
Sampler	: ALAN ROBERTSON		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 7		
No. of samples analysed	: 7		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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Signatories

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Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Sarah Ashworth	Laboratory Manager - Brisbane	Stafford Minerals - ST, Stafford, QLD
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Satishkumar Trivedi	Senior Acid Sulfate Soil Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

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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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED037 (Alkalinity): NATA accreditation does not cover the performance of this service.
- ED038 (Acidity): NATA accreditation does not cover the performance of this service.
- EK040S (Fluoride - Soluble) - Particular samples required dilution prior to analysis due to matrix interferences. LOR values have been adjusted accordingly.
- ED093T (Major Cations - Total): Sample Composite of 1 and 3 (EB1931850-005) shows poor duplicate results due to sample heterogeneity. Confirmed by visual inspection.
- EG005T (Total Metals by ICP-AES): Sample EB1932078-010 shows poor duplicate results due to sample heterogeneity. Confirmed by visual inspection.
- EG005T (Total Metals by ICP-AES): Sample EB1931809-020 shows poor duplicate results due to sample heterogeneity. Confirmed by visual inspection.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	IP19006604R005	IP19006604R006	IP1900410R298	IP1900410R299	Composite of 1 and 3
			Client sampling date / time	01-Nov-2019 00:00	01-Nov-2019 00:00	01-Nov-2019 00:00	01-Nov-2019 00:00	01-Nov-2019 00:00
Compound	CAS Number	LOR	Unit	EB1931850-001	EB1931850-002	EB1931850-003	EB1931850-004	EB1931850-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	----	----	----	----	8.6
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	----	----	----	----	86
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.388	0.190	0.047	0.219	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	----	----	----	----	1.6
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	----	----	----	----	122
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	----	----	----	----	122
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	----	----	----	----	<5
ED038A: Acidity								
Acidity	----	1	mg/kg	----	----	----	----	94
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	----	----	----	----	90
Silica	7631-86-9	1	mg/kg	----	----	----	----	17
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	----	----	----	----	40
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	----	----	----	----	<10
Magnesium	7439-95-4	10	mg/kg	----	----	----	----	<10
Sodium	7440-23-5	10	mg/kg	----	----	----	----	130
Potassium	7440-09-7	10	mg/kg	----	----	----	----	<10
ED093T: Total Major Cations								
Sodium	7440-23-5	50	mg/kg	----	----	----	----	120
Potassium	7440-09-7	50	mg/kg	----	----	----	----	500
Calcium	7440-70-2	50	mg/kg	----	----	----	----	2650
Magnesium	7439-95-4	50	mg/kg	----	----	----	----	2160
EG005(ED093)S : Soluble Metals by ICPAES								
Boron	7440-42-8	1	mg/kg	----	----	----	----	<1
Iron	7439-89-6	1	mg/kg	----	----	----	----	<1
EG005(ED093)T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	----	----	----	----	1100

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	IP19006604R005	IP19006604R006	IP1900410R298	IP1900410R299	Composite of 1 and 3
				Client sampling date / time	01-Nov-2019 00:00	01-Nov-2019 00:00	01-Nov-2019 00:00	01-Nov-2019 00:00	01-Nov-2019 00:00
Compound	CAS Number	LOR	Unit		EB1931850-001	EB1931850-002	EB1931850-003	EB1931850-004	EB1931850-005
					Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES - Continued									
Antimony	7440-36-0	5	mg/kg		----	----	----	----	<5
Barium	7440-39-3	10	mg/kg		----	----	----	----	**80**
Beryllium	7440-41-7	1	mg/kg		----	----	----	----	<1
Boron	7440-42-8	50	mg/kg		----	----	----	----	<50
Cobalt	7440-48-4	2	mg/kg		----	----	----	----	**5**
Iron	7439-89-6	50	mg/kg		----	----	----	----	**46900**
Manganese	7439-96-5	5	mg/kg		----	----	----	----	**1100**
Molybdenum	7439-98-7	2	mg/kg		----	----	----	----	<2
Selenium	7782-49-2	5	mg/kg		----	----	----	----	<5
Thallium	7440-28-0	5	mg/kg		----	----	----	----	<5
Arsenic	7440-38-2	5	mg/kg		----	----	----	----	**7**
Cadmium	7440-43-9	1	mg/kg		----	----	----	----	<1
Chromium	7440-47-3	2	mg/kg		----	----	----	----	<2
Copper	7440-50-8	5	mg/kg		----	----	----	----	**23**
Lead	7439-92-1	5	mg/kg		----	----	----	----	**6**
Nickel	7440-02-0	2	mg/kg		----	----	----	----	**6**
Zinc	7440-66-6	5	mg/kg		----	----	----	----	**62**
EG020S: Soluble Metals by ICPMS									
Arsenic	7440-38-2	0.01	mg/kg		----	----	----	----	**0.01**
Selenium	7782-49-2	0.1	mg/kg		----	----	----	----	<0.1
Barium	7440-39-3	0.01	mg/kg		----	----	----	----	<0.01
Beryllium	7440-41-7	0.01	mg/kg		----	----	----	----	<0.01
Cadmium	7440-43-9	0.01	mg/kg		----	----	----	----	<0.01
Cobalt	7440-48-4	0.01	mg/kg		----	----	----	----	<0.01
Chromium	7440-47-3	0.01	mg/kg		----	----	----	----	<0.01
Thorium	7440-29-1	0.01	mg/kg		----	----	----	----	<0.01
Copper	7440-50-8	0.01	mg/kg		----	----	----	----	**0.01**
Manganese	7439-96-5	0.01	mg/kg		----	----	----	----	<0.01
Molybdenum	7439-98-7	0.01	mg/kg		----	----	----	----	**0.17**
Nickel	7440-02-0	0.01	mg/kg		----	----	----	----	**0.01**
Lead	7439-92-1	0.01	mg/kg		----	----	----	----	<0.01
Antimony	7440-36-0	0.01	mg/kg		----	----	----	----	**0.01**
Uranium	7440-61-1	0.01	mg/kg		----	----	----	----	<0.01
Zinc	7440-66-6	0.05	mg/kg		----	----	----	----	<0.05
Vanadium	7440-62-2	0.1	mg/kg		----	----	----	----	<0.1

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	IP19006604R005	IP19006604R006	IP1900410R298	IP1900410R299	Composite of 1 and 3
				Client sampling date / time	01-Nov-2019 00:00	01-Nov-2019 00:00	01-Nov-2019 00:00	01-Nov-2019 00:00	01-Nov-2019 00:00
Compound	CAS Number	LOR	Unit		EB1931850-001	EB1931850-002	EB1931850-003	EB1931850-004	EB1931850-005
					Result	Result	Result	Result	Result
EG020S: Soluble Metals by ICPMS - Continued									
Aluminium	7429-90-5	0.1	mg/kg		----	----	----	----	**0.7**
EG020T: Total Metals by ICP-MS									
Uranium	7440-61-1	0.1	mg/kg		----	----	----	----	**0.6**
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		----	----	----	----	<0.0005
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		----	----	----	----	**0.3**
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		----	----	----	----	<5
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		----	----	----	----	<0.1
ME-ICP81: Silica and Metals Oxides by Peroxide Fusion									
Silica as SiO2	7631-86-9	0.01	%		----	----	----	----	**28.0**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	Composite of 2 and 4	pH & EC of DI Water	----	----	----
			Client sampling date / time	01-Nov-2019 00:00	27-Nov-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EB1931850-006	EB1931850-007	--------	--------	--------
				Result	Result	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**7.4**	**5.7**	----	----	----
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**154**	<1	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**1.7**	----	----	----	----
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	**166**	----	----	----	----
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	**166**	----	----	----	----
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	<5	----	----	----	----
ED038A: Acidity								
Acidity	----	1	mg/kg	**242**	----	----	----	----
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**160**	----	----	----	----
Silica	7631-86-9	1	mg/kg	**8**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	**120**	----	----	----	----
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	**20**	----	----	----	----
Magnesium	7439-95-4	10	mg/kg	**20**	----	----	----	----
Sodium	7440-23-5	10	mg/kg	**130**	----	----	----	----
Potassium	7440-09-7	10	mg/kg	<10	----	----	----	----
ED093T: Total Major Cations								
Sodium	7440-23-5	50	mg/kg	**150**	----	----	----	----
Potassium	7440-09-7	50	mg/kg	**720**	----	----	----	----
Calcium	7440-70-2	50	mg/kg	**2090**	----	----	----	----
Magnesium	7439-95-4	50	mg/kg	**1120**	----	----	----	----
EG005(ED093)S : Soluble Metals by ICPAES								
Boron	7440-42-8	1	mg/kg	<1	----	----	----	----
Iron	7439-89-6	1	mg/kg	<1	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**1790**	----	----	----	----
Antimony	7440-36-0	5	mg/kg	<5	----	----	----	----
Barium	7440-39-3	10	mg/kg	**230**	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	Composite of 2 and 4	pH & EC of DI Water	----	----	----
				Client sampling date / time	01-Nov-2019 00:00	27-Nov-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EB1931850-006	EB1931850-007	--------	--------	--------
					Result	Result	----	----	----
EG005(ED093)T: Total Metals by ICP-AES - Continued									
Beryllium	7440-41-7	1	mg/kg		**1**	----	----	----	----
Boron	7440-42-8	50	mg/kg		<50	----	----	----	----
Cobalt	7440-48-4	2	mg/kg		**22**	----	----	----	----
Iron	7439-89-6	50	mg/kg		**11200**	----	----	----	----
Manganese	7439-96-5	5	mg/kg		**179**	----	----	----	----
Molybdenum	7439-98-7	2	mg/kg		**3**	----	----	----	----
Selenium	7782-49-2	5	mg/kg		<5	----	----	----	----
Thallium	7440-28-0	5	mg/kg		<5	----	----	----	----
Arsenic	7440-38-2	5	mg/kg		**12**	----	----	----	----
Cadmium	7440-43-9	1	mg/kg		<1	----	----	----	----
Chromium	7440-47-3	2	mg/kg		<2	----	----	----	----
Copper	7440-50-8	5	mg/kg		**44**	----	----	----	----
Lead	7439-92-1	5	mg/kg		**15**	----	----	----	----
Nickel	7440-02-0	2	mg/kg		**23**	----	----	----	----
Zinc	7440-66-6	5	mg/kg		**145**	----	----	----	----
EG020S: Soluble Metals by ICPMS									
Arsenic	7440-38-2	0.01	mg/kg		<0.01	----	----	----	----
Selenium	7782-49-2	0.1	mg/kg		<0.1	----	----	----	----
Barium	7440-39-3	0.01	mg/kg		**0.01**	----	----	----	----
Beryllium	7440-41-7	0.01	mg/kg		<0.01	----	----	----	----
Cadmium	7440-43-9	0.01	mg/kg		<0.01	----	----	----	----
Cobalt	7440-48-4	0.01	mg/kg		<0.01	----	----	----	----
Chromium	7440-47-3	0.01	mg/kg		<0.01	----	----	----	----
Thorium	7440-29-1	0.01	mg/kg		<0.01	----	----	----	----
Copper	7440-50-8	0.01	mg/kg		**0.02**	----	----	----	----
Manganese	7439-96-5	0.01	mg/kg		**0.02**	----	----	----	----
Molybdenum	7439-98-7	0.01	mg/kg		**0.10**	----	----	----	----
Nickel	7440-02-0	0.01	mg/kg		<0.01	----	----	----	----
Lead	7439-92-1	0.01	mg/kg		<0.01	----	----	----	----
Antimony	7440-36-0	0.01	mg/kg		<0.01	----	----	----	----
Uranium	7440-61-1	0.01	mg/kg		<0.01	----	----	----	----
Zinc	7440-66-6	0.05	mg/kg		<0.05	----	----	----	----
Vanadium	7440-62-2	0.1	mg/kg		<0.1	----	----	----	----
Aluminium	7429-90-5	0.1	mg/kg		<0.1	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	Composite of 2 and 4	pH & EC of DI Water	----	----	----
				Client sampling date / time	01-Nov-2019 00:00	27-Nov-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EB1931850-006	EB1931850-007	--------	--------	--------
					Result	Result	----	----	----
EG020T: Total Metals by ICP-MS									
Uranium	7440-61-1	0.1	mg/kg		**1.0**	----	----	----	----
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		<0.0005	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		**0.1**	----	----	----	----
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		**5**	----	----	----	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		<0.1	----	----	----	----
ME-ICP81: Silica and Metals Oxides by Peroxide Fusion									
Silica as SiO2	7631-86-9	0.01	%		**34.2**	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1933850**	Page	: 1 of 6
Amendment	: **1**		
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Carsten Emrich
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2019010 Saraji West/Vulcan	Date Samples Received	: 13-Dec-2019 11:55
Order number	: ----	Date Analysis Commenced	: 23-Dec-2019
C-O-C number	: ----	Issue Date	: 16-Jan-2020 11:07
Sampler	: ALAN ROBERTSON		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 10		
No. of samples analysed	: 10		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Andrew Epps	Senior Inorganic Chemist	Stafford Minerals - ST, Stafford, QLD
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- ED037 (Alkalinity): NATA accreditation does not cover the performance of this service.
- ED038 (Acidity): NATA accreditation does not cover the performance of this service.
- Amendment (16/01/2020): This report has been amended and re-released to allow the reporting of additional analytical data. Total Silica results have now been provided as subcon data.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	IP19002032R587 "Coarse" (Wash 2, -50+2mm) reject	IP19003592R466 "Coarse" (Wash 2, -50+2mm) reject	IP19004096R302 "Coarse" (Wash 2, -50+2mm)reject	IP19004601R298 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	IP19004096R303 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject
			Client sampling date / time	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
Compound	CAS Number	LOR	Unit	EB1933850-001	EB1933850-002	EB1933850-003	EB1933850-004	EB1933850-005
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	**0.049**	**0.055**	**0.569**	**0.018**	**0.382**

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	IP19002032R588 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	IP19003592R467 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	Composite 3	Composite 4	pH and EC of DI water
				Client sampling date / time	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
					EB1933850-006	EB1933850-007	EB1933850-008	EB1933850-009	EB1933850-010
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		----	----	**5.8**	**6.2**	**5.6**
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		----	----	**96**	**54**	<1
EA026 : Chromium Reducible Sulfur									
Chromium Reducible Sulphur	----	0.005	%		**0.027**	**0.152**	----	----	----
ED037: Alkalinity									
ø **Total Alkalinity as CaCO3**	----	1	mg/kg		----	----	**280**	**5160**	----
ø **Bicarbonate Alkalinity as CaCO3**	71-52-3	1	mg/kg		----	----	**280**	**5160**	----
ø **Carbonate Alkalinity as CaCO3**	3812-32-6	1	mg/kg		----	----	<5	<5	----
ED038A: Acidity									
Acidity	----	1	mg/kg		----	----	**230**	**892**	----
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		----	----	**120**	**100**	----
Silica	7631-86-9	1	mg/kg		----	----	**81**	**43**	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		----	----	**50**	**130**	----
ED093S: Soluble Major Cations									
Calcium	7440-70-2	10	mg/kg		----	----	<10	**10**	----
Magnesium	7439-95-4	10	mg/kg		----	----	<10	**20**	----
Sodium	7440-23-5	10	mg/kg		----	----	**120**	**120**	----
Potassium	7440-09-7	10	mg/kg		----	----	<10	**20**	----
ED093T: Total Major Cations									
Sodium	7440-23-5	50	mg/kg		----	----	**410**	**470**	----
Potassium	7440-09-7	50	mg/kg		----	----	**1270**	**1280**	----
Calcium	7440-70-2	50	mg/kg		----	----	**1600**	**4780**	----
Magnesium	7439-95-4	50	mg/kg		----	----	**680**	**2700**	----
EG005(ED093)S : Soluble Metals by ICPAES									
Boron	7440-42-8	1	mg/kg		----	----	<1	<1	----
Iron	7439-89-6	1	mg/kg		----	----	<1	<1	----
EG005(ED093)T: Total Metals by ICP-AES									

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	IP19002032R588 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	IP19003592R467 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	Composite 3	Composite 4	pH and EC of DI water
				Client sampling date / time	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
					EB1933850-006	EB1933850-007	EB1933850-008	EB1933850-009	EB1933850-010
					Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES - Continued									
Aluminium	7429-90-5	50	mg/kg		----	----	**2770**	**3360**	----
Boron	7440-42-8	50	mg/kg		----	----	<50	<50	----
Iron	7439-89-6	50	mg/kg		----	----	**7940**	**6340**	----
EG020S: Soluble Metals by ICPMS									
Arsenic	7440-38-2	0.01	mg/kg		----	----	<0.01	<0.01	----
Selenium	7782-49-2	0.1	mg/kg		----	----	<0.1	<0.1	----
Barium	7440-39-3	0.01	mg/kg		----	----	<0.01	**0.02**	----
Beryllium	7440-41-7	0.01	mg/kg		----	----	<0.01	<0.01	----
Cadmium	7440-43-9	0.01	mg/kg		----	----	<0.01	<0.01	----
Cobalt	7440-48-4	0.01	mg/kg		----	----	<0.01	<0.01	----
Chromium	7440-47-3	0.01	mg/kg		----	----	<0.01	<0.01	----
Thorium	7440-29-1	0.01	mg/kg		----	----	<0.01	<0.01	----
Copper	7440-50-8	0.01	mg/kg		----	----	<0.01	<0.01	----
Manganese	7439-96-5	0.01	mg/kg		----	----	<0.01	<0.01	----
Molybdenum	7439-98-7	0.01	mg/kg		----	----	**0.04**	**0.01**	----
Nickel	7440-02-0	0.01	mg/kg		----	----	<0.01	<0.01	----
Lead	7439-92-1	0.01	mg/kg		----	----	<0.01	<0.01	----
Antimony	7440-36-0	0.01	mg/kg		----	----	**0.02**	<0.01	----
Uranium	7440-61-1	0.01	mg/kg		----	----	<0.01	<0.01	----
Zinc	7440-66-6	0.05	mg/kg		----	----	<0.05	<0.05	----
Vanadium	7440-62-2	0.1	mg/kg		----	----	<0.1	<0.1	----
Aluminium	7429-90-5	0.1	mg/kg		----	----	<0.1	<0.1	----
EG020T: Total Metals by ICP-MS									
Arsenic	7440-38-2	0.1	mg/kg		----	----	**16.1**	**10.7**	----
Selenium	7782-49-2	1	mg/kg		----	----	**2**	**2**	----
Barium	7440-39-3	0.1	mg/kg		----	----	**313**	**256**	----
Beryllium	7440-41-7	0.1	mg/kg		----	----	**0.9**	**1.4**	----
Cadmium	7440-43-9	0.1	mg/kg		----	----	**0.1**	**0.1**	----
Cobalt	7440-48-4	0.1	mg/kg		----	----	**5.4**	**5.9**	----
Chromium	7440-47-3	0.1	mg/kg		----	----	**0.6**	**2.1**	----
Copper	7440-50-8	0.1	mg/kg		----	----	**55.3**	**45.9**	----

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

Compound	CAS Number	LOR	Unit	Client sample ID	IP19002032R588 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	IP19003592R467 "Fine" (Wash 3 & Fines, -2+0.25 & -0.25+0mm respectively) reject	Composite 3	Composite 4	pH and EC of DI water
				Client sampling date / time	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00	02-Dec-2019 00:00
					EB1933850-006	EB1933850-007	EB1933850-008	EB1933850-009	EB1933850-010
					Result	Result	Result	Result	Result
EG020T: Total Metals by ICP-MS - Continued									
Thorium	7440-29-1	0.1	mg/kg		----	----	**1.9**	**2.0**	----
Manganese	7439-96-5	0.1	mg/kg		----	----	**84.6**	**73.5**	----
Molybdenum	7439-98-7	0.1	mg/kg		----	----	**1.2**	**0.9**	----
Nickel	7440-02-0	0.1	mg/kg		----	----	**7.0**	**12.9**	----
Lead	7439-92-1	0.1	mg/kg		----	----	**14.2**	**18.9**	----
Antimony	7440-36-0	0.1	mg/kg		----	----	**0.1**	**0.1**	----
Uranium	7440-61-1	0.1	mg/kg		----	----	**0.8**	**5.4**	----
Zinc	7440-66-6	0.5	mg/kg		----	----	**49.2**	**72.2**	----
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		----	----	<0.0005	<0.0005	----
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		----	----	<0.1	**0.1**	----
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		----	----	**1**	**2**	----
EK071G: Reactive Phosphorus as P by discrete analyser									
Reactive Phosphorus as P	14265-44-2	0.1	mg/kg		----	----	**0.1**	<0.1	----
ME-ICP81: Silica and Metals Oxides by Peroxide Fusion									
Silica as SiO2	7631-86-9	0.01	%		----	----	**34.9**	**29.5**	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1916412**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2019010 Vulcan (Saraji West)	Date Samples Received	: 25-Jun-2019 14:50
Order number	: 2019010	Date Analysis Commenced	: 26-Jun-2019
C-O-C number	: ----	Issue Date	: 02-Jul-2019 14:52
Sampler	: MARY MACILROY		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 4		
No. of samples analysed	: 4		

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Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

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

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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	----
			Client sampling date / time	25-Jun-2019 00:00	25-Jun-2019 00:00	25-Jun-2019 00:00	25-Jun-2019 00:00	----
Compound	CAS Number	LOR	Unit	EB1916412-001	EB1916412-002	EB1916412-003	EB1916412-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.87**	**6.71**	**5.84**	**6.45**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**56**	**76**	**616**	**720**	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**7**	**6**	**2**	**5**	----
Total Alkalinity as CaCO3	----	1	mg/L	**7**	**6**	**2**	**5**	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**1**	**1**	**2**	**5**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**3**	**6**	**111**	**45**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**10**	**13**	**108**	**193**	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	<1	<1	**4**	<1	----
Magnesium	7439-95-4	1	mg/L	<1	<1	**7**	**4**	----
Sodium	7440-23-5	1	mg/L	**12**	**15**	**104**	**150**	----
Potassium	7440-09-7	1	mg/L	<1	<1	**6**	**6**	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**1.09**	**1.07**	**0.08**	**0.24**	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	**0.0002**	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	**0.001**	**0.001**	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	**0.039**	**0.003**	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	**0.045**	**0.003**	----
Lead	7439-92-1	0.001	mg/L	<0.001	**0.001**	<0.001	**0.001**	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	**0.158**	**0.010**	----
Manganese	7439-96-5	0.001	mg/L	**0.002**	**0.007**	**0.153**	**0.041**	----
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	----
				Client sampling date / time	25-Jun-2019 00:00	25-Jun-2019 00:00	25-Jun-2019 00:00	25-Jun-2019 00:00	----
Compound	CAS Number	LOR	Unit		EB1916412-001	EB1916412-002	EB1916412-003	EB1916412-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	----
Iron	7439-89-6	0.05	mg/L		**0.21**	**0.40**	<0.05	**0.14**	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	**0.1**	<0.1	**0.2**	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**0.48**	**0.61**	**5.40**	**6.48**	----
ø **Total Cations**	----	0.01	meq/L		**0.52**	**0.65**	**5.45**	**7.01**	----
ø **Ionic Balance**	----	0.01	%		**----**	**----**	**0.51**	**3.90**	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1918957**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: 2019010 Vulcan (Saraji West)	Date Samples Received	: 22-Jul-2019 15:05
Order number	:	Date Analysis Commenced	: 23-Jul-2019
C-O-C number	: ----	Issue Date	: 30-Jul-2019 11:01
Sampler	: MARY MACELROY		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 4		
No. of samples analysed	: 4		

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This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

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

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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Ionic balances are within acceptable limits as detailed in the 21st Ed. APHA "Standard Methods for the Examination of Water and Wastewater".
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	----
			Client sampling date / time	22-Jul-2019 00:00	22-Jul-2019 00:00	22-Jul-2019 00:00	22-Jul-2019 00:00	----
Compound	CAS Number	LOR	Unit	EB1918957-001	EB1918957-002	EB1918957-003	EB1918957-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.02**	**6.86**	**6.18**	**6.51**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**171**	**299**	**144**	**557**	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**5**	**4**	**1**	**2**	----
Total Alkalinity as CaCO3	----	1	mg/L	**5**	**4**	**1**	**2**	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**1**	**2**	**1**	**6**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**20**	**34**	**22**	**57**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**33**	**63**	**25**	**130**	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**2**	**3**	<1	<1	----
Magnesium	7439-95-4	1	mg/L	**5**	**9**	**2**	**7**	----
Sodium	7440-23-5	1	mg/L	**22**	**39**	**23**	**89**	----
Potassium	7440-09-7	1	mg/L	<1	<1	**1**	**3**	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.22**	**0.05**	**0.15**	**0.14**	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Cobalt	7440-48-4	0.001	mg/L	**0.001**	<0.001	**0.007**	**0.002**	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	**0.009**	**0.002**	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	**0.001**	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	**0.022**	<0.005	----
Manganese	7439-96-5	0.001	mg/L	**0.020**	**0.008**	**0.101**	**0.045**	----
Molybdenum	7439-98-7	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC 1	KLC 2	KLC 3	KLC 4	----
				Client sampling date / time	22-Jul-2019 00:00	22-Jul-2019 00:00	22-Jul-2019 00:00	22-Jul-2019 00:00	----
Compound	CAS Number	LOR	Unit		EB1918957-001	EB1918957-002	EB1918957-003	EB1918957-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	----
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	**0.07**	**0.11**	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<0.1	**0.1**	<0.1	**0.1**	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**1.45**	**2.56**	**1.18**	**4.89**	----
ø **Total Cations**	----	0.01	meq/L		**1.47**	**2.59**	**1.19**	**4.52**	----
ø **Ionic Balance**	----	0.01	%		**----**	**----**	**----**	**3.92**	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1922363**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MS VERONICA CANALES	Contact	: Customer Services EB
Address	:	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: Vulcan Template	Date Samples Received	: 27-Aug-2019 15:20
Order number	:	Date Analysis Commenced	: 27-Aug-2019
C-O-C number	: 3545	Issue Date	: 03-Sep-2019 16:55
Sampler	: CARSTEN EMRICH		
Site	: Vulcan L3		
Quote number	: BN/1234/19		
No. of samples received	: 4		
No. of samples analysed	: 4		

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- General Comments
- Analytical Results

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Signatories

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

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

General Comments

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Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Ionic Balance out of acceptable limits for some samples due to analytes not quantified in this report.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC-1	KLC-2	KLC-3	KLC-4	----
			Client sampling date / time	27-Aug-2019 11:41	27-Aug-2019 11:44	27-Aug-2019 11:50	27-Aug-2019 11:51	----
Compound	CAS Number	LOR	Unit	EB1922363-001	EB1922363-002	EB1922363-003	EB1922363-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.25**	**6.94**	**6.03**	**6.41**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**282**	**414**	**181**	**382**	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**8**	**8**	**2**	**3**	----
Total Alkalinity as CaCO3	----	1	mg/L	**8**	**8**	**2**	**3**	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**1**	**1**	**2**	**2**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**39**	**71**	**40**	**48**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**52**	**68**	**21**	**74**	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**3**	**7**	**2**	<1	----
Magnesium	7439-95-4	1	mg/L	**7**	**13**	**3**	**5**	----
Sodium	7440-23-5	1	mg/L	**44**	**57**	**30**	**71**	----
Potassium	7440-09-7	1	mg/L	<1	**1**	**2**	**2**	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.13**	**0.04**	**0.09**	**0.17**	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	**0.0004**	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	**0.004**	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	**0.006**	**0.002**	----
Nickel	7440-02-0	0.001	mg/L	<0.001	**0.001**	**0.008**	**0.002**	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	**0.023**	**0.137**	----
Manganese	7439-96-5	0.001	mg/L	**0.005**	**0.004**	**0.134**	**0.042**	----
Molybdenum	7439-98-7	0.001	mg/L	**0.001**	**0.001**	<0.001	<0.001	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC-1	KLC-2	KLC-3	KLC-4	----
				Client sampling date / time	27-Aug-2019 11:41	27-Aug-2019 11:44	27-Aug-2019 11:50	27-Aug-2019 11:51	----
Compound	CAS Number	LOR	Unit		EB1922363-001	EB1922363-002	EB1922363-003	EB1922363-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	----
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	<0.05	**0.07**	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.1**	**0.2**	<0.1	**0.1**	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**2.44**	**3.56**	**1.46**	**3.15**	----
ø **Total Cations**	----	0.01	meq/L		**2.64**	**3.92**	**1.70**	**3.55**	----
ø **Ionic Balance**	----	0.01	%		**----**	**4.92**	**----**	**6.04**	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1925267**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Customer Services EB
Address	:	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: Vulcan - 2019010	Date Samples Received	: 25-Sep-2019 15:51
Order number	:	Date Analysis Commenced	: 26-Sep-2019
C-O-C number	: 4379	Issue Date	: 02-Oct-2019 12:36
Sampler	: MARY MACELROY, VERONICA CANALES		
Site	: Vulcan L-4		
Quote number	: BN/1234/19		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

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

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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC-1	KLC-2	KLC-3	KLC-4	----
			Client sampling date / time	25-Sep-2019 10:05	25-Sep-2019 10:09	25-Sep-2019 10:10	25-Sep-2019 10:10	----
Compound	CAS Number	LOR	Unit	EB1925267-001	EB1925267-002	EB1925267-003	EB1925267-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.45**	**6.99**	**5.98**	**6.45**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**930**	**251**	**300**	**431**	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**26**	**7**	**5**	**5**	----
Total Alkalinity as CaCO3	----	1	mg/L	**26**	**7**	**5**	**5**	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**7**	**8**	**7**	**3**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**107**	**37**	**73**	**74**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**222**	**44**	**37**	**76**	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**7**	**2**	**2**	<1	----
Magnesium	7439-95-4	1	mg/L	**22**	**6**	**4**	**4**	----
Sodium	7440-23-5	1	mg/L	**146**	**36**	**49**	**75**	----
Potassium	7440-09-7	1	mg/L	**1**	<1	**2**	**3**	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.01**	**0.26**	**0.06**	**0.68**	----
Antimony	7440-36-0	0.001	mg/L	**0.002**	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L	**0.002**	<0.001	<0.001	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	**0.008**	**0.002**	----
Nickel	7440-02-0	0.001	mg/L	**0.001**	<0.001	**0.010**	**0.003**	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	**0.002**	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	**0.031**	<0.005	----
Manganese	7439-96-5	0.001	mg/L	**0.009**	**0.003**	**0.229**	**0.048**	----
Molybdenum	7439-98-7	0.001	mg/L	**0.008**	**0.002**	<0.001	<0.001	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC-1	KLC-2	KLC-3	KLC-4	----
				Client sampling date / time	25-Sep-2019 10:05	25-Sep-2019 10:09	25-Sep-2019 10:10	25-Sep-2019 10:10	----
Compound	CAS Number	LOR	Unit		EB1925267-001	EB1925267-002	EB1925267-003	EB1925267-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.06**	<0.05	<0.05	<0.05	**----**
Iron	7439-89-6	0.05	mg/L		<0.05	**0.13**	**0.05**	**0.20**	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.5**	**0.2**	<0.1	**0.2**	**----**
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**9.01**	**2.15**	**2.66**	**3.78**	**----**
ø **Total Cations**	----	0.01	meq/L		**8.54**	**2.16**	**2.61**	**3.67**	**----**
ø **Ionic Balance**	----	0.01	%		**2.70**	**----**	**----**	**1.56**	**----**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1927981**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MS VERONICA CANALES	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: Vulcan Template	Date Samples Received	: 22-Oct-2019 16:15
Order number	:	Date Analysis Commenced	: 22-Oct-2019
C-O-C number	: 5170	Issue Date	: 29-Oct-2019 13:14
Sampler	: VERONICA CANALES		
Site	: Vulcan- L5		
Quote number	: BN/1234/19		
No. of samples received	: 4		
No. of samples analysed	: 4		

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Accreditation No. 825
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This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

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

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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC-1	KLC-2	KLC-3	KLC-4	----
			Client sampling date / time	22-Oct-2019 14:14	22-Oct-2019 14:15	22-Oct-2019 14:16	22-Oct-2019 14:19	----
Compound	CAS Number	LOR	Unit	EB1927981-001	EB1927981-002	EB1927981-003	EB1927981-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.15**	**6.85**	**6.11**	**6.43**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1150**	**150**	**208**	**310**	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**25**	**8**	**5**	**5**	----
Total Alkalinity as CaCO3	----	1	mg/L	**25**	**8**	**5**	**5**	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**2**	<1	**2**	**2**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**95**	**22**	**51**	**53**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**318**	**23**	**21**	**48**	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**12**	**2**	**2**	<1	----
Magnesium	7439-95-4	1	mg/L	**38**	**4**	**3**	**3**	----
Sodium	7440-23-5	1	mg/L	**142**	**18**	**31**	**51**	----
Potassium	7440-09-7	1	mg/L	<1	<1	**2**	**2**	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	**0.22**	**0.24**	**0.73**	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L	**0.001**	**0.002**	<0.001	<0.001	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	**0.021**	**0.004**	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L	**0.002**	<0.001	<0.001	<0.001	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	**0.004**	**0.002**	----
Nickel	7440-02-0	0.001	mg/L	**0.002**	<0.001	**0.004**	**0.003**	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	**0.001**	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	**0.014**	<0.005	----
Manganese	7439-96-5	0.001	mg/L	**0.024**	**0.003**	**0.121**	**0.034**	----
Molybdenum	7439-98-7	0.001	mg/L	**0.005**	<0.001	<0.001	<0.001	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC-1	KLC-2	KLC-3	KLC-4	----
				Client sampling date / time	22-Oct-2019 14:14	22-Oct-2019 14:15	22-Oct-2019 14:16	22-Oct-2019 14:19	----
Compound	CAS Number	LOR	Unit		EB1927981-001	EB1927981-002	EB1927981-003	EB1927981-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	----
Iron	7439-89-6	0.05	mg/L		**0.16**	**0.14**	<0.05	<0.05	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.3**	**0.1**	<0.1	**0.1**	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**11.4**	**1.27**	**1.75**	**2.56**	----
ø **Total Cations**	----	0.01	meq/L		**9.90**	**1.21**	**1.75**	**2.52**	----
ø **Ionic Balance**	----	0.01	%		**7.24**	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1931659**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MARY MACELROY	Contact	: Customer Services EB
Address	: Level 7 380 QUEEN STREET BRISBANE QLD, AUSTRALIA 4000	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: Vulcan - 2019010	Date Samples Received	: 26-Nov-2019 17:07
Order number	:	Date Analysis Commenced	: 27-Nov-2019
C-O-C number	: 6210	Issue Date	: 04-Dec-2019 09:59
Sampler	: VERONICA CANALES		
Site	: Vulcan 2019010 leach 7		
Quote number	: BN/1234/19		
No. of samples received	: 4		
No. of samples analysed	: 4		

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Signatories

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

General Comments

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ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC-1	KLC-2	KLC-3	KLC-4	----
				Client sampling date / time	26-Nov-2019 15:44	26-Nov-2019 15:52	26-Nov-2019 15:56	26-Nov-2019 15:57	----
Compound	CAS Number	LOR	Unit		EB1931659-001	EB1931659-002	EB1931659-003	EB1931659-004	--------
					Result	Result	Result	Result	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		7.85	7.17	6.35	6.62	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		1750	119	181	409	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		47	6	5	4	----
Total Alkalinity as CaCO3	----	1	mg/L		47	6	5	4	----
ED038A: Acidity									
Acidity as CaCO3	----	1	mg/L		5	<1	1	1	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		186	18	47	78	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		456	18	15	67	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		16	2	2	<1	----
Magnesium	7439-95-4	1	mg/L		49	3	2	4	----
Sodium	7440-23-5	1	mg/L		258	15	27	70	----
Potassium	7440-09-7	1	mg/L		2	<1	2	3	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		<0.01	0.22	0.20	0.91	----
Antimony	7440-36-0	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L		0.006	0.004	0.003	0.003	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L		<0.001	<0.001	<0.001	<0.001	----
Copper	7440-50-8	0.001	mg/L		0.002	<0.001	<0.001	<0.001	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	<0.001	0.002	0.002	----
Nickel	7440-02-0	0.001	mg/L		0.002	<0.001	0.003	0.002	----
Lead	7439-92-1	0.001	mg/L		<0.001	<0.001	<0.001	0.002	----
Zinc	7440-66-6	0.005	mg/L		<0.005	<0.005	0.008	0.008	----
Manganese	7439-96-5	0.001	mg/L		0.035	0.002	0.098	0.040	----
Molybdenum	7439-98-7	0.001	mg/L		0.012	0.001	<0.001	<0.001	----
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC-1	KLC-2	KLC-3	KLC-4	----
				Client sampling date / time	26-Nov-2019 15:44	26-Nov-2019 15:52	26-Nov-2019 15:56	26-Nov-2019 15:57	----
Compound	CAS Number	LOR	Unit		EB1931659-001	EB1931659-002	EB1931659-003	EB1931659-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.09**	<0.05	<0.05	<0.05	**----**
Iron	7439-89-6	0.05	mg/L		<0.05	**0.09**	**0.08**	**0.27**	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.7**	**0.1**	<0.1	**0.2**	**----**
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**17.7**	**1.00**	**1.50**	**3.59**	**----**
ø **Total Cations**	----	0.01	meq/L		**16.1**	**1.00**	**1.49**	**3.45**	**----**
ø **Ionic Balance**	----	0.01	%		**4.65**	**----**	**----**	**2.03**	**----**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1932471**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MARY MACELROY	Contact	: Customer Services EB
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61-7-3243 7222
Project	: Vulcan - 2019010	Date Samples Received	: 03-Dec-2019 16:14
Order number	: -	Date Analysis Commenced	: 03-Dec-2019
C-O-C number	: 6459	Issue Date	: 11-Dec-2019 10:23
Sampler	: ALAN ROBERTSON, VERONICA CANALES		
Site	: 2019010 -Vulcan 5-6 L1		
Quote number	: BN/1234/19		
No. of samples received	: 2		
No. of samples analysed	: 2		

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Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

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

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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC-5	KLC-6	----	----	----
			Client sampling date / time	03-Dec-2019 11:00	03-Dec-2019 11:02	----	----	----
Compound	CAS Number	LOR	Unit	EB1932471-005	EB1932471-006	--------	--------	--------
				Result	Result	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**7.35**	**7.01**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**833**	**151**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**32**	**12**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**32**	**12**	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**3**	**1**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**150**	**32**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**158**	**19**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**35**	**2**	----	----	----
Magnesium	7439-95-4	1	mg/L	**31**	**2**	----	----	----
Sodium	7440-23-5	1	mg/L	**70**	**23**	----	----	----
Potassium	7440-09-7	1	mg/L	**5**	**1**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.02**	**0.09**	----	----	----
Antimony	7440-36-0	0.001	mg/L	**0.002**	<0.001	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.002**	**0.002**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0021**	<0.0001	----	----	----
Chromium	7440-47-3	0.001	mg/L	**0.001**	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.006**	**0.002**	----	----	----
Cobalt	7440-48-4	0.001	mg/L	**0.070**	**0.006**	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.046**	**0.005**	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.067**	<0.005	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.016**	**0.002**	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.050**	**0.036**	----	----	----
Selenium	7782-49-2	0.01	mg/L	**0.05**	**0.02**	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC-5	KLC-6	----	----	----
				Client sampling date / time	03-Dec-2019 11:00	03-Dec-2019 11:02	----	----	----
Compound	CAS Number	LOR	Unit		EB1932471-005	EB1932471-006	--------	--------	--------
					Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.11**	<0.05	----	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**1.2**	**0.4**	----	----	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**8.22**	**1.44**	----	----	----
ø **Total Cations**	----	0.01	meq/L		**7.47**	**1.29**	----	----	----
ø **Ionic Balance**	----	0.01	%		**4.77**	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB1934601**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Carsten Emrich
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: Vulcan - 2019010	Date Samples Received	: 24-Dec-2019 11:30
Order number	: -	Date Analysis Commenced	: 27-Dec-2019
C-O-C number	: 7040	Issue Date	: 10-Jan-2020 17:28
Sampler	: VERONICA CANALES		
Site	: Vulcan L-7		
Quote number	: BN/1234/19		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Mark Hallas	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC-1	KLC-2	KLC-3	KLC-4	----
			Client sampling date / time	24-Dec-2019 09:26	24-Dec-2019 09:29	24-Dec-2019 09:30	24-Dec-2019 09:30	----
Compound	CAS Number	LOR	Unit	EB1934601-001	EB1934601-002	EB1934601-003	EB1934601-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**8.03**	**7.39**	**6.35**	**6.70**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**462**	**94**	**148**	**384**	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	<1	<1	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	<1	<1	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**80**	**11**	**5**	**8**	----
Total Alkalinity as CaCO3	----	1	mg/L	**80**	**11**	**5**	**8**	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	<1	**2**	**1**	**3**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**47**	**12**	**41**	**72**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**64**	**13**	**10**	**56**	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**3**	<1	**1**	<1	----
Magnesium	7439-95-4	1	mg/L	**8**	**2**	**2**	**2**	----
Sodium	7440-23-5	1	mg/L	**91**	**15**	**24**	**71**	----
Potassium	7440-09-7	1	mg/L	**1**	<1	**2**	**3**	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.77**	**0.29**	**0.28**	**1.13**	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L	**0.004**	<0.001	<0.001	**0.002**	----
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	**0.001**	<0.001	<0.001	**0.001**	----
Copper	7440-50-8	0.001	mg/L	**0.005**	<0.001	<0.001	**0.002**	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	**0.001**	**0.001**	----
Nickel	7440-02-0	0.001	mg/L	**0.001**	<0.001	**0.002**	**0.003**	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	<0.001	**0.003**	----
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	**0.005**	**0.005**	----
Manganese	7439-96-5	0.001	mg/L	**0.003**	**0.003**	**0.058**	**0.033**	----
Molybdenum	7439-98-7	0.001	mg/L	**0.013**	<0.001	<0.001	<0.001	----
Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC-1	KLC-2	KLC-3	KLC-4	----
				Client sampling date / time	24-Dec-2019 09:26	24-Dec-2019 09:29	24-Dec-2019 09:30	24-Dec-2019 09:30	----
Compound	CAS Number	LOR	Unit		EB1934601-001	EB1934601-002	EB1934601-003	EB1934601-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.14**	<0.05	<0.05	<0.05	**----**
Iron	7439-89-6	0.05	mg/L		**0.10**	**0.09**	**0.09**	**0.42**	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.9**	**0.1**	<0.1	**0.2**	**----**
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**4.38**	**0.84**	**1.24**	**3.24**	**----**
ø **Total Cations**	----	0.01	meq/L		**4.79**	**0.82**	**1.31**	**3.33**	**----**
ø **Ionic Balance**	----	0.01	%		**4.46**	**----**	**----**	**1.39**	**----**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2000205**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Carsten Emrich
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: Vulcan - 2019010	Date Samples Received	: 07-Jan-2020 17:10
Order number	:	Date Analysis Commenced	: 08-Jan-2020
C-O-C number	: 7144	Issue Date	: 15-Jan-2020 09:53
Sampler	: CARSTEN EMRICH		
Site	: 2019010- Vulcan Saraji West (5&6) L2 January 2020		
Quote number	: BN/1234/19		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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- Analytical Results

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Signatories

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

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

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 insufficient 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.

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LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC-5	KLC-6	----	----	----
			Client sampling date / time	07-Jan-2020 13:32	07-Jan-2020 13:32	----	----	----
Compound	CAS Number	LOR	Unit	EB2000205-001	EB2000205-002	--------	--------	--------
				Result	Result	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.69**	**6.90**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**504**	**205**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**9**	**14**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**9**	**14**	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**1**	**1**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**143**	**52**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**40**	**14**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**22**	**2**	----	----	----
Magnesium	7439-95-4	1	mg/L	**18**	**2**	----	----	----
Sodium	7440-23-5	1	mg/L	**45**	**33**	----	----	----
Potassium	7440-09-7	1	mg/L	**5**	**2**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	**0.14**	----	----	----
Antimony	7440-36-0	0.001	mg/L	**0.001**	**0.001**	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	**0.002**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0015**	**0.0002**	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.006**	**0.003**	----	----	----
Cobalt	7440-48-4	0.001	mg/L	**0.099**	**0.016**	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.072**	**0.015**	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.098**	**0.009**	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.023**	**0.004**	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.013**	**0.046**	----	----	----
Selenium	7782-49-2	0.01	mg/L	**0.02**	**0.03**	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC-5	KLC-6	----	----	----
				Client sampling date / time	07-Jan-2020 13:32	07-Jan-2020 13:32	----	----	----
Compound	CAS Number	LOR	Unit		EB2000205-001	EB2000205-002	--------	--------	--------
					Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.09**	<0.05	----	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	**0.07**	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.6**	**0.5**	----	----	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**4.28**	**1.76**	----	----	----
ø **Total Cations**	----	0.01	meq/L		**4.66**	**1.75**	----	----	----
ø **Ionic Balance**	----	0.01	%		**4.24**	**----**	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2002875**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Carsten Emrich
Address	: PO Box 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: Vulcan - 2019010	Date Samples Received	: 04-Feb-2020 16:27
Order number	: -	Date Analysis Commenced	: 05-Feb-2020
C-O-C number	: 7933	Issue Date	: 12-Feb-2020 14:55
Sampler	: CARSTEN EMRICH		
Site	: 2019010- Vulcan Saraji West (5&6) L3		
Quote number	: BN/1234/19		
No. of samples received	: 2		
No. of samples analysed	: 2		

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Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dave Gitsham	Metals Instrument Chemist	Brisbane Inorganics, Stafford, QLD
Mark Hallas	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC-5	KLC-6	----	----	----
			Client sampling date / time	04-Feb-2020 13:48	04-Feb-2020 13:48	----	----	----
Compound	CAS Number	LOR	Unit	EB2002875-001	EB2002875-002	--------	--------	--------
				Result	Result	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**5.77**	**6.66**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**980**	**263**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**14**	**23**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**14**	**23**	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**5**	**2**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**374**	**78**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**56**	**13**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**50**	**2**	----	----	----
Magnesium	7439-95-4	1	mg/L	**42**	**4**	----	----	----
Sodium	7440-23-5	1	mg/L	**73**	**42**	----	----	----
Potassium	7440-09-7	1	mg/L	**8**	**2**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.04**	**0.33**	----	----	----
Antimony	7440-36-0	0.001	mg/L	**0.001**	**0.002**	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.001**	**0.002**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0068**	**0.0003**	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.020**	**0.005**	----	----	----
Cobalt	7440-48-4	0.001	mg/L	**0.423**	**0.023**	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.271**	**0.023**	----	----	----
Lead	7439-92-1	0.001	mg/L	**0.020**	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.554**	**0.016**	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.108**	**0.004**	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.010**	**0.052**	----	----	----
Selenium	7782-49-2	0.01	mg/L	**0.05**	**0.04**	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC-5	KLC-6	----	----	----
				Client sampling date / time	04-Feb-2020 13:48	04-Feb-2020 13:48	----	----	----
Compound	CAS Number	LOR	Unit		EB2002875-001	EB2002875-002	--------	--------	--------
					Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.16**	**0.13**	----	----	----
Iron	7439-89-6	0.05	mg/L		**0.10**	**0.15**	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.5**	**0.9**	----	----	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**9.65**	**2.45**	----	----	----
ø **Total Cations**	----	0.01	meq/L		**9.33**	**2.31**	----	----	----
ø **Ionic Balance**	----	0.01	%		**1.66**	**----**	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2005904**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Carsten Emrich
Address	: PO BOX 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: Vulcan - 2019010	Date Samples Received	: 03-Mar-2020 16:59
Order number	: -	Date Analysis Commenced	: 07-Mar-2020
C-O-C number	: 7143	Issue Date	: 11-Mar-2020 10:06
Sampler	: VERONICA CANALES		
Site	: 2019010- Vulcan Saraji West (5&6) L4		
Quote number	: BN/1234/19		
No. of samples received	: 2		
No. of samples analysed	: 2		

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This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

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

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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC-5	KLC-6	----	----	----
			Client sampling date / time	03-Mar-2020 11:49	03-Mar-2020 11:49	----	----	----
Compound	CAS Number	LOR	Unit	EB2005904-001	EB2005904-002	--------	--------	--------
				Result	Result	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**5.59**	**6.68**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1060**	**275**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**3**	**18**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**3**	**18**	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**6**	**2**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**487**	**86**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**36**	**11**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**64**	**3**	----	----	----
Magnesium	7439-95-4	1	mg/L	**54**	**4**	----	----	----
Sodium	7440-23-5	1	mg/L	**86**	**44**	----	----	----
Potassium	7440-09-7	1	mg/L	**8**	**2**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.01**	**0.16**	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	**0.001**	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.001**	**0.001**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0088**	**0.0004**	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.025**	**0.006**	----	----	----
Cobalt	7440-48-4	0.001	mg/L	**0.552**	**0.021**	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.352**	**0.024**	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.971**	**0.026**	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.198**	**0.006**	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.007**	**0.058**	----	----	----
Selenium	7782-49-2	0.01	mg/L	**0.05**	**0.04**	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC-5	KLC-6	----	----	----
				Client sampling date / time	03-Mar-2020 11:49	03-Mar-2020 11:49	----	----	----
Compound	CAS Number	LOR	Unit		EB2005904-001	EB2005904-002	--------	--------	--------
					Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.18**	**0.18**	----	----	----
Iron	7439-89-6	0.05	mg/L		<0.05	**0.06**	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.4**	**0.6**	----	----	----
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**11.2**	**2.46**	----	----	----
ø **Total Cations**	----	0.01	meq/L		**11.6**	**2.44**	----	----	----
ø **Ionic Balance**	----	0.01	%		**1.62**	----	----	----	----

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2009682**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Carsten Emrich
Address	: PO BOX 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: Vulcan - 2019010	Date Samples Received	: 07-Apr-2020 17:00
Order number	: -	Date Analysis Commenced	: 08-Apr-2020
C-O-C number	: 10041	Issue Date	: 17-Apr-2020 11:48
Sampler	: VERONICA CANALES		
Site	: Vulcan 5 & 6 L5		
Quote number	: BN/1234/19		
No. of samples received	: 2		
No. of samples analysed	: 2		

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This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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Signatories

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

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

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC-5	KLC-6	----	----	----
			Client sampling date / time	07-Apr-2020 14:28	07-Apr-2020 14:29	----	----	----
Compound	CAS Number	LOR	Unit	EB2009682-001	EB2009682-002	--------	--------	--------
				Result	Result	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.03**	**6.98**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**660**	**225**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**6**	**17**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**6**	**17**	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**5**	**2**	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**291**	**77**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**17**	**8**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**31**	**2**	----	----	----
Magnesium	7439-95-4	1	mg/L	**30**	**3**	----	----	----
Sodium	7440-23-5	1	mg/L	**51**	**36**	----	----	----
Potassium	7440-09-7	1	mg/L	**6**	**2**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.05**	**0.24**	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	**0.002**	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	<0.001	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0064**	**0.0004**	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.029**	**0.009**	----	----	----
Cobalt	7440-48-4	0.001	mg/L	**0.346**	**0.020**	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.233**	**0.020**	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.777**	**0.036**	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.195**	**0.010**	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.006**	**0.035**	----	----	----
Selenium	7782-49-2	0.01	mg/L	**0.04**	**0.03**	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC-5	KLC-6	----	----	----
				Client sampling date / time	07-Apr-2020 14:28	07-Apr-2020 14:29	----	----	----
Compound	CAS Number	LOR	Unit		EB2009682-001	EB2009682-002	--------	--------	--------
					Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.15**	**0.06**	**----**	**----**	**----**
Iron	7439-89-6	0.05	mg/L		**0.07**	<0.05	**----**	**----**	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.5**	**0.8**	**----**	**----**	**----**
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**6.66**	**2.17**	**----**	**----**	**----**
ø **Total Cations**	----	0.01	meq/L		**6.39**	**1.96**	**----**	**----**	**----**
ø **Ionic Balance**	----	0.01	%		**2.07**	**----**	**----**	**----**	**----**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2011988**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Carsten Emrich
Address	: PO BOX 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: Vulcan - 2019010	Date Samples Received	: 06-May-2020 16:05
Order number	: -	Date Analysis Commenced	: 07-May-2020
C-O-C number	: 10786	Issue Date	: 12-May-2020 13:30
Sampler	: VERONICA CANALES		
Site	: 2019010_Vulcan_L7		
Quote number	: BN/1234/19		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

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

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Ionic Balance out of acceptable limits due to analytes not quantified in this report.
- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC-5	KLC-6	----	----	----
			Client sampling date / time	06-May-2020 08:26	06-May-2020 08:27	----	----	----
Compound	CAS Number	LOR	Unit	EB2011988-001	EB2011988-002	--------	--------	--------
				Result	Result	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.58**	**7.15**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**504**	**215**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**8**	**17**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**8**	**17**	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**2**	<1	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**215**	**69**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**8**	**6**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**26**	**2**	----	----	----
Magnesium	7439-95-4	1	mg/L	**28**	**4**	----	----	----
Sodium	7440-23-5	1	mg/L	**39**	**39**	----	----	----
Potassium	7440-09-7	1	mg/L	**5**	**2**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	**0.32**	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	**0.002**	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	**0.001**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0058**	**0.0004**	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.018**	**0.005**	----	----	----
Cobalt	7440-48-4	0.001	mg/L	**0.320**	**0.019**	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.221**	**0.018**	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.862**	**0.040**	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.202**	**0.007**	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.005**	**0.054**	----	----	----
Selenium	7782-49-2	0.01	mg/L	**0.03**	**0.03**	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC-5	KLC-6	----	----	----
				Client sampling date / time	06-May-2020 08:26	06-May-2020 08:27	----	----	----
Compound	CAS Number	LOR	Unit		EB2011988-001	EB2011988-002	--------	--------	--------
					Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.06**	<0.05	**----**	**----**	**----**
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	**----**	**----**	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.4**	**0.7**	**----**	**----**	**----**
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**4.86**	**1.94**	**----**	**----**	**----**
ø **Total Cations**	----	0.01	meq/L		**5.43**	**2.18**	**----**	**----**	**----**
ø **Ionic Balance**	----	0.01	%		**5.48**	**----**	**----**	**----**	**----**

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2014636**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: MR ALAN ROBERTSON	Contact	: Carsten Emrich
Address	: PO BOX 3091 SUNNYBANK SOUTH QLD, AUSTRALIA 4109	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: +61 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: Vulcan - 2019010	Date Samples Received	: 02-Jun-2020 16:45
Order number	: -	Date Analysis Commenced	: 03-Jun-2020
C-O-C number	: 11564	Issue Date	: 09-Jun-2020 09:36
Sampler	: VERONICA CANALES		
Site	: 2019010_Vulcan_L7-1		
Quote number	: BN/1234/19		
No. of samples received	: 2		
No. of samples analysed	: 2		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

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

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

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the 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 insufficient 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.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

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
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Sodium Adsorption Ratio (where reported): Where results for Na, Ca or Mg are <LOR, a concentration at half the reported LOR is incorporated into the SAR calculation. This represents a conservative approach for Na relative to the assumption that <LOR = zero concentration and a conservative approach for Ca & Mg relative to the assumption that <LOR is equivalent to the LOR concentration.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	KLC-5	KLC-6	----	----	----
			Client sampling date / time	02-Jun-2020 10:06	02-Jun-2020 10:07	----	----	----
Compound	CAS Number	LOR	Unit	EB2014636-001	EB2014636-002	--------	--------	--------
				Result	Result	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**6.48**	**7.28**	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**426**	**173**	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	<1	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	<1	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	**4**	**21**	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	**4**	**21**	----	----	----
ED038A: Acidity								
Acidity as CaCO3	----	1	mg/L	**2**	<1	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**180**	**48**	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**6**	**4**	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**21**	**2**	----	----	----
Magnesium	7439-95-4	1	mg/L	**21**	**3**	----	----	----
Sodium	7440-23-5	1	mg/L	**26**	**27**	----	----	----
Potassium	7440-09-7	1	mg/L	**4**	**2**	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.01	**0.33**	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	**0.002**	----	----	----
Arsenic	7440-38-2	0.001	mg/L	<0.001	**0.002**	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0052**	**0.0004**	----	----	----
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.016**	**0.007**	----	----	----
Cobalt	7440-48-4	0.001	mg/L	**0.262**	**0.016**	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.184**	**0.014**	----	----	----
Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	----	----	----
Zinc	7440-66-6	0.005	mg/L	**0.796**	**0.038**	----	----	----
Manganese	7439-96-5	0.001	mg/L	**0.174**	**0.007**	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	**0.002**	**0.027**	----	----	----
Selenium	7782-49-2	0.01	mg/L	**0.02**	**0.02**	----	----	----
Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	KLC-5	KLC-6	----	----	----
				Client sampling date / time	02-Jun-2020 10:06	02-Jun-2020 10:07	----	----	----
Compound	CAS Number	LOR	Unit		EB2014636-001	EB2014636-002	--------	--------	--------
					Result	Result	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Boron	7440-42-8	0.05	mg/L		**0.08**	**0.05**	**----**	**----**	**----**
Iron	7439-89-6	0.05	mg/L		<0.05	<0.05	**----**	**----**	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.4**	**0.6**	**----**	**----**	**----**
EN055: Ionic Balance									
ø **Total Anions**	----	0.01	meq/L		**4.00**	**1.53**	**----**	**----**	**----**
ø **Total Cations**	----	0.01	meq/L		**4.01**	**1.57**	**----**	**----**	**----**
ø **Ionic Balance**	----	0.01	%		**0.16**	**----**	**----**	**----**	**----**



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