Appendix M
Geochemical Assessment

TECHNICAL REPORT

Geochemical Assessment

Boggabri Coal Mine Modification 10

Prepared for: Xenith Consulting Pty Ltd

MINE WASTE AND
WATER MANAGEMENT

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TECHNICAL REPORT

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Boggabri Coal Mine Modification 10

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Glossary of terms and acronyms

Acidity	A measurement of the amount of acidity in a water sample generally derived using a titration method to a set pH value (in units of mg/L $CaCO_3$ equivalent).
Alkalinity	A measurement of the amount of alkalinity in a water sample generally derived using a titration method to a set pH value (in units of mg/L $CaCO_3$ equivalent).
ABA	Acid Base Account. Evaluation of the balance between acid generation and acid neutralisation processes. Determines the maximum potential acidity (MPA) and the inherent acid neutralising capacity (ANC), as defined below.
AHD	Australian Height Datum used for altitude measurement in Australia.
ALS	Australian Laboratory Services.
AMD	Acid and metalliferous drainage from mine waste materials characterised by low pH, elevated metal concentrations, high sulfate concentrations and high salinity.
ANC	Acid Neutralising Capacity expressed as kg H_2SO_4 per tonne of sample. A measure of a sample's maximum potential ability to neutralise acid.
ANC:MPA	The ratio of the acid neutralising capacity to the maximum potential acidity of a sample. Used to assess the risk of a sample generating acid conditions.
AS	Australian Standards
BCM	Boggabri Coal Mine
BCOPL	Boggabri Coal Operations Pty Ltd, a wholly owned subsidiary of Idemitsu Australia Pty Ltd (IA). BCOPL operates the BCM on behalf of IA and its joint venture partners.
Dispersive	Dispersive soil and rock materials are structurally unstable and disperse into basic particles such as sand, silt and clay in water. When a dispersive soil is wet, the basic structure has a tendency to collapse, whereas when it is dry it is prone to surface sealing and crusting.
EC	Electrical Conductivity, expressed as µS/cm.
eCEC	Effective cation exchange capacity provides a measure of the mass of exchangeable cations (Ca, Mg, Na and K) in a sample.
EIS	Environmental Impact Statement.
EP&A Act	*Environmental Planning & Assessment Act 1979*
ESP	Exchangeable sodium percentage provides a measure of the sodicity of a material and propensity to erode.
GAI	Geochemical Abundance Index
IA	Idemitsu Australia
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
ICP-AES	Inductively Coupled Plasma Atomic Emission Spectrometry.
INAP	International Network on Acid Prevention
Interburden	The material found in between ore layers, and considered to be of low economic value (i.e., a type of waste material).
KLC	Kinetic Leach Column. Leaching setup that generates time-dependent data on the kinetics and rate of acid generation and acid neutralising reactions under laboratory controlled (or onsite conditions).
Km	Kilometre

MOD_{10}	Modification 10 to SSD 09_0182
LoR	Limit of Reporting. Laboratory detection limit for the reporting of results for a particular geochemical test.
MPA	Maximum Potential Acidity. Calculated by multiplying the total sulfur or sulfide-sulfur (CRS) content of a sample by 30.6 (stoichiometric factor) and expressed as kg H_2SO_4 per tonne.
Mt	Million tonnes
Mtpa	Million tonnes per annum
NAF	Non-Acid Forming. Geochemical classification criterion for a sample that will not generate acid conditions.
NAF_{BARREN}	Non-acid forming and barren of sulfur (i.e. less than or equal to 0.1% sulfur).
NAPP	Net Acid Producing Potential, expressed as kg H_2SO_4 per tonne. Calculated by subtracting the ANC from the MPA.
NMD	Neutral mine drainage typically caused by exposure of sulfide minerals in mine waste materials to oxygen and water and then neutralisation by gangue minerals. Typically characterised by neutral pH and elevated concentrations of salts, sulfate and metals.
NSW	New South Wales
Overburden	The waste rock material found overlying the first coal horizon within the stratigraphic profile.
PAF	Potentially Acid Forming. Geochemical classification criterion for a sample that has the potential to generate acid conditions.
PC Titrator	Potentiometric Compact Titrator. PC Titrators are specially designed for routine applications and simple operation, allowing basic titration analysis from a single device.
pH	A measure of hydrogen ion (H^+) concentration.
ROM	Run of Mine
S	Sulfur.
SD	Saline Drainage. Water that is elevated in dissolved salts (e.g., Na^+, K^+, Ca^{2+}, Mg^{2+}, Cl^-, and SO_4^{2-}), but may have acidic, neutral, or alkaline pH.
Slaking	Disintegration of unconfined soil or rock after exposure to air and subsequent immersion in water.
Sodic	Sodic soil and rock materials are characterized by a disproportionately high concentration of sodium (Na) in their cation exchange complex and are innately unstable, exhibiting poor physical and chemical properties, which impede water infiltration, water availability, and ultimately plant growth.
SO_4^{2-}	Sulfate.
SSD	State Significant Development Approval
Static test	Procedure for characterising the geochemical nature of a sample at a single point in time. Static tests may include measurements of mineral and chemical composition of a sample and the Acid Base Account.
TSS	Total suspended solids is a measurement of the suspended solids concentration in a water sample.
TS	Total sulfur content of a sample generally measured using a 'LECO' analyser expressed as total sulfur%.
w:v	Weight to volume ratio.

1 Introduction

RGS Environmental Consultants Pty Ltd (RGS) has been commissioned by Xenith Consulting Pty Ltd (Xenith) on behalf of Boggabri Coal Operations Pty Limited (BCOPL) to undertake a Geochemical Assessment of a proposed extension to operations at the Boggabri Coal Mine (BCM) (MOD 10). The Geochemical Assessment will be appended to a Modification Report being prepared by Xenith in support of an application to modify the BCM approval (State Significant Development (SSD) approval 09_0182) under Section 4.55(2) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.1 Background

BCM is located approximately 15 km northeast of Boggabri in the Gunnedah Basin of New South Wales (NSW) and is located wholly within the Narrabri Local Government Area (LGA). BCM is part of the Boggabri, Tarrawonga, Maules Creek Coal Mining Complex (BTM Complex) and is immediately adjacent to the Tarrawonga Mine to the south and Maules Creek Mine to the north.

MOD 10 to SSD 09_0182 proposes the continuation of mining operations at BCM towards the north-west beyond the approved Mine Disturbance Boundary but entirely within the existing Project Boundary. The additional mining area proposed by MOD 10 is illustrated on **Figure 1-1**. Key parameters for the Modification include:

- Mining will continue to recover coal down to the Templemore Coal Seam within the existing Mine Disturbance Boundary recovering up to 15.4 Million tonnes (Mt)(approximate) of additional Run of Mine (ROM) coal resource;
- Operations in the Modification Disturbance Footprint will enable the recovery of an additional 14.5 Mt of ROM coal down to the Templemore Coal Seam;
- Disturbance to an additional 85 ha of land within the Project Boundary, maintaining the existing Vegetation Corridor as a condition in SSD 09_0182; and
- Extension to the life of mining operations by four years until the end of 2040; and
- Amendment to the Conceptual Final Landform design resulting from the additional mining proposed.

There are no proposed changes to the currently approved mining methods, annual ROM coal extraction rate of up to 8.6 Million tonnes per annum (Mtpa), the operational workforce, nor the coal seams approved to be mined at BCM. Further to this, MOD 10 does not seek to change the approved operational hours, mining related infrastructure, water management system, coal handling and processing, transport methods and rates and access to the mine site.

1.2 Geology

BCM is located within the Gunnedah Basin, one of the main coal basins in NSW. The deposit is located with the Permian-aged Maules Creek sub-basin and is underlain by the Boggabri Volcanics unit (which also separates the Maules Creek sub-basin from the Mulalley sub-basin to the west). Within topographical valleys, Quaternary alluvial deposits overlie the stratigraphy.

The Maules Creek sub-basin is comprised of a sedimentary sequence (the Maules Creek Formation) that consists of predominantly conglomerate and sandstone, with minor siltstone, claystone and coal seams present. Conglomerate beds dominate the top of the Maules Creek Formation, but finer sandstone and siltstone beds become more common towards the base of the formation. The underlying Boggabri Volcanics consist of rhyolite and pyroclastics, and minor sediments, basalt, andesite and tuffs are also present.

There are two coal-bearing sequences contained within the Gunnedah Basin – the early Permian aged Bellata Group, and the late Permian Black Jack Group. The majority of the Bellata Group coal seams are within the Maules Creek Formation. Currently, BCM mines coal from eight coal seams within the Bellata Group, including the Herndale, Onavale, Teston, Thornfield, Braymont, Bollol Creek, Jeralong and Merriown seams. The mine plan changes considered as part of the previous MOD 8 proposed to expand the number of coal seams mined to include the Velyama, Nagero, Northam, Therribri, Flixton, Tarrawonga and Templemore seams as illustrated in **Figure 1-2**.

Geological interpretation suggests that potential waste rock from the proposed Modification is likely to primarily comprise conglomerate and sandstone units.

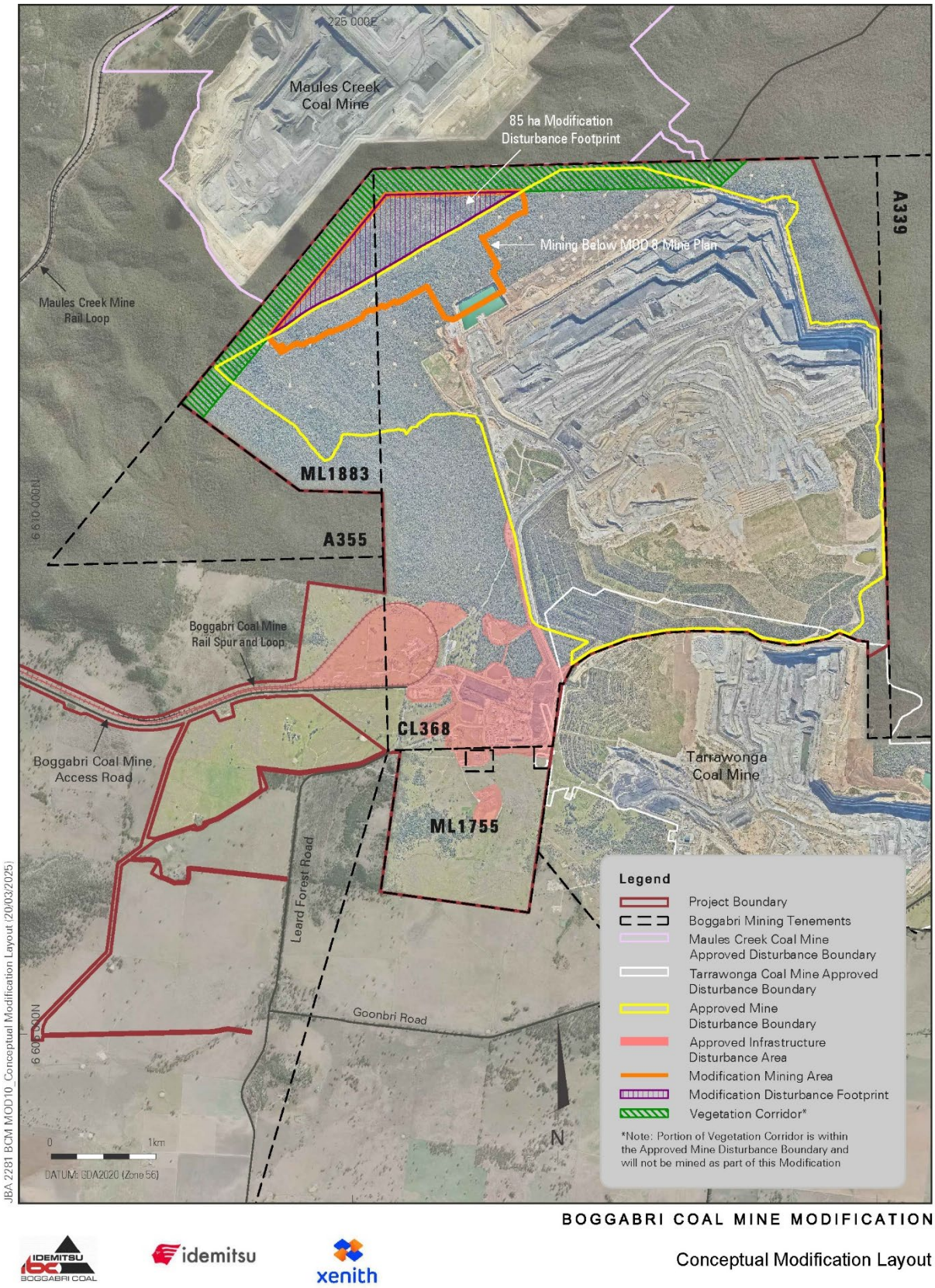
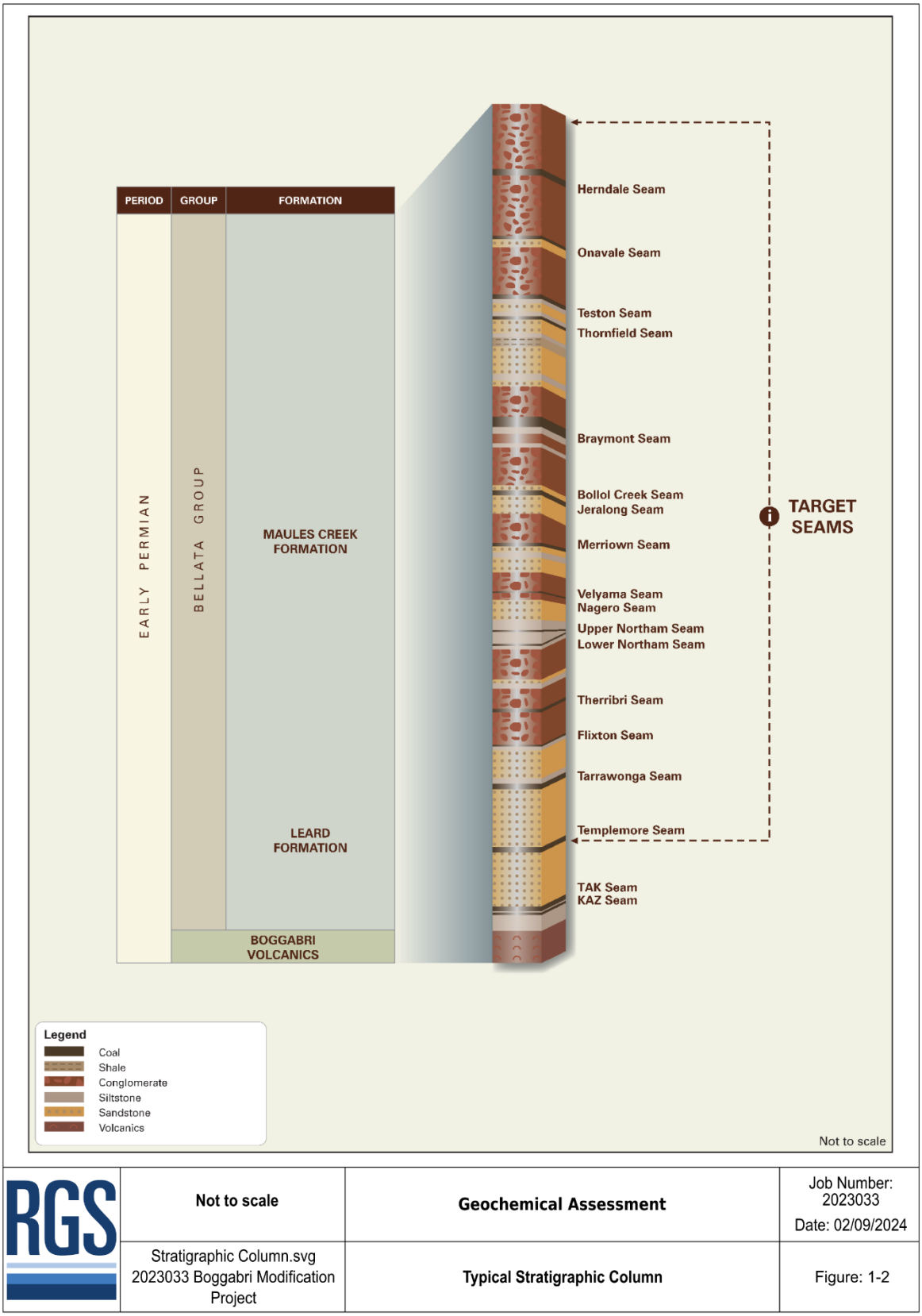


Figure 1-1: Conceptual Modification Layout



RGS	Not to scale	Geochemical Assessment	Job Number: 2023033 Date: 02/09/2024
	Stratigraphic Column.svg 2023033 Boggabri Modification Project	Typical Stratigraphic Column	Figure: 1-2

Figure 1-2: Typical Stratigraphic Column for BCM

2 Methodology

2.1 Review of previous work

Several geochemical assessment studies have previously been completed on overburden, interburden and potential/actual coal reject materials at BCM. These include the studies completed as part of the initial Environmental Impact Statement (EIS) for BCM (Boggabri EIS, 1987); geochemical assessments completed in 2006 (EGi, 2006) and 2009 (RGS, 2009) and more recent studies completed from 2019 to 2022 (RGS 2020a; 2021a; 2022a and 2023a and 2024). In addition, several geochemistry studies at neighbouring operations mining the same stratigraphic units below the Merriown seam have been completed such as Maules Creek (RGS, 2011; 2012; 2019c and 2020d) and Tarrawonga (URS, 2005; GEM, 2010; 2011; RGS 2017; 2019a; 2019b; 2020b; 2021b, 2022b and 2023b). A review of the results of these reports are provided in **Attachment A**.

2.2 Material sampling

The sampling methodology used to obtain representative samples was completed in accordance with relevant guidelines. While there are no specific regulatory requirements regarding the total number of samples required, existing risk-based technical guidelines for the geochemical assessment of mine waste materials in Australia (ACARP, 2008; AMIRA, 2002; COA, 2016) and worldwide (INAP, 2025) were used by RGS as a framework for the sampling program.

Three diamond core exploration drill holes within the Modification Disturbance Footprint were selected for sampling (**Table 2-1** and **Figure 2-1**). A total of 96 representative core samples of overburden, interburden, and coal seam roof and floor materials were collected for testing (**Table 2-2**). Throughout this report material above the highest targeted coal seam is referred to as overburden, materials immediately adjacent to the top and base of coal seams are referred to as coal seam roof and floor materials respectively, and strata that lies between the floors and roofs of coal seams are referred to as interburden. Generally, overburden and interburden materials are expected to report to mine waste emplacements while coal seam roof and floor may be mined with the coal resource and report as coal reject or tailing materials from the CHPP.

Samples were collected by BCM personnel and sent to RGS. Sample splits were then separated and sent to the National Association of Testing Authorities (NATA) accredited ALS Environmental Laboratory in Stafford, Queensland for geochemical testing.

Table 2-1: Drill holes selected for geochemical sampling

Drill Hole ID	Eastings (GDA 2020 Zone 56)	Northings (GDA 2020 Zone 56)	Total Depth (m)
BC2569	225206.26	6612808.76	282.56
BC2571	225599.07	6612805.91	316.65
BC2572	226198.04	6612998.13	324.12

Table 2-2: Drill core intervals and sample types selected for testing by drill hole

BC2569		
Sample type	From (m)	To (m)
Overburden	15.5	15.8
Overburden	21.3	21.6
Roof	24.4	24.7
Floor	28.4	29.0
Interburden	33.4	33.7
Roof	53.8	54.4
Floor	58.3	58.7
Interburden	66.4	66.7
Roof	94.2	94.8
Floor	99.2	99.5
Roof	101.5	102.2
Floor	103.6	103.9
Interburden	109.9	110.2
Roof	131.3	132.1
Floor	140.3	140.9
Interburden	143.6	143.9
Roof	175.0	175.3
Floor	178.6	178.9
Roof	185.6	185.9
Floor	189.3	189.6
Interburden	200.3	200.6
Roof	216.6	216.9
Floor	218.5	218.8
Roof	229.2	229.9
Floor	231.2	231.5
Roof	231.7	232.0
Floor	233.5	234.2
Interburden	240.5	240.8
Roof	247.4	248.0
Floor	250.9	251.4
Interburden	270.7	271.0
Roof	275.39	275.9
Floor	282.45	282.75

BC2571		
Sample type	From (m)	To (m)
Overburden	5.0	5.3
Overburden	24.6	24.9
Roof	35.6	35.9
Floor	40.3	40.6
Interburden	51.3	51.6
Roof	65.2	65.5
Floor	70.7	71.0
Interburden	84.4	84.7
Roof	106.4	106.7
Floor	111.0	111.3
Roof	114.9	115.5
Floor	116.5	116.8
Interburden	123.4	123.7
Roof	149.6	149.3
Floor	157.7	158.0
Interburden	168.5	168.8
Roof	189.8	190.1
Floor	192.5	192.8
Roof	202.9	203.2
Floor	206.2	206.5
Roof	236.6	236.9
Floor	238.1	238.8
Roof	244.8	245.2
Floor	246.3	246.6
Roof	246.7	247.0
Floor	248.4	248.7
Interburden	249.5	249.8
Roof	265.8	266.2
Floor	269.3	269.6
Interburden	283.7	284.0
Interburden	303.7	304.0
Roof	310.16	310.47
Floor	316.32	316.65

BC2572		
Sample type	From (m)	To (m)
Overburden	3.0	3.3
Overburden	13.7	14.0
Roof	17.2	17.6
Floor	18.6	18.9
Interburden	20.5	20.8
Roof	27.7	28.1
Floor	30.4	30.7
Interburden	48.0	48.3
Roof	58.8	59.1
Floor	67.5	67.8
Roof	70.9	71.2
Floor	71.8	72.1
Interburden	75.0	75.3
Roof	109.1	109.4
Floor	117.4	117.7
Interburden	133.0	133.3
Roof	147.9	148.2
Floor	151.6	151.9
Roof	168.4	168.7
Floor	171.9	172.2
Interburden	194.0	194.3
Roof	213.7	214.0
Floor	215.6	215.9
Roof	218.0	218.3
Floor	219.5	219.8
Roof	219.8	220.1
R/F	249.6	249.9
Floor	252.4	252.6
Interburden	255.0	255.3
Roof	276.2	276.5
Floor	278.4	278.6
Floor	283	283.3
Roof	303.38	303.68
Floor	306.2	306.5

Figure 2-1: Drill hole collar locations of holes selected for geochemical sampling

2.3 Geochemical characterisation

A series of geochemical characterisation tests were completed on the 96 samples. The test program was designed to assess the degree of risk associated with the presence and potential oxidation of sulfides, and the generation and presence/leaching of soluble metals/metalloids and salts. The assessment also included characterisation of salinity and major metal/metalloid concentrations.

A summary of the parameters involved in completing a static geochemical characterisation and assessment of coal reject materials is provided in **Attachment B**.

2.3.1 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) was used as a screening procedure whereby the acid-neutralising and acid-generating characteristics of a material were assessed. All 96 samples were screened using ABA by 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 by LECO high temperature method; and
- Acid Neutralising Capacity (ANC) [AMIRA, 2002 method].

Selected samples (n = 8) with total sulfur values greater than or equal to 0.1 %S were also tested for Chromium Reducible Sulfur (S_{CR}).

The results of the ABA screening assessment are discussed in **Section 3**. Maximum Potential Acidity (MPA) and Net Acid Producing Potential (NAPP) values were calculated from the total sulfur (or S_{CR} where available). S_{CR} data was preferentially used, as it provides a more accurate representation of the potential MPA and NAPP, as acid generation primarily forms from the reactive sulfide measured by this method.

Following a review of the initial static geochemical test results, individual samples were used to create 19 composite samples. All 19 composite samples were sent for whole rock multi-element testing at ALS laboratory and were tested for:

- pH [1:5 w:v, sample:deionised water];
- Electrical conductivity (EC) [1:5 w:v, sample:deionised water];
- Acidity and alkalinity as $CaCO_3$ mg/L [PC Titrator (1:5 w:v water extracts)];
- Total major cations (Ca, Mg, K, Na) [HCl and HNO_3 acid digest followed by ICP-AES/MS];
- Total metals (Al, As, B, Ba, Be, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Sb, Se, Th, U, V, and Zn) [HCl and HNO_3 acid digest followed by FIMS and/or ICP-AES/MS];
- Soluble major cations (Ca, Mg, K, Na) [ICP-AES/MS (1:5 w:v water extracts)];
- Soluble major anions (Cl, SO_4, F, Si, Reactive Phosphorus as P) [ICP-AES/MS and PC Titrator (1:5 w:v water extracts)]; and
- Soluble metals (Al, As, B, Ba, Be, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Sb, Se, Th, U, V, and Zn [ICP-AES/MS; FIMS (1:5 w:v water extracts)].

In addition, three of the 19 composite samples representing overburden and interburden were also tested for:

- Exchangeable Cations (Ca, Mg, Na, K) [by ICP-AES/MS].

The effective Cation Exchange Capacity (eCEC) and Exchangeable Sodium Percentage (ESP) values were calculated from the results received.

The ALS test results for the static geochemical test program are provided in **Attachment E**. Summary results tables are provided in **Attachment C** and discussed in **Section 3.1** and **3.2**.

2.3.2 Kinetic tests

Kinetic leach column (KLC) tests simulate the weathering process that leads to acid and base generation and reaction under laboratory-controlled conditions. The kinetic tests allow an assessment of the acid-forming and acid neutralising characteristics and indicate the rate of any acid generation, the period over which it will occur, and the management controls that may be required. A description of the methodology used for KLC tests is provided in **Attachment B**.

The results from the static geochemical analyses on individual and composite samples were used to assess appropriate composite samples for KLC testing. A total of four composite samples (one NAF coal seam roof and floor composite sample, one PAF coal seam roof and floor composite sample, one overburden material composite sample, and one interburden materials composite sample) were created based on material type and geochemical nature. The identities of the samples combined to create the KLC testing composite samples is shown in **Table 2-3**.

The KLC tests commenced leaching in January 2024 and were leached monthly for a period of six months until July 2024. Heat Lamps were used during daylight hours for the KLC tests between leaching events to simulate sunshine and ensure that the test materials dried out and were exposed to oxidising conditions. The KLC test containing the PAF coal seam roof and floor composite sample was continued for a further period of six months until January 2025 in order to reach a steady state.

The monthly KLC leachate samples were subjected to the following analyses:

- pH and EC;
- Alkalinity and Acidity (as $CaCO_3$) [Automatic titrator];
- Major cations (Ca, Mg, Na and K) [ICP-AES];
- Major anions (Cl, F and SO_4) [Discrete Analyser and PC Titrator]; and
- Soluble metals/metalloids (Al, As, B, Ba, Be, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Sb, Se, Th, U, V, Zn) [ICP-MS/ICP-AES].

KLC summary results tables and trends are provided in **Attachment D** and discussed in **Section 3.3**. The raw ALS laboratory test results for the kinetic geochemical test program are provided in **Attachment E**.

Table 2-3: KLC composite sample materials

KLC Composite	Sample Lithology	Coal Seam	Sample Type	Sample Type
1	Conglomerate	HE	Roof	Herndale and Onavale Seams Roof/Floor (PAF)
	Conglomerate			
	Conglomerate			
	Mudstone		Floor	
	Sandstone			
	Siltstone	ON	Roof	
	Conglomerate			
	Conglomerate			
	Sandstone		Floor	
	Sandstone			
	Siltstone			
2	Conglomerate	TS	Roof	Teston to TAK Seams Roof/Floor (NAF)
	Siltstone	TS	Floor	
	Sandstone	THO	Roof	
	Sandstone	THO	Floor	
	Siltstone	BRU	Roof	
	Sandstone	BR	Floor	
	Claystone	JE	Roof	
	Carbonaceous Mudstone	JE	Floor	
	Siltstone	MN	Roof	
	Siltstone	MN	Floor	
	Conglomerate	VY	Roof	
	Siltstone	VY	Floor	
	Carbonaceous Mudstone	NG	Roof	
	Siltstone	NG	Floor	
	Sandstone	NT	Roof	
	Mudstone	NT/TH	Floor/Roof	
	Sandstone	TH	Floor	
	Siltstone	FX	Roof	
	Carbonaceous Mudstone	FX/TA	Floor/Roof	
	Siltstone	TA	Floor	
	Sandstone	TP	Roof	
	Pellet Claystone	TP	Floor	
	Carbonaceous Claystone	TAK	Floor	
3	Sandstone		Overburden	Overburden (NAF)
	Conglomerate			
	Conglomerate			

KLC Composite	Sample Lithology	Coal Seam	Sample Type	Sample Type
4	Sandstone		Interburden	Interburden (NAF)
	Conglomerate			
	Conglomerate			
	Sandstone			
	Conglomerate			
	Sandstone			
	Conglomerate			
	Siltstone			
	Siltstone			
	Conglomerate			
	Siltstone			
	Conglomerate			
	Sandstone			
	Conglomerate			
	Sandstone			
	Siltstone			
	Sandstone			
	Conglomerate			
	Sandstone			
	Conglomerate			
	Conglomerate			

3 Geochemical Characterisation

3.1 Acid-Base Account

Acid Base Account (ABA) results for the 96 samples (overburden, interburden, roof and floor) are provided in **Table C1** (**Attachment C**) and data trends are presented in **Figures 3-1** to **3-8**. ABA results are shown by material type to facilitate interpretation.

pH

The $pH_{(1:5)}$ values for the coal seam roof and floor, overburden, and interburden samples obtained from the Modification Disturbance Footprint range from acidic to alkaline (pH 4.1 to 9.0) but are generally circum-neutral to alkaline with a median $pH_{(1:5)}$ value of 7.9 (**Figure 3-1**). Coal seam roof and floor samples are generally less alkaline than overburden and interburden samples and the lowest pH values are associated with some of the roof and floor samples from the Herndale and Onavale coal seams.

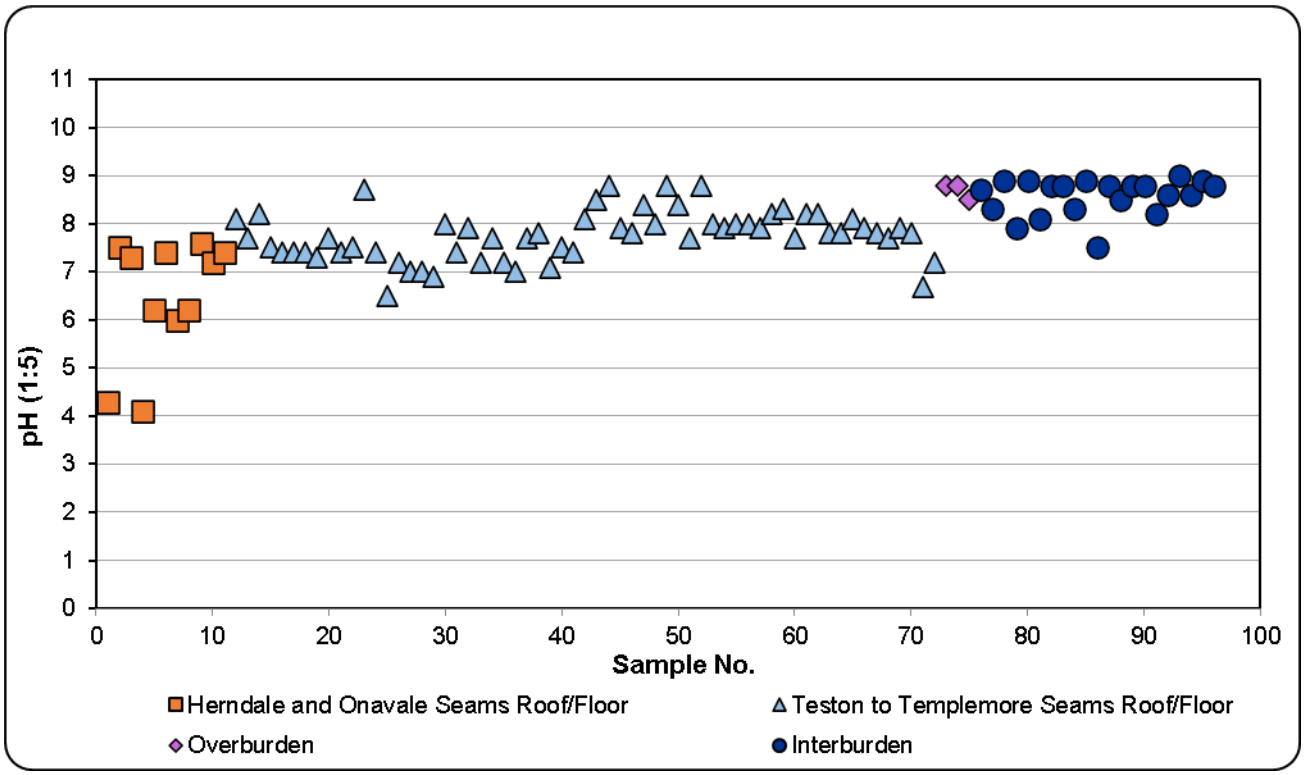


Figure 3-1: pH(1:5) values for samples from the BCM Modification Disturbance Footprint

Electrical Conductivity

$EC_{(1:5)}$ values for the samples range from 22 to 2,790 µS/cm, with a median of 125 µS/cm (**Figure 3-2**). Elevated $EC_{(1:5)}$ values relative to most samples are associated with coal seam roof and floor samples from the Herndale and Onavale Seams. While there is some variation in values, overburden (median $EC_{(1:5)}$ of 214 µS/cm), interburden (median $EC_{(1:5)}$ of 194 µS/cm), and roof and floor samples from the Teston to Templemore seams generally had lower $EC_{(1:5)}$ values than some of the roof and floor samples collected from the Herndale and Onavale Seams (median $EC_{(1:5)}$ of 91 µS/cm).

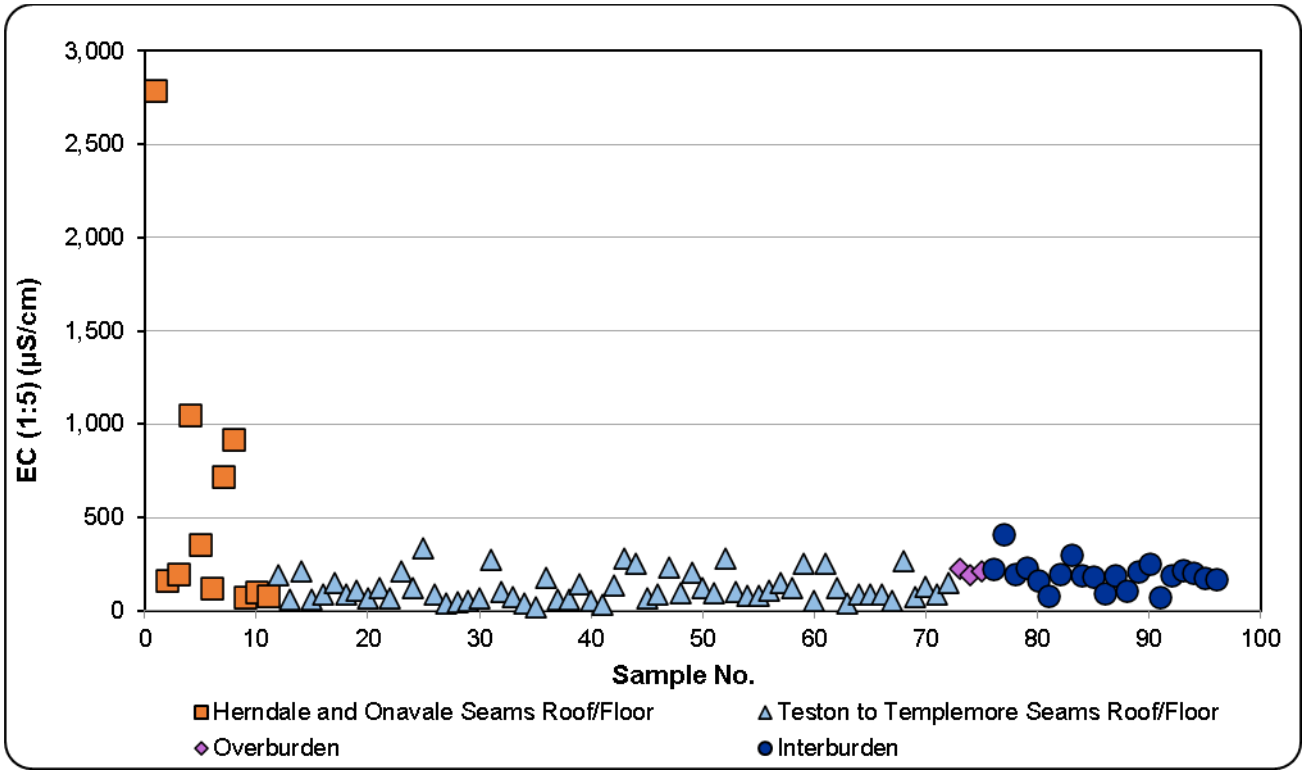


Figure 3-2: EC(1:5) values for samples from the BCM Modification Disturbance Footprint

Total and sulfide sulfur

Total sulfur concentration values for samples range from 0.1 % to 6.76 %, with a median of 0.03 %. Roof and floor samples from the Herndale and Onavale Seams showed the greatest variability in total sulfur concentration values (**Figure 3-3**). Most other coal seam roof and floor, overburden, and interburden samples have total sulfur concentration values less than the median crustal abundance of sulfur in unmineralised soils of 0.1 % (Bowen, 1979)

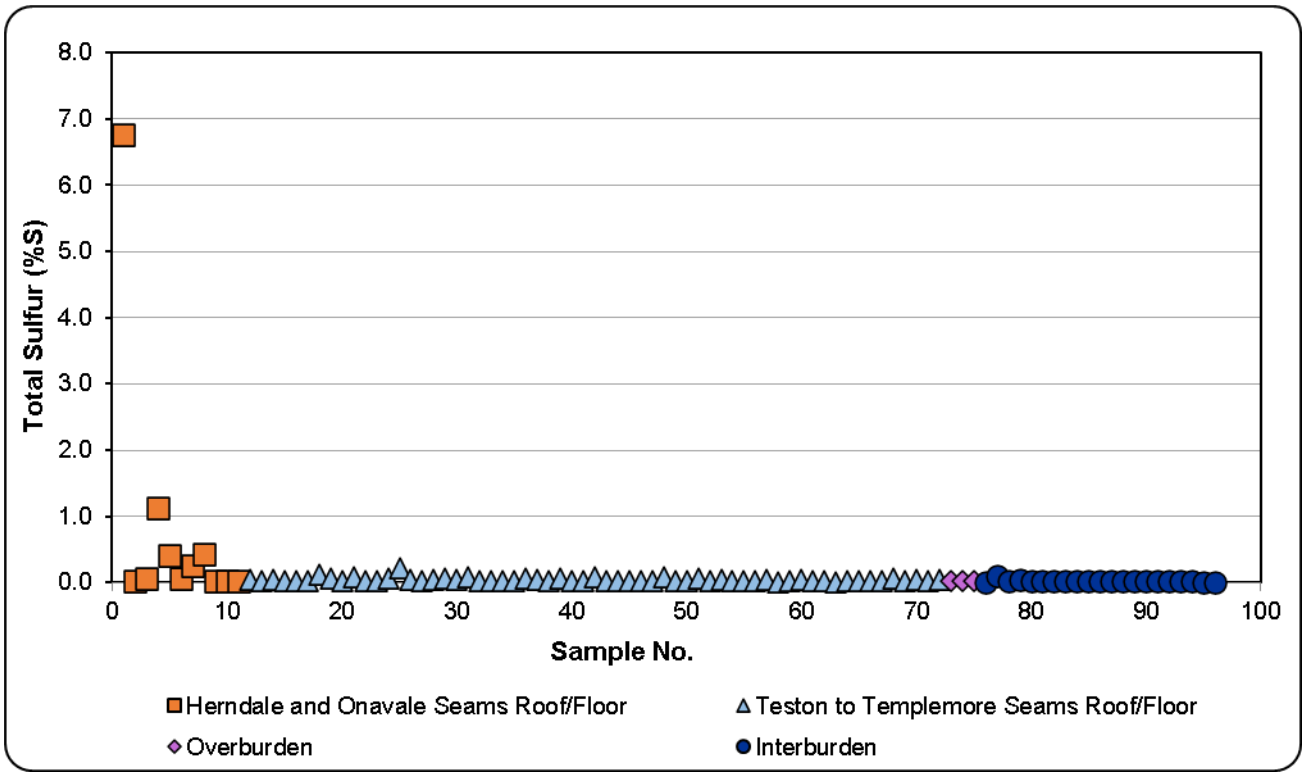


Figure 3-3: Total sulfur concentration values for samples from the BCM Modification Disturbance Footprint

Based on guidance from INAP (2025), eight samples with total sulfur concentration values greater than or equal to the median crustal abundance of sulfur (0.1 %) in unmineralised soils (Bowen, 1979) were also tested for S_{CR}.

The proportions of total sulfur present as sulfide in the eight samples tested ranges from 42 % in a carbonaceous mudstone roof sample from the Thorndale Seam to 92 % in a sandstone floor sample from the Herndale Seam (**Figure 3-4**). The five samples tested from the roof and floor materials of the Herndale and Onavale Seams all had sulfide sulfur concentration values of over 50 % of the total sulfur concentration values. Hence, some of the sulfur is present in these selected samples in a sulfide form that has the potential to oxidise and generate acidity.

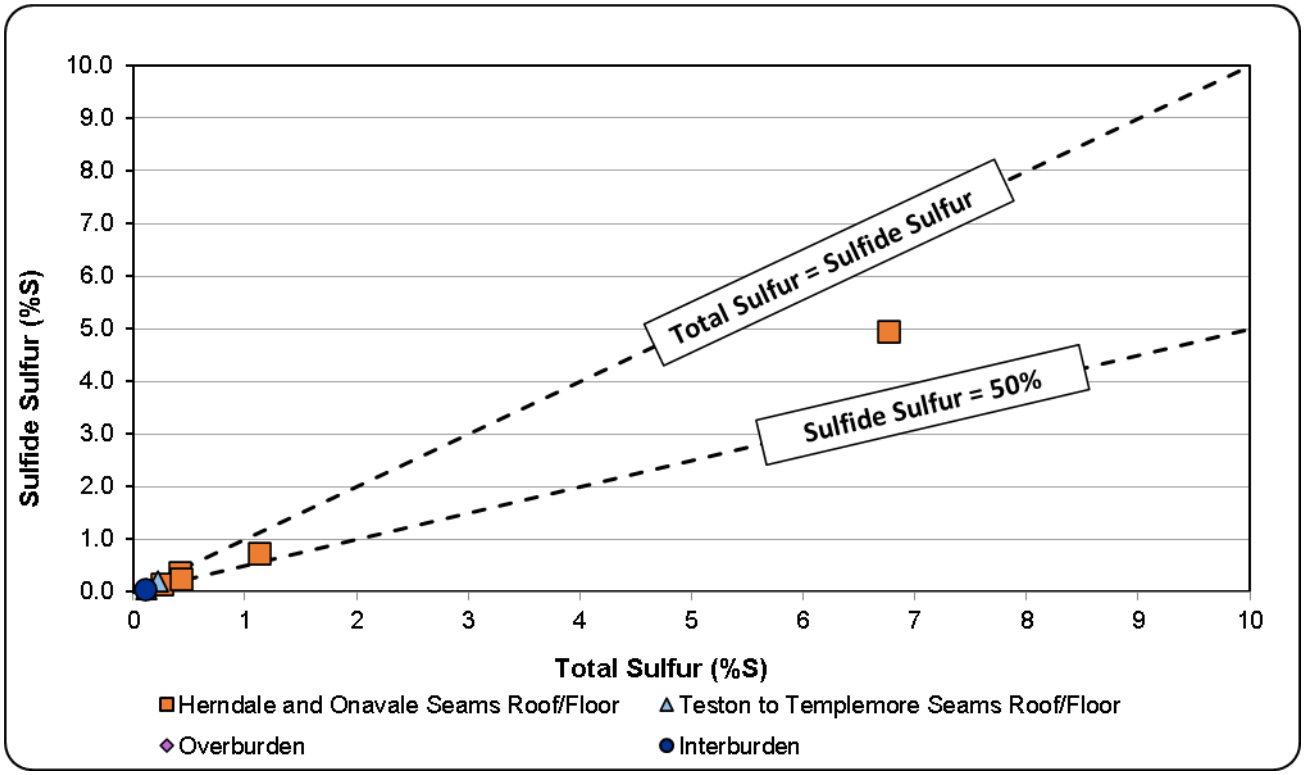


Figure 3-4: Sulfide sulfur vs total sulfur concentration values for samples from the BCM Modification Disturbance Footprint

Acid Neutralising Capacity and Maximum Potential Acidity

The ANC values of the samples range from 0.3 to 500 kg H_2SO_4/t, with a median value of 14.2 kg H_2SO_4/t. Generally, ANC values of greater than 50 kg H_2SO_4/t are associated with siltstone, sandstone, and conglomerate overburden and interburden samples. ANC values of less than 10 kg H_2SO_4/t are associated with various coal seam roof and floor samples, which exhibit a range of lithological types.

The MPA values of the samples range from 0.3 to 151.9 kg H_2SO_4/t, with a median of 0.9 kg H_2SO_4/t. The highest MPA values are associated with some coal seam roof and floor samples from the Herndale and Onavale Seams, while all other samples have much lower MPA values (maximum 6.1 kg H_2SO_4/t for a siltstone sample from the roof of the Braymont Upper Seam).

Figure 3-5 shows the relationships between ANC and MPA for all samples, with **Figure 3-6** showing the same relationship for samples with ANC values of less than 100 kg H_2SO_4/t and MPA values of less than 50 kg H_2SO_4/t. Samples with S_{CR} (or total sulfur in the absence of S_{CR}) concentration values of less than 0.1 % or with an ANC to MPA ratio of greater than 3 are considered to have a higher factor of safety and pose a negligible risk of acid generation. Samples with sulfur/sulfide concentration values of greater than 0.1 % and an ANC to MPA ratio of less than 1 are considered to have a lower factor of safety and may have some risk of acid generation.

One conglomerate roof sample from the Onavale seam has an ANC to MPA ratio between 2 and 3 and so is described as low risk in regard to acid generation. Two roof samples (one siltstone from the Braymont Upper and one conglomerate from the Onavale) have ANC to MPA ratios between 1 and 2 and so have a possible risk of acid generation. Three samples from the Herndale Seam (one sandstone floor sample, one mudstone floor sample, and one conglomerate roof sample) have ANC to MPA ratios between 0 and 1 and are considered to have a low factor of safety and to pose an increased risk of acid generation. The remaining 90 samples tested have sufficiently low sulfur concentration values that they are considered to have a high factor of safety and a negligible risk of acid generation.

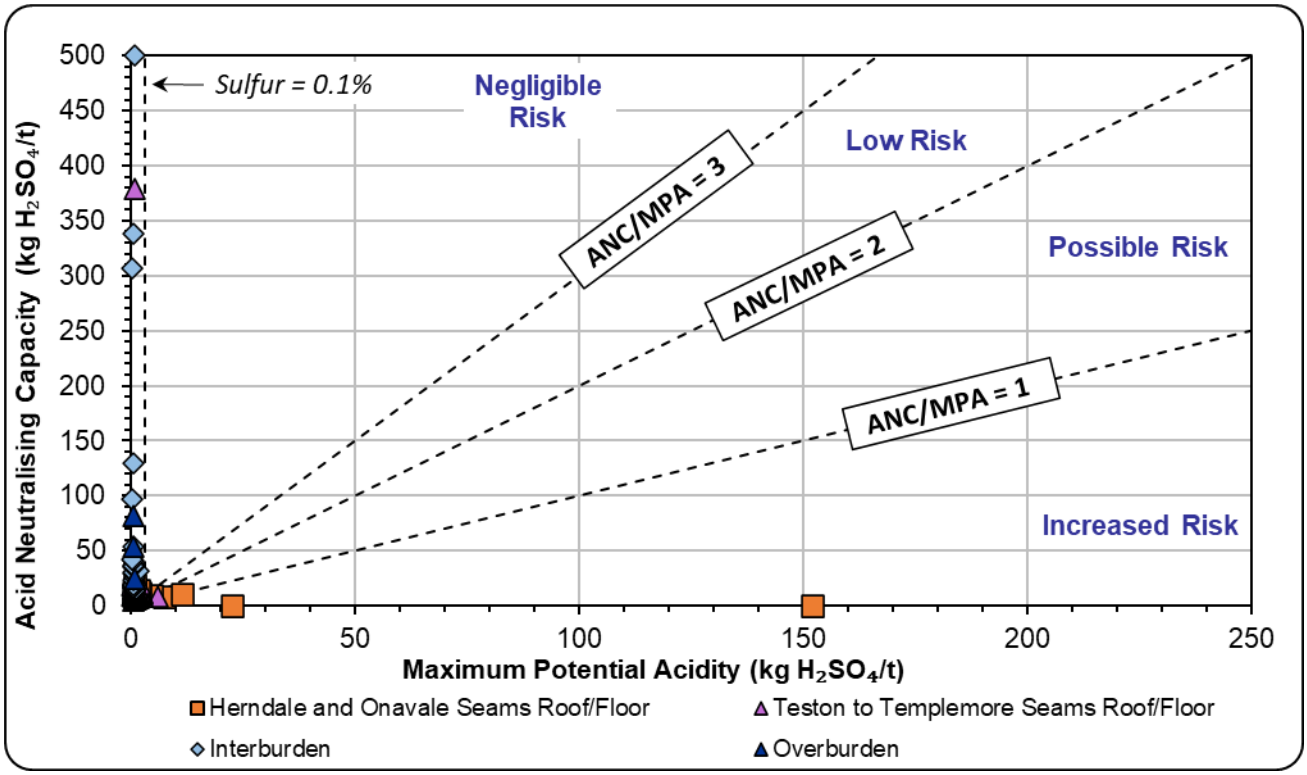


Figure 3-5: ANC vs MPA values for samples from the BCM Modification Disturbance Footprint

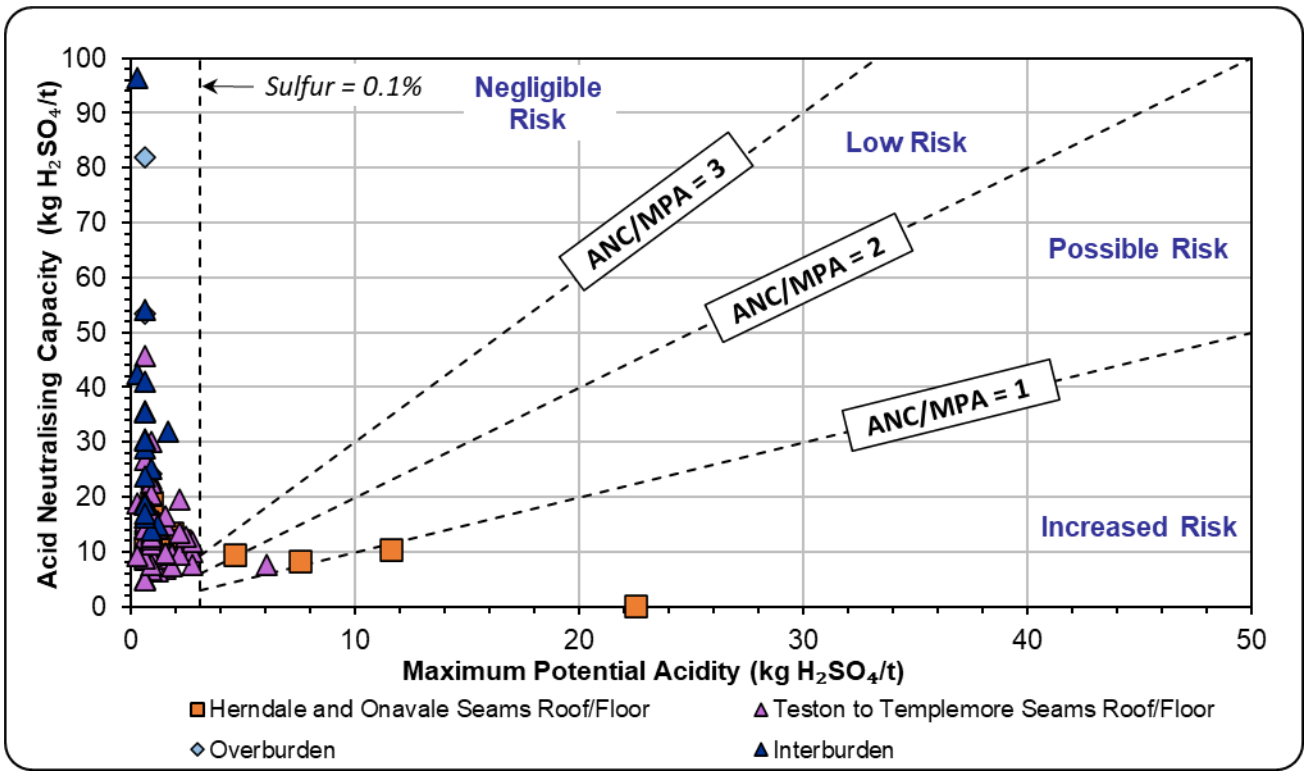


Figure 3-6: ANC vs MPA values for samples with MPA values less than 50 kg H_2SO_4/t from the BCM Modification Disturbance Footprint

Net Acid Producing Potential

NAPP values describe the balance of the ANC and MPA of a sample. A positive NAPP value indicates that the MPA of a sample exceeds the ANC of the sample and a negative NAPP value indicates an excess of ANC relative to the MPA. NAPP values for the samples range from -499.1 to 151.7 kg H_2SO_4/t, with a median of -13.2 kg H_2SO_4/t. Three samples from the Herndale Seam (one sandstone floor sample, one mudstone floor sample, and one conglomerate roof sample) have positive NAPP values, while all other samples have negative NAPP values (**Figure 3-7**).

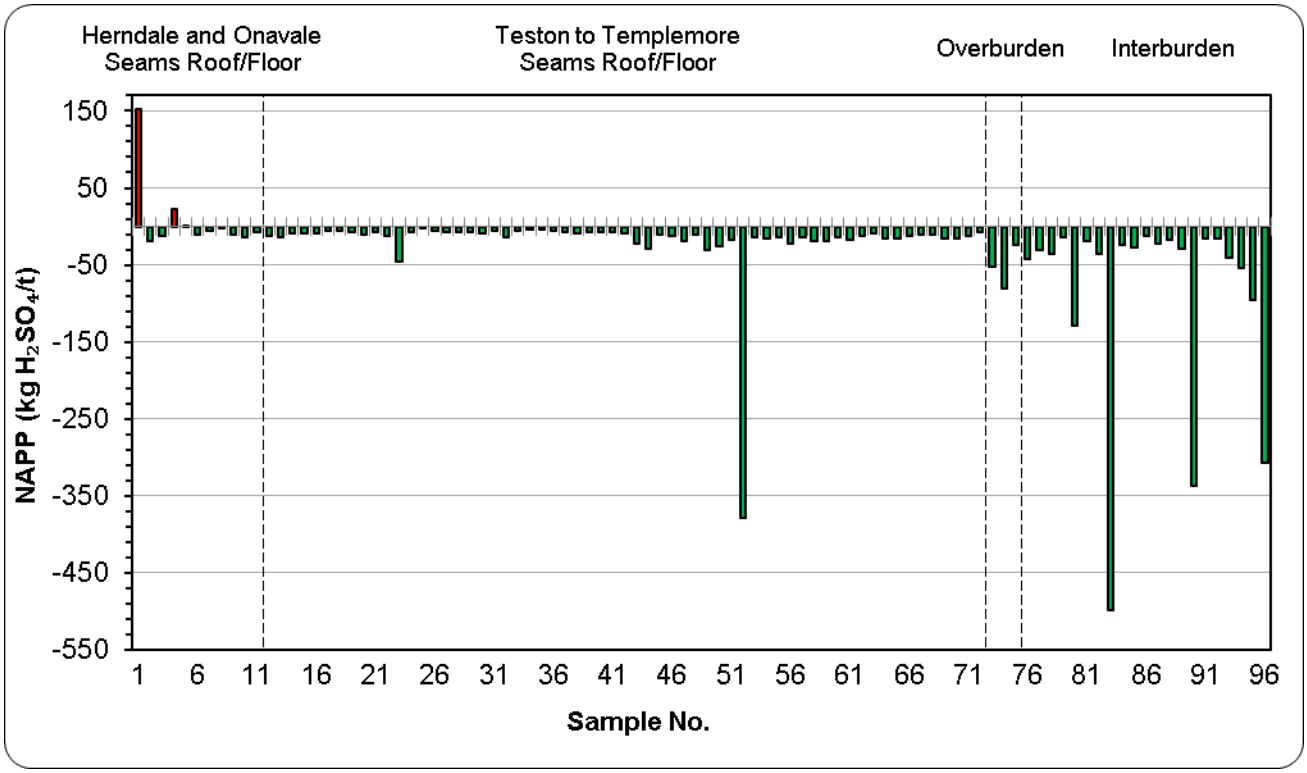


Figure 3-7: NAPP values for samples from the BCM Modification Disturbance Footprint

Geochemical classification

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 is shown in **Table 3-1**. The classification criteria reflect Australian (COA, 2016) and international (INAP, 2025) guidelines for the classification of mining waste materials.

The Acid Base Account test data presented in **Table C1 (Attachment C)** and discussed in this section have been used to classify the acid forming nature of the 96 coal seam roof and floor, overburden, and interburden samples.

Table 3-1 shows that of the 96 samples tested, 90 samples are classified as Non-Acid Forming (NAF) (Barren), four samples are classified as Uncertain, and two samples are classified as Potentially Acid Forming (PAF). **Figure 3-8** shows the classification of samples by material, with overburden, interburden, and most coal seam roof and floor samples from the Teston and Templemore Seams (inclusive) are NAF (Barren). Roof and floor materials from the Herndale and Onavale Seams have varied classifications, with six samples classified as NAF (Barren), three samples classified as Uncertain, and two samples classified as PAF.

Table 3-1: Geochemical classification criteria for samples from the BCM Modification Disturbance Footprint

Classification	Sulfur[1] (%)	NAPP[2] (kg H^2SO^4/t)	Number of Samples
Non-Acid Forming (Barren)[3]	≤ 0.1	-	90
Non-Acid Forming	> 0.1	< - 5	0
Uncertain	> 0.1	> - 5 to ≤ + 5	4
Potentially Acid Forming - Low Capacity	> 0.1	> + 5 to ≤ + 10	0
Potentially Acid Forming	> 0.1	> 10	2

Notes:

1. Where available S_{CR} concentration values have been used to classify samples, in the absence of S_{CR} values total sulfur concentration values are used instead.
2. 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.
3. 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.

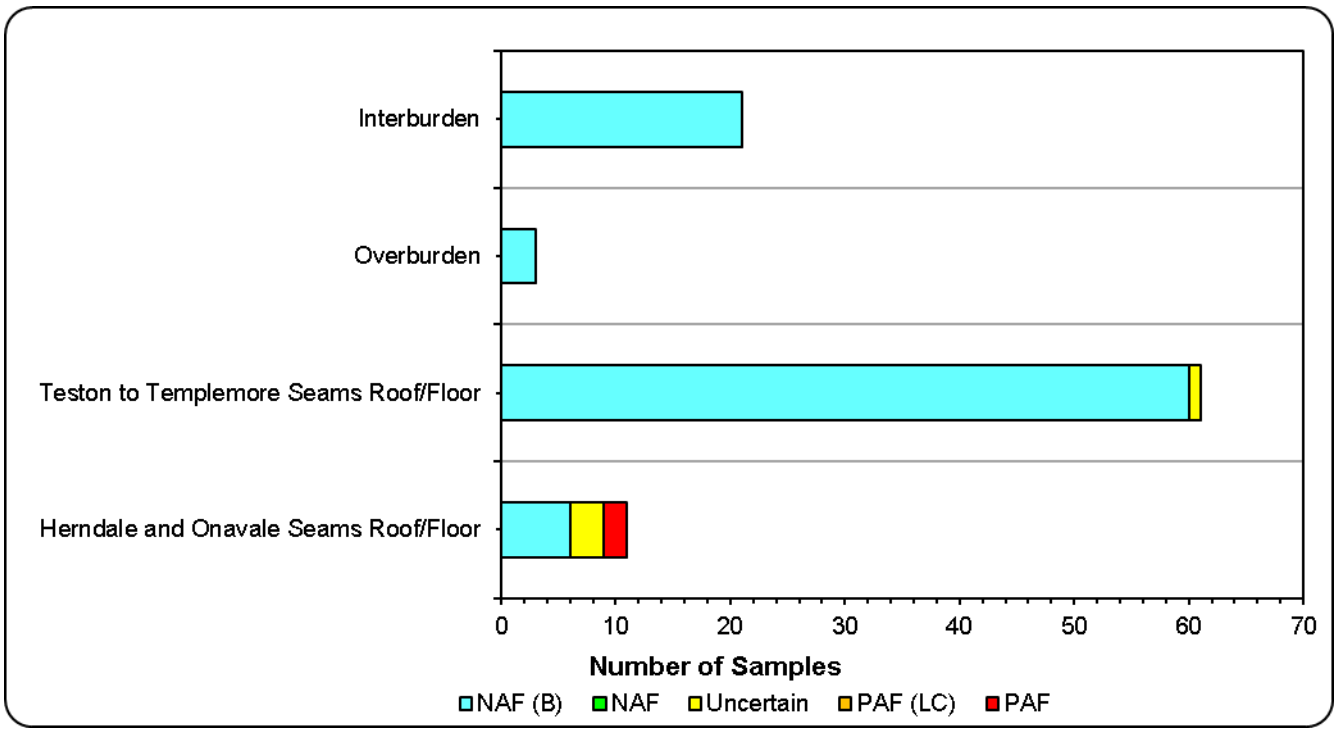


Figure 3-8: Geochemical classifications of samples from the BCM Modification Disturbance Footprint by material type

Total Sulfur in BCM Coal Seams

RGS has been provided with a database containing total sulfur information for 198 samples from the target coal seams at BCM. **Figure 3-9** illustrates the overall total sulfur distribution for all of the current target coal seams at BCM. **Figure 3-10** provides an example of the variability of the total sulfur concentration within a specific coal seam (the Braymont seam) and illustrates that while there are a few samples with higher total sulfur concentration, the majority of the total sulfur concentrations in the samples are relatively low and in the range 0.3 to 0.5 %.

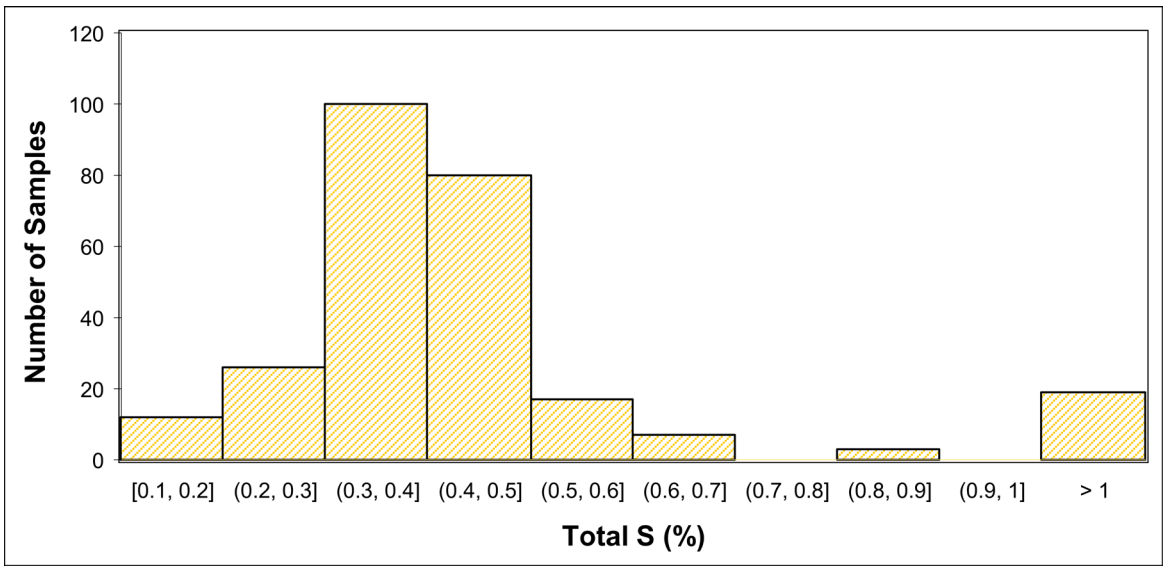


Figure 3-9:: Total Sulfur Content in all BCM Coal Seams

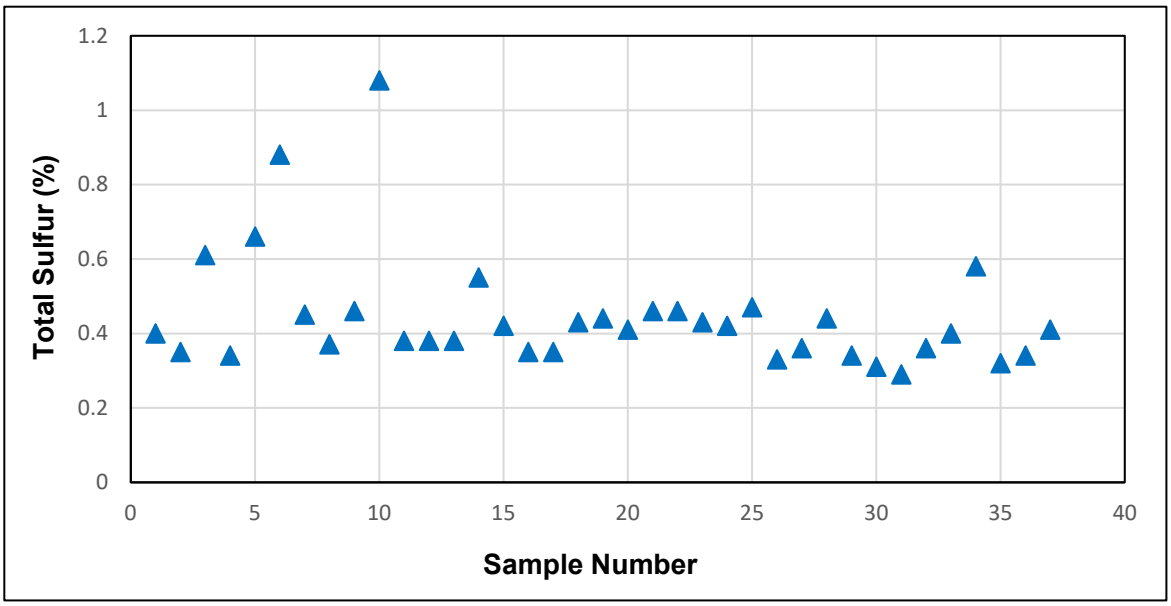


Figure 3-10:: Total Sulfur Content of Braymont Seam

3.2 Multi-Element Analysis

Based on the results of the ABA testing and the sample types, 19 composite samples were tested for total and soluble multi-element testing. The metals and metalloids selected for testing are listed in **Section 2.3.1**. One composite sample comprises overburden materials, two composite samples comprise interburden materials, and 16 composite samples represent coal seam roof and floor samples. The individual samples within each composite are provided in **Table C1 (Attachment C)**.

Total multi-element analysis

Multi-element assays were carried out on 19 composite samples to identify elements (metals or metalloids) that may be present in the sample materials at concentrations that could be of environmental concern with respect to materials handling, storage, revegetation, and water quality. The samples underwent an aqua regia digest (1-part nitric acid to 3-parts hydrochloric acid by volume), following testing by inductively coupled plasma atomic emission spectroscopy or mass spectrometry (ICP-AES/ICP-MS) for selected elements. The results of the total multi-element testing are provided in **Table C2 (Attachment C)**. To help provide context for the total multi-element analysis results values have been compared against the median crustal abundances in unmineralised soils for the selected metals and metalloids.

Geochemical Abundance Index

Total metal/metalloid concentrations in mine materials can be compared to the median crustal abundance for unmineralised soils (Bowen, 1979, INAP, 2025). The extent of enrichment is reported as the Geochemical Abundance Index (GAI), which relates the actual concentration in a sample with the median crustal abundance on a $\log_2$ 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 (**Table 3-2**).

Table 3-2: 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 As, Cr, Cd, Cu, Pb, Se and Zn, more so than with major rock-forming elements, such as Al, Ca, Fe, Mg and Na.

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

- The median crustal abundance varies between different literature sources, therefore affecting the calculated GAI values.
- If a sample is shown to be enriched relative to the median crustal abundance, there is no direct correlation that particular sample will also leach metals/metalloids at elevated concentrations. The mobility of metals/metalloids is dependent on mineralogy, adsorption/desorption and the environment in which it occurs.
- Whilst some element concentrations can be elevated relative to the median crustal abundance, the nature of an ore deposit means the background levels are generally expected to be elevated.

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 Al, Cu, Cd, Fe and Zn can increase significantly.

GAI values for the 19 composite samples are shown in **Table C3 (Attachment C)**. All samples, regardless of sample material type, show little or no enrichment relative to the median crustal abundance of the selected metals and metalloids in unmineralised soils (i.e. all samples have GAI values less than 3).

Exchangeable Cations and Sodicity

The exchangeable cation results for the three composite overburden and interburden samples are presented in **Table C2** (**Attachment C**). The results show that the effective Cation Exchange Capacity (eCEC) of the samples ranges from 1.7 to 3.3 meq/100g and is typically low. These values indicate that materials represented by the overburden and interburden samples are typically within the 'Very Low' range for eCEC (**Table 3-3**) in typical soils.

Table 3-3: Ratings for Effective Cation Exchange Capacity

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

The low concentration of exchangeable cations in these samples indicates that nutrient levels are also low. The addition of some fertiliser and organic materials to the surface of final landforms as part of rehabilitation activities may therefore assist in revegetation activities.

The exchangeable sodium percentage (ESP) results for the overburden and interburden samples are less than the laboratory limit of reporting (LoR) (0.2 %). In broad terms, samples with ESP values less than 6 are considered non-sodic, greater than 6 are considered sodic and greater than 14 are considered strongly sodic and may be susceptible to dispersion and erosion (Isbell, 2002; Northcote and Skene, 1972).

The overburden and interburden materials represented by the selected samples therefore have low ESP values and are unlikely to be sodic and dispersive. Therefore, no special management measures are required for these materials during rehabilitation activities beyond those currently used by BCM.

Water Extract Tests

There are no specific regulatory criteria for metal/metalloid concentrations in leachate from mining waste materials on mine sites in NSW. As such, RGS has compared the multi-element results in water extracts from the 19 composite samples with Australian water quality guideline values for freshwater aquatic ecosystems (95 % species protection level) and livestock drinking water (ANZG, 2018). 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" or "trigger" values. Using sample pulps (ground to passing 75µm) provides a high surface area to solution ratio, which encourages mineral reaction and dissolution of the solid phase. The results from screening tests on water extract solutions essentially represent a "worst case" scenario for initial surface runoff and seepage from mine materials.

The results from multi-element testing of water extracts (using a $1:5_{(w:v)}$ sample to water ratio) from the 19 composite samples are presented in **Table C4** (**Attachment C**).

The pH values for the sample water extracts range from acidic to alkaline (pH 4.3 to 8.9). Most samples are circum-neutral (median pH 7.9) with more alkaline values associated with overburden and interburden materials. The only composite sample that generates an acidic pH value is the PAF Herndale seam roof and floor sample (pH 4.3) which is lower than the applied guideline range for freshwater aquatic ecosystems of pH

6 to 9. The EC values for the water extracts are all less than the applied guideline value of 1,000 µS/cm and range from 51 to 985 µS/cm, with a median value of 196 µS/cm. The highest EC value is associated with the water extract from the PAF Herndale seam roof and floor sample.

All water extract samples, except the Herndale roof and floor sample, had excess alkalinity relative to acidity leading to a positive net alkalinity value. The Onavale roof and floor sample water extract had relatively balanced acidity and alkalinity values (net alkalinity = +10 mg/L $CaCO_3$ equivalent) compared to other composite samples (net alkalinity ranges from +107 to +9,279 mg/L $CaCO_3$ equivalent, median 499 mg/L $CaCO_3$ equivalent). Sample water extracts from the overburden and interburden samples had acidity values below the LoR (1 mg/L $CaCO_3$ equivalent) and generally higher net alkalinity values.

The concentration of major cations in the sample water extracts are generally low and variable. Major anions in the water extracts are dominated by bicarbonate and sulfate. The water extract from the PAF Herndale roof and floor sample has the highest concentrations of calcium, magnesium and sulfate. Notwithstanding the sulfate concentration in the water extracts is typically more than an order of magnitude less than the applied livestock drinking water guideline value of 1,000 µS/cm.

Dissolved metal and metalloid concentrations in the water extracts from the composite samples are generally low with most results below the laboratory LoR. Exceptions include the concentrations of aluminium (3 samples), arsenic (1 sample), manganese (1 sample), nickel (2 samples), selenium (1 sample) and zinc (4 samples), which can be greater than the applied Australian water quality guideline values for freshwater aquatic ecosystems (95 % species protection level) (ANZG, 2018). The water extract from the PAF Herndale roof and floor material composite sample has an aluminium concentration that is marginally greater than the applied livestock drinking water guideline value of 5 mg/L.

Based on these results, it is expected that the risk of potential impact on the quality of surface water and groundwater from initial contact with NAF mine materials generated from the Modification area will be low. However, if any PAF roof and floor materials from the Herndale seam (and possibly the Onavale seam) are unmanaged and allowed to freely oxidise, it is possible that inherent sulfides could react and generate acidity and lower pH conditions, which can influence the level of sulfate salt generation and the solubility and mobility of metal/metalloids.

Notwithstanding, if PAF roof and floor materials are managed in a similar manner to PAF coal reject materials (i.e., by placement deep in the open pit profile and covered with NAF spoil material), the potential for elevated sulfate salt and metal/metalloid concentrations in any surface runoff and seepage from the pit is expected to be low. This finding should be confirmed by the ongoing water quality monitoring program at the site.

3.3 Kinetic Leach Column Tests

The dynamic quality of contact water (if mine waste materials are not managed and are left exposed to oxidising conditions) and the potential risk to water resources from these materials at the BCM was investigated further using a KLC test program. The KLC test data also has the potential be used as an input into the development of source terms associated with any future site water balance/quality modelling activities and/or closure studies at the BCM.

KLC 2, KLC 3, and KLC 4 underwent seven monthly KLC leaching events from January to July 2024 and the KLC containing the PAF coal seam roof and floor composite sample (KLC 1) continued for a further six months until January 2025 in order to achieve a steady state. The KLC results have been tabulated and data trends are provided in **Attachment D**. The leachate results for the four KLC tests are summarised below.

The pH of the leachate collected from the NAF samples is generally stable and in the neutral pH range for the Teston to TAK Seams roof and floor (KLC 2), overburden (KLC 3), and interburden (KLC 4) materials. The pH of the leachate collected from the PAF Herndale and Onavale Seams roof and floor sample (KLC 1) is acidic and relatively stable at approximately pH 3. The relatively quick initial drop in pH value for KLC 1 suggests that the sample has very little buffering capacity. The pH of the deionised water used in the KLC tests ranges from 5.1 to 7.6 and suggests that only KLC 1 adds any appreciable acidity to contact water over time.

The net alkalinity for leachate collected from the PAF KLC 1 sample is negative and trends toward a value of approximately -600 mg/L ($CaCO_3$ equivalent) with no appreciable alkalinity. Net alkalinity values for leachate collected from the NAF samples KLC 2, 3, and 4 are close to zero and trend towards a slightly positive value indicating a slight excess of alkalinity relative to acidity. Net alkalinity values for these NAF samples are less than 15 mg/L ($CaCO_3$ equivalent).

The EC value for leachate from the most recent leach (Leach 15) from the PAF KLC 1 sample is 2,240 µS/cm and has remained elevated relative to leachate from other KLCs throughout the test period. Salinity values in the leachates from the NAF samples (KLC 2, 3, and 4) are an order of magnitude lower than the PAF sample and are relatively stable.

Major ion concentrations in leachate collected from the PAF KLC 1 sample are dominated by sulfate, accompanied by lower concentrations of calcium and magnesium, with very low concentrations of potassium, sodium, chloride, and fluoride. Major ion concentrations in leachate collected from the NAF KLC 2, 3 and 4 samples are typically more than an order of magnitude lower, with some below or near the laboratory LoR.

The NAF KLC 2, KLC 3, and KLC 4 samples retained at least 87.6 % of their inherent total sulfur content after 6 months under exposure to idealised oxidising conditions, while the KLC 1 sample retained 79.9 % after 12 months. Similarly, at least 99.8 % of the inherent ANC value of the KLC 2, KLC 3, and KLC 4 samples is retained within the sample matrix after 6 months while the KLC 1 sample retained 81.8 % of its ANC after 12 months.

The sulfate generation rate results obtained for the KLC tests have been used to determine the rate of sulfide oxidation in these materials. Most sulfate salts generated from a 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 the KLC leachates are generally lower 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 average rate of sulfide oxidation and the average sulfate generation rate calculated over the test period are summarised in **Table 3-4**.

Table 3-4: Sulfate Generation and Sulfide Oxidation Rates for KLC Tests

KLC Sample Number	Sample Description	Sulfate Generation Rate (mg/kg/week)	Oxidation Rate (kg $O_2/m^3/s$)
KLC 1	PAF Herndale and Onavale Seams Roof/Floor	93.6	3.1×10^{-8}
KLC 2	NAF Teston to TAK Seams Roof/Floor	1.4	4.5×10^{-10}
KLC 3	NAF Overburden	3.0	1.1×10^{-9}
KLC 4	NAF Interburden	1.8	7.2×10^{-10}

Note: mg/kg/week = milligrams per kilogram per week; kg $O_2/m^3/s$ = kilograms of oxygen per cubic metre per second

The sulfate generation rate ranges from 1.4 to 93.56 mg/kg/week for the four KLC samples, indicating that the rate of sulfide oxidation is low in NAF materials but higher in PAF materials. The equivalent sulfide oxidation rate for these samples ranges from 4.5×10^{-10} to 3.1×10^{-8} kg $O_2/m^3/s$. Mine materials with an oxidation rate greater than 1×10^{-8} kg $O_2/m^3/s$ and a low inherent ANC have a reduced factor of safety and are likely to generate leachate that may be acidic (AMIRA, 1995; Bennett et al., 2000). Hence, the PAF materials represented by KLC 1 generated an acidic leachate. In contrast, the NAF sample materials represented by KLC 2, 3 and 4 had a circum-neutral pH throughout the test period.

For the KLC sample containing PAF materials (KLC 1), the magnitude of the acidity released into leachate increased as the available inherent ANC was consumed generating a lower pH and more acidic leachate.

Overall, the KLC results reflect the range of material characteristics predicted from the static geochemical test results described in **Section 5.1.**

Dissolved metal and metalloid concentrations in leachate collected from the NAF KLC 2, 3, and 4 samples are typically low and often below the LoR. The main exception is dissolved aluminium which is slightly elevated compared to the applied freshwater aquatic ecosystem (95 % species protection) guideline value (0.055 mg/L) but can often pass through the laboratory filtration stage if present in a fine colloidal form (ANZG, 2018). There is also an isolated occurrence of dissolved selenium concentration values greater than the applied freshwater aquatic ecosystem guideline value (0.011 mg/L) in two of the six leachate events from KLC 2, although the concentration has decreased in subsequent leach events to below the applied guideline value.

Leachate collected from the PAF KLC 1 sample contains dissolved aluminium, arsenic cadmium, chromium, copper, manganese, nickel, lead and zinc concentrations that can be elevated compared to the applied freshwater aquatic ecosystem (95 % species protection) guideline values. In addition, the aluminium, cadmium and nickel concentrations can be greater than the applied livestock drinking water guideline values

It is important to note that references to water quality guideline values are included to help provide context for the water extract and KLC test results only. These values are not intended to be interpreted as “maximum permissible levels” for site water storage or discharge. It is generally recommended that site develops their own target parameters for site water based on the unique aspects of the site.

4 Conclusions and Recommendations

4.1 Conclusions

RGS has completed a geochemistry assessment for the BCM MOD 10 extension area for representative samples of overburden, interburden, and coal seam roof and floor materials. The results indicate that:

- Overburden, interburden and most coal seam roof and floor materials have very low sulfur content, excess ANC and are classified as NAF.
- Some coal seam roof and floor materials from the Herndale and Onavale coal seams have elevated sulfur content and are classified as Uncertain or PAF.
- Comparison with the NEPM and median crustal abundance values in unmineralised soils indicates that overburden, interburden, and coal seam roof and floor materials are not significantly enriched with metals/metalloids.
- Initial and ongoing surface runoff and seepage from bulk NAF overburden, interburden, and most coal seam roof and floor materials are expected to be pH neutral to slightly alkaline and have a low level of salinity. In contrast, the pH and acidity/salinity of leachate from any PAF roof and floor materials associated with the Herndale and Onavale seams could decrease and increase, respectively, over time due to sulfide oxidation if these materials are left unmanaged and exposed to ongoing oxidising conditions.
- The concentration of dissolved trace metals/metalloids in leachate from bulk NAF overburden, interburden and coal seam roof and floor materials is likely to be to be low, typically less than the laboratory LoR, and below applied water quality guideline limits. However, if PAF roof and floor materials associated with the with the Herndale and Onavale seams are unmanaged and allowed to freely oxidise, the concentration of dissolved trace metals/metalloids in leachate could be elevated for elements such as aluminium, iron, manganese, nickel and zinc.
- The total amount of PAF coal seam roof and floor materials associated with the with the Herndale and Onavale seams will represent a small fraction of the total amount of NAF overburden, interburden and coal seam roof and floor materials material with excess ANC. Hence if managed according to existing site procedures for PAF coal reject materials (i.e. buried deep in the open pit profile and covered with NAF spoil material), the risk of AMD from encapsulated PAF materials generated from processing coal from the MOD 10 extension area will be low.
- While there is likely to be some variability in the geochemical characteristics of the coal seam plies (used to produce coal rejects) in a lateral and vertical direction, the majority of the coal samples tested and included in the BCM total sulfur database have a relatively consistent total sulfur content.
- Overburden and interburden materials represented by the samples tested have a low concentration of exchangeable cations, which indicates that nutrient levels are also low and these materials could benefit from fertilizer and/or organic matter application if used in rehabilitation activities. Overburden and interburden materials represented by the samples tested are unlikely to be sodic or dispersive; and
- Overburden and interburden materials may be suitable for use in site infrastructure and as part of revegetation and rehabilitation activities.

4.2 Recommendations

As a result of the geochemistry assessment work completed on representative overburden, interburden, and coal seam roof and floor materials from the MOD 10 extension area, several recommendations are provided to minimise the risk of any significant environmental harm to the immediate and downstream environment.

- The geochemical characteristics and operational management requirements for overburden, interburden, and coal seam roof and floor materials are well understood, and any ongoing operational sampling and geochemical testing of these materials should be based on risk.
- In line with current management practices at BCM for coal rejects, coal seam roof and floor materials associated with the Herndale and Onavale seams coal reject materials should be buried deep in the open pit profile and covered with NAF spoil.

- The KLC data collected over the 6 to 12-month test period from representative samples of overburden, interburden, and NAF and PAF coal seam roof and floor materials should be used as an input into the development of source terms associated with any future site water balance/quality modelling activities and/or closure studies at BCM.
- It is generally recommended that site develops their own target parameters for site water based on the unique aspects of the site. The range of water quality parameters described in this report should be included in the planned MOD 10 extension area water quality monitoring program as part of the BCM Water Management Plan.

5 References

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6 Attachments

Attachment A: Review of Previous Geochemistry Work Completed at BCM

Boggabri Environmental Impact Statement (1987)

As part of the EIS for the BCM (Boggabri EIS, 1987), a geochemical assessment was completed on 32 soil samples and 31 rock samples from two drill holes (ABB001 and ABB040).

The assessment found that most overburden (and interburden) materials were likely to be non-saline, non-sodic and slightly alkaline to slightly acidic. In addition, potential sodic, saline and acid producing strata relative to the four main coal seams made up a relatively small proportion of the material that was planned to be mined. The assessment also identified that the roof and floor material associated with the Braymont Seam was potentially acid forming (PAF). The sandy conglomerate associated with the Braymont and Jeralong seams was also identified as sodic.

The EIS recommended that all potentially sodic, saline or acidic overburden (and interburden) materials be buried during the mining process in order to reduce the risk of environmental impacts from the proposed mining activities.

ARD Assessment of Overburden and Interburden (2006)

A geochemical (Acid Rock Drainage) assessment study was completed in 2006 (EGi, 2006) using 49 composite drill core samples (prepared from 106 individual drill core samples) from a single drill hole (IBC2115) at BCM.

The study found that while the bulk of the overburden and interburden materials were non-acid forming (NAF), material close to the Braymont and Jeralong seams (both roof and floor material) may be PAF. There was no significant elemental enrichment in the overburden and interburden materials and no significant risk of leaching of metals or metalloids from NAF materials at neutral pH.

The EGi report found that segregation and selective handling of PAF materials would be required and would involve the deep burial of PAF material under NAF material.

Continuation of Boggabri Coal Mine - Geochemical Assessment (2009)

RGS completed a geochemical assessment of overburden, interburden and potential coal reject materials at BCM as part of an application for the continuation of the BCM (RGS, 2009). A total of 69 samples were collected by Boggabri Coal personnel from two drill holes (BC2163 and BC2172) at various depths.

The assessment found that most of the overburden, interburden and potential coal reject material had a low total sulfur content (<0.1 %S) with excess acid neutralising capacity (ANC) and was therefore classified as NAF (barren). A small proportion of the potential coal reject materials located near the Braymont Seam (roof samples) had elevated total sulfur content and negligible buffering capacity (and hence a reduced factor of safety) and were classified as PAF.

The concentration of total metals in the NAF overburden, interburden and potential coal reject material was low and considered unlikely to present any environmental issues associated with revegetation and rehabilitation. Surface runoff and seepage from the overburden, interburden and potential coal reject material was predicted to be slightly alkaline and to have relatively low salinity. However, this was not the case for potential coal reject material from the Braymont seam (and potentially the Jeralong seam), where PAF materials were considered likely to generate acidic and more saline runoff and seepage.

The assessment concluded that the major ion chemistry of any initial surface runoff and seepage from the overburden, interburden and potential coal reject materials was likely to be dominated by sodium, bicarbonate, chloride and sulfate, although for PAF materials, calcium and sulfate was expected to be more prominent. For PAF materials, the initial concentration of soluble sulfate in surface runoff and seepage was expected to remain within the applied water quality guideline criterion (1,000 mg/L; ANZG, 2018), although further exposure to oxidising conditions could lead to increased soluble sulfate concentrations.

The assessment also concluded that some of the overburden, interburden and potential coal reject materials were potentially sodic and could have structural stability problems related to potential material dispersion.

Notwithstanding, some of the near surface and conglomerate overburden materials were likely to be less sodic (and more suitable for use along with salvaged topsoil and subsoil in revegetation and rehabilitation activities).

Geochemical Assessment of Overburden, Interburden and Potential Coal Reject (2020a)

RGS completed a geochemical assessment of overburden, interburden and potential coal reject materials at BCM in 2019/2020 (RGS, 2020a). The assessment focused on the geochemistry of the overburden, interburden and potential coal reject materials likely to be generated from the currently approved mining operations within the upper part of the stratigraphic profile (namely, from the surface to the base of the Merriown Seam). The work program was completed in order to provide suitable input into a planned hydrochemical modelling program for long-term water quality as required by SSD 09_0182 for BCM (expected to be completed by 2025).

A total of 104 samples were collected from the three diamond core drill holes provided (37 samples from BC2358, 17 samples from BC2361 and 50 samples from BC2376). The assessment found that most overburden, interburden and potential coal reject materials were classified as NAF with excess ANC. Overall, the majority of the material tested was expected to have a relatively low risk of acid generation. A small number of PAF samples were identified, mainly associated with the immediate roof of the Braymont and Thornfield seams (but not in this case, the Jeralong seam), and it was recommended that materials represented by these samples be selectively handled and buried deep in the open-pit profile under NAF material.

The concentration of total metals in the overburden, interburden and potential coal reject material was low and considered unlikely to present any environmental issues associated with revegetation and rehabilitation. Surface runoff and seepage from NAF overburden, interburden and potential coal reject material generally ranged from pH neutral to slightly alkaline, with a low to moderate level of salinity. The surface runoff and seepage from any PAF materials was considered to have the potential to become acidic, saline and contain elevated concentrations of some metals/metalloids if left exposed to oxidising conditions.

At the neutral to slightly alkaline pH of any leachate expected from the bulk NAF overburden and interburden material, metals/metalloids were found to be sparingly soluble. Dissolved metal/metalloid concentrations in surface runoff and seepage from NAF materials were therefore predicted to be low and unlikely to pose any environmental issues with respect to the quality of surface and groundwater resources at the site.

The RGS assessment concluded that the NAF overburden, interburden and potential coal reject materials should be amenable to revegetation as part of any rehabilitation activities, however sodic material may require the addition of gypsum, fertiliser and organic matter to limit the potential for dispersion and erosion and provide a reasonable growth medium for revegetation and rehabilitation.

Geochemical Assessment of Interburden and Potential Coal Reject (2021a)

RGS completed a geochemical assessment of interburden and potential coal reject materials at BCM in 2019/2020 (RGS, 2021a) as part of an application to seek a Modification (MOD8) to the current Project Approval (PA 09_0182) for BCM under Section 4.55 of the *Environmental Planning and Assessment Act (1979)*. MOD8 was being sought to increase the depth of the approved mining operations within the current approved disturbance area and to facilitate the construction of additional mine infrastructure to support the establishment of the alternative vegetation corner at BCM. The RGS assessment focussed on the geochemistry of the interburden and potential coal reject materials likely to be generated from mining the lower part of the stratigraphic profile (namely, from the below the Merriown seam to the base of the Templemore seam).

A total of 92 samples were collected from the three drill holes provided (35 samples from BC2463, 27 samples from BC2464 and 30 samples from BC2466). The assessment found that for the lower coal seams, the overwhelming majority of interburden and potential coal reject materials had low sulfur content, excess ANC and were classified as NAF. Materials represented by the samples tested had a very low risk of acid generation and a high factor of safety with respect to potential for the generation of acidity. The initial and ongoing surface runoff and seepage from these materials is expected to be slightly alkaline and have a low level of salinity.

The concentration of total metals in the interburden and potential coal reject materials was low compared to applied guidelines and median crustal abundance in unmineralised soils; and was considered unlikely to present any environmental issues associated with revegetation and rehabilitation. Dissolved metal/metalloid

concentrations in surface runoff and leachate were expected to be low and unlikely to pose a significant risk to the quality of surface water and groundwater resources at the site.

The interburden and potential coal reject materials were found to be potentially sodic and may be prone to dispersion and erosion. However, the addition of gypsum, organic matter and fertiliser to selected interburden materials could be considered to improve the soil characteristics of these materials and provide a reasonable material for revegetation and rehabilitation. To improve the likelihood of success of final rehabilitation at the site, RGS recommended completion of field trials if interburden was intended for use in rehabilitation activities at final landforms.

Operational sampling and geochemical testing of mining waste materials was recommended throughout the mine life to verify the veracity and performance of the adopted mining waste strategy. In particular, future sampling and testing was recommended to focus on the geochemical characterisation of actual coal reject materials from the CHPP while specific coal seam blends were being processed, to determine whether coal rejects are likely to be PAF and require any special management measures.

Monitoring of surface water and seepage from the mining waste storage areas was recommended to be integrated into the existing water quality monitoring program to ensure parameters remain within appropriate licence criteria.

Geochemical and Physical Assessment of Coal Reject (2021c)

RGS completed a geochemical and physical assessment of coal reject materials collected from the BCM CHPP in 2020/2021 (RGS, 2021c). The RGS assessment focussed on the geochemistry and physical characteristics of coal reject materials generated from mining and processing various coal seam blends at the CHPP.

A total of 27 coal reject samples were collected from the CHPP over a period of approximately six months and subjected to a series of geochemical and physical test programs. The assessment found that the coal reject materials had elevated sulfur content, appreciable ANC, and had a variable factor of safety with respect to generation of AMD. There was no correlation between coal seam blends being processed at the CHPP at the time of coal reject sampling and the acid forming characteristics of the coal reject samples.

Initial surface runoff and seepage from coal reject materials was expected to be pH neutral to slightly alkaline and have low salinity. The salinity of leachate from higher sulfur coal reject materials was expected to have the potential to increase over time due to sulfide oxidations if coal rejects remained exposed to oxidising condition. Comparison with applied NEPM (NEPC, 2013) and median crustal abundance (INAP, 2025; Bowen; 1979) values indicated that coal reject materials were not significantly enriched with metals/metalloids.

Most metals/metalloids were found to be sparingly soluble at the initial pH values of the coal rejects and the risk of potential impact on the quality of surface water and groundwater from initial dissolved metal/metalloid concentrations was expected to be low. However, if coal reject materials were to remain unmanaged and allowed to freely oxidise, it was expected that reaction of inherent sulfides would be possible and could generate acidity and lower pH conditions over time, which could increase the mobility of metal/metalloids.

The RGS report recommended ongoing geochemical testing of representative coal reject samples from the CHPP with interpretation of results. Coal reject materials were to report deep into the open pit profile and be covered with NAF spoil materials and water quality monitoring was to continue. A KLC test program was recommended for coal reject samples for a minimum period of six months or until such time as an equilibrium state is reached in terms of leachate quality to provide source term input information for future required site water balance/quality modelling activities at BCM. The variability in the geochemical characteristics of individual coal seams in a lateral direction was recommended to be quantified using existing total sulfur data coal quality information.

Geochemical Assessment of Coal Reject (2022a)

RGS completed a geochemical assessment of coal reject materials collected from the BCM CHPP in 2021/2022 (RGS, 2022a). The RGS assessment focussed on the geochemistry characteristics of coal reject materials generated from mining and processing various coal seam blends at the CHPP.

A total of eight coal reject samples were collected from a variety of selected coal seam blends used to generate coal reject materials from the CHPP over a period of four months. These samples were then subjected to a

series of static geochemical tests. The samples represented the coal reject materials expected to be produced during ongoing mining and processing of the upper coal seams at BCM. The samples cover coal seams in the stratigraphic profile from the Teston Seam down to the Merriown Seam, with minor amounts of ROM coal reject. The samples were selected to provide a good statistical representation of the range of coal materials likely to be generated, considering the risk profile indicated from the geology and previous geochemical testing programs at BCM.

The assessment found that the coal reject materials had elevated sulfur content (of which less than half was present in a non-acid generating form, e.g., organic sulfur), appreciable ANC, and had a variable factor of safety with respect to generation of AMD. There was no correlation between coal seam blends being processed at the CHPP at the time of coal reject sampling and the acid forming characteristics of the coal reject samples. It was suggested that there is some variability in the geochemical characteristics of coal seams (used to produce coal rejects) by coal seam and in a lateral direction, which could be further investigated using coal quality sulfur data.

Comparison with applied NEPM (NEPC, 2013) and median crustal abundance (INAP, 2025; Bowen; 1979) values indicated that coal reject materials were not significantly enriched with metals/metalloids.

Initial surface runoff and seepage from coal reject materials was expected to be pH neutral to slightly alkaline and have a relatively low level of salinity. The pH of initial surface runoff and seepage from bulk coal reject materials is likely to be within the range (pH 6 to 9).

The major ion concentrations in water extracts from coal reject materials were relatively low and dominated by sulfate and bicarbonate with lower concentrations of the other major ions tested. The sulfate concentration in leachate from the samples was below the applied livestock drinking water quality guideline criterion of 1,000 mg/L for this ion. The concentrations of most trace metals/ metalloids tested for water in contact with coal reject materials was predominantly below the laboratory LoR and typically below the applied water quality guideline criteria (ANZG, 2018). Whilst some exceptions included aluminium, copper and zinc in acidic samples and sporadically lead, nickel and selenium in other samples, the soluble concentrations of these elements in the water extracts were all less than the applied livestock drinking water guideline values.

It was expected that the potential risk of any significant impact to the quality of surface and groundwater water from initial coal reject contact water at the project will be low. Notwithstanding, material represented by higher sulfur coal reject materials, if left exposed to oxidising conditions, may have the potential to generate more brackish leachate containing higher concentrations of sulfate and potentially increased concentrations of some soluble metals/metalloids under acidic conditions. If coal reject materials are managed by placement deep in the open pit profile and covered with NAF spoil material, the potential for elevated sulfate and metal/metalloid concentrations in any surface runoff and seepage from the pit should be low. This finding should be confirmed by the ongoing water quality monitoring program at the site.

Geochemical Assessment of Coal Reject (2023a)

RGS completed a geochemical assessment of coal reject materials collected from the BCM CHPP in 2022 (RGS, 2023a). The RGS assessment focussed on the geochemistry characteristics of coal reject materials generated from mining and processing various coal seam blends at the CHPP.

A total of 20 coal reject samples were collected from a variety of selected coal seam blends used to generate coal reject materials from the CHPP over a period of 11 months. These samples were then subjected to a series of static geochemical tests. The samples represented the coal reject materials expected to be produced during ongoing mining and processing of the upper coal seams at BCM. The samples cover coal seams in the stratigraphic profile from the Teston Seam down to the Merriown Seam, with minor amounts of ROM coal reject. The samples were selected to provide a good statistical representation of the range of coal materials likely to be generated, considering the risk profile indicated from the geology and previous geochemical testing programs at BCM.

The assessment found that the coal reject materials had elevated sulfur content (of which less than half was present in a non-acid generating form, e.g., organic sulfur), appreciable ANC, and had a variable factor of safety with respect to generation of AMD. There was no correlation between coal seam blends being processed at the CHPP at the time of coal reject sampling and the acid forming characteristics of the coal reject samples. It was suggested that there is some variability in the geochemical characteristics of coal seams

(used to produce coal rejects) by coal seam and in a lateral direction, which could be further investigated using coal quality sulfur data.

Comparison with applied NEPM (NEPC, 2013) and median crustal abundance (INAP, 2025; Bowen; 1979) values indicated that coal reject materials were not significantly enriched with metals/metalloids.

Initial surface runoff and seepage from coal reject materials was expected to range from slightly acidic to slightly alkaline and have a relatively low level of salinity. The pH of initial surface runoff and seepage from bulk coal reject materials was expected to be within the range (pH 6 to 9).

The major ion concentrations in water extracts from coal reject materials were relatively low and dominated by sulfate and bicarbonate with lower concentrations of the other major ions tested. The sulfate concentration in leachate from the samples was below the applied livestock drinking water quality guideline criterion of 1,000 mg/L for this ion. The concentrations of most trace metals/ metalloids tested for water in contact with coal reject materials was predominantly below the laboratory LoR and typically below the applied water quality guideline criteria (ANZG, 2018). Whilst some exceptions included aluminium, copper and zinc in acidic samples and sporadically lead, nickel and selenium in other samples, the soluble concentrations of these elements in the water extracts were all less than the applied livestock drinking water guideline values.

It was expected that the potential risk of any significant impact to the quality of surface and groundwater water from initial coal reject contact water at the project will be low. Notwithstanding, material represented by higher sulfur coal reject materials, if left exposed to oxidising conditions, may have the potential to generate more brackish leachate containing higher concentrations of sulfate and potentially increased concentrations of some soluble metals/metalloids under acidic conditions. If coal reject materials are managed by placement deep in the open pit profile and covered with NAF spoil material, the potential for elevated sulfate and metal/metalloid concentrations in any surface runoff and seepage from the pit should be low. This finding should be confirmed by the ongoing water quality monitoring program at the site.

Geochemical Assessment of Overburden/Interburden and Coal Reject (RGS, 2024)

RGS was provided with static geochemical test data from 16 samples of overburden and interburden materials collected from an in-pit large diameter drill hole (Hole BC2677LD) drilled in 2023 and geochemically tested in 2023/2024. In addition, RGS completed a geochemical characterisation of 25 samples of coal reject materials generated at the CHPP over time (in 2023) as various coal seam blends were being processed. Kinetic leach column tests were also completed over a 12 month period for representative samples of NAF and PAF coal reject materials.

The Acid Base Account results for the overburden and interburden samples demonstrated that the material types (conglomerate, sandstone, siltstone, siderite and pellet claystone) were characterised by negligible sulfur content, excess ANC and a negative NAPP value. All sample materials were classified as NAF (Barren) and have a high factor of safety with respect to potential for AMD.

Comparison with applied NEPM (NEPC, 2013) and median crustal abundance (INAP, 2025; Bowen; 1979) values indicated that overburden/interburden materials were typically not significantly enriched with metals/metalloids compared to typical concentrations in unmineralised soils, although concentrations of iron, beryllium and manganese were elevated in siderite.

Initial surface runoff and seepage from overburden/interburden materials represented by the samples tested was expected to be pH neutral to slightly alkaline and have a relatively low level of salinity. The pH of initial surface runoff and seepage from bulk materials was expected to be within the range (pH 6 to 9).

The major ion concentrations in water extracts from overburden/interburden materials were low and dominated by sulfate and bicarbonate with lower concentrations of the other major ions tested. The sulfate concentration in leachate from the samples was well below the applied livestock drinking water quality guideline criterion of 1,000 mg/L for this anion. The concentrations of most trace metals/ metalloids tested for water in contact with overburden/interburden materials was predominantly below the laboratory LoR and typically below the applied water quality guideline criteria (ANZG, 2018). The only exceptions was aluminium in the water extract collected from conglomerate and selenium in the water extracts collected from the pellet claystone, which had marginally elevated concentrations compared to the applied guideline values.

In contrast, coal reject materials had elevated sulfur content, appreciable ANC and a variable factor of safety with respect to generation of AMD. There was no correlation between the coal seam blends being produced at the CHPP at the time of coal reject sampling and the acid forming characteristics of the coal reject samples.

The coal rejects were also not significantly enriched with metals/metalloids compared to unmineralised soils. While initial surface runoff and seepage from coal reject materials was expected to be pH neutral to slightly alkaline and have a relatively low level of salinity, the salinity of leachate from higher sulfur coal reject materials and acidity could increase over time due to sulfide oxidation, if exposed to ongoing oxidising conditions.

Most metals/metalloids were sparingly soluble in leachate from NAF coal reject materials and the risk of potential impact on the quality of surface water and groundwater from initial dissolved metal/metalloid concentrations was expected to be low. However, if PAF coal reject materials were unmanaged and allowed to freely oxidise over time, it is possible that inherent sulfides could react and generate increased acidity and lower pH conditions, which could increase the solubility and mobility of metal/metalloids such as aluminium, cadmium, nickel and selenium.

Attachment B: Geochemical Assessment of Mine Materials

Acid generation and prediction

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

$$FeS_2 + 15/4\ O_2 + 7/2\ H_2O \text{ ---> } Fe(OH)_3 + 2\ H_2SO_4$$

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

Net Acid Producing Potential

The Net Acid Producing Potential (NAPP) is used as an indicator of materials that may be of concern with respect to acid generation. The NAPP calculation represents the balance between the maximum potential acidity (MPA) of a sample, which is derived from the 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 mining waste material when initially exposed in an 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)

The ANC is determined 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 endpoint in the Acid Buffering Characteristic Curve (ABCC) test through calculation of the amount of acid consumed and evaluation of the resultant titration curve.

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 the median concentration in un-mineralised soils to determine the Geochemical Abundance Index (GAI) and 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 1:5 (solid:water) 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 B1 shows the kinetic leach column set up used by RGS adapted from *AMIRA, 2002*. The columns are placed under heat lamps to allow the sample to dry between water additions to ensure adequate oxygen ingress into the sample material.

Approximately 2 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.

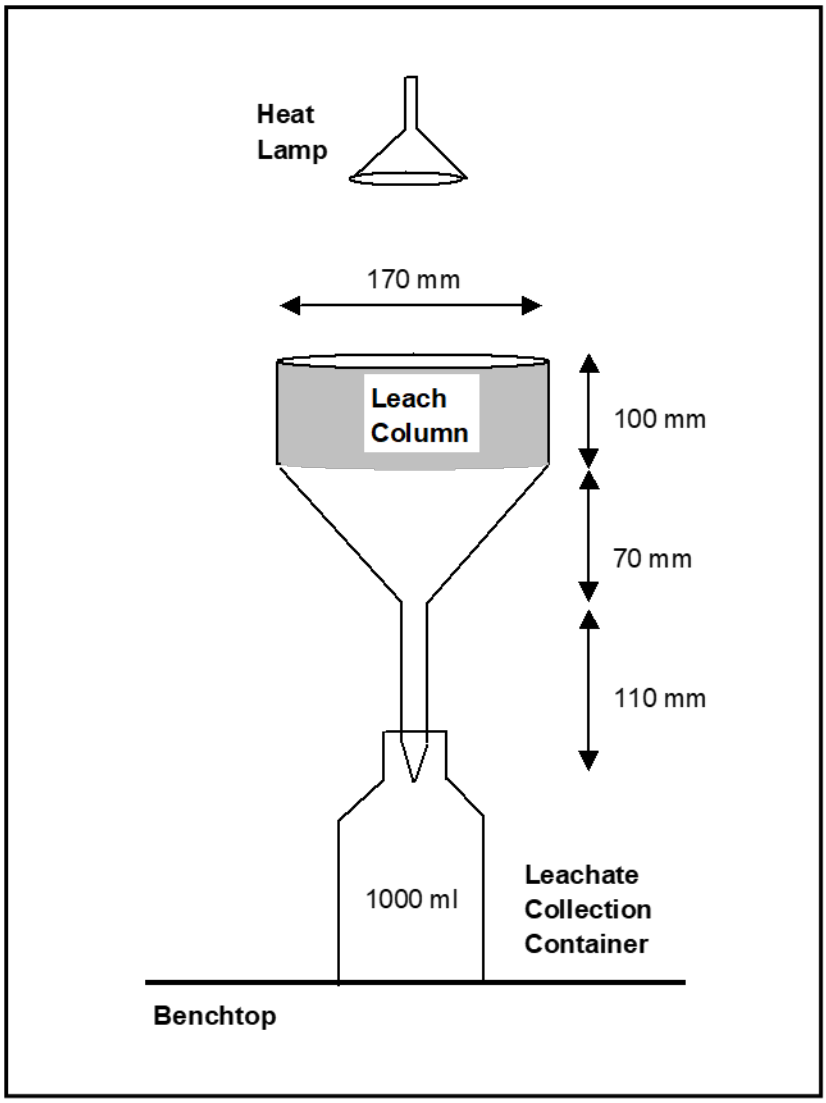


Figure B1: Kinetic Leach Column Setup

Attachment C: Static Geochemical Test Results Tables

Table C1: Acid Base Account Results for Samples from the Boggabri Modification Project

Sample No.	Date	RGS Sample ID	ALS Lab ID	Drill Hole ID	Client Sample ID	Sample Lithology	Coal Seam	Sample Type	Sample Period	From	To	Interval	pH (1:5)	EC (1:5)	Total S	Scr	ANC[2]	MPA[2]	NAPP[2]	ANC: MPA Ratio	Sample Classification[3]	Composite
										(m)				(µS/cm)	(%)		kg H_2SO_4/t					
Roof, Floor, Overburden and Interburden																						
1	02/11/2023	2023033_027	EB2335701027	BC2572	72001	Conglomerate	HE	Roof	Herndale and Onavale Seams	17.4	17.7	0.4	4.30	2,790	6.76	4.960	0.3	151.9	151.7	0.0	Potentially Acid Forming	1
2	02/11/2023	2023033_025	EB2335701025	BC2569	69003	Conglomerate	HE	Roof	Herndale and Onavale Seams	24.4	24.7	0.3	7.50	160	0.03		19.2	0.9	-18.3	20.9	Non-Acid Forming (Barren)	1
3	02/11/2023	2023033_026	EB2335701026	BC2571	71002	Conglomerate	HE	Roof	Herndale and Onavale Seams	35.5	35.8	0.3	7.30	200	0.06		13.6	1.8	-11.8	7.4	Non-Acid Forming (Barren)	1
4	02/11/2023	2023033_063	EB2335701063	BC2569	69004	Mudstone	HE	Floor	Herndale and Onavale Seams	28.6	29.5	0.9	4.10	1,050	1.13	0.735	0.3	22.5	22.3	0.0	Potentially Acid Forming	1
5	02/11/2023	2023033_064	EB2335701064	BC2571	71003	Sandstone	HE	Floor	Herndale and Onavale Seams	40.3	40.6	0.3	6.20	354	0.41	0.379	10.5	11.6	1.1	0.9	Uncertain	1
6	02/11/2023	2023033_030	EB2335701030	BC2572	72003	Siltstone	ON	Roof	Herndale and Onavale Seams	27.9	28.2	0.3	7.40	122	0.07		12.1	2.1	-10.0	5.6	Non-Acid Forming (Barren)	2
7	02/11/2023	2023033_028	EB2335701028	BC2569	69006	Conglomerate	ON	Roof	Herndale and Onavale Seams	53.8	54.3	0.5	6.00	718	0.25	0.152	9.6	4.7	-4.9	2.1	Uncertain	2
8	02/11/2023	2023033_029	EB2335701029	BC2571	71005	Conglomerate	ON	Roof	Herndale and Onavale Seams	65.2	65.5	0.3	6.20	923	0.43	0.246	8.4	7.5	-0.9	1.1	Uncertain	2
9	02/11/2023	2023033_066	EB2335701066	BC2572	72004	Sandstone	ON	Floor	Herndale and Onavale Seams	30.5	30.8	0.3	7.60	72	0.02		11.0	0.6	-10.4	18.0	Non-Acid Forming (Barren)	2
10	02/11/2023	2023033_065	EB2335701065	BC2569	69007	Sandstone	ON	Floor	Herndale and Onavale Seams	58.6	59.0	0.4	7.20	99	0.03		14.7	0.9	-13.8	16.0	Non-Acid Forming (Barren)	2
11	02/11/2023	2023033_067	EB2335701067	BC2571	71006	Siltstone	ON	Floor	Herndale and Onavale Seams	70.6	70.9	0.3	7.40	80	0.03		8.7	0.9	-7.8	9.5	Non-Acid Forming (Barren)	2
12	02/11/2023	2023033_031	EB2335701031	BC2572	72006	Conglomerate	TS	Roof	Teston to Templemore Seams	62.8	63.1	0.3	8.10	188	0.04		14.3	1.2	-13.1	11.7	Non-Acid Forming (Barren)	3
13	02/11/2023	2023033_032	EB2335701032	BC2569	69009	Sandstone	TS	Roof	Teston to Templemore Seams	93.9	94.5	0.6	7.70	63	0.02		15.2	0.6	-14.6	24.8	Non-Acid Forming (Barren)	3
14	02/11/2023	2023033_033	EB2335701033	BC2571	71008	Sandstone	TS	Roof	Teston to Templemore Seams	106.3	106.6	0.3	8.20	210	0.04		11.0	1.2	-9.8	9.0	Non-Acid Forming (Barren)	3
15	02/11/2023	2023033_070	EB2335701070	BC2572	72007	Siltstone	TS	Floor	Teston to Templemore Seams	68.0	68.3	0.3	7.50	58	0.02		9.9	0.6	-9.3	16.2	Non-Acid Forming (Barren)	3
16	02/11/2023	2023033_069	EB2335701069	BC2569	69010	Siltstone	TS	Floor	Teston to Templemore Seams	99.4	99.5	0.2	7.40	84	0.02		8.9	0.6	-8.3	14.5	Non-Acid Forming (Barren)	3
17	02/11/2023	2023033_068	EB2335701068	BC2571	71009	Sandstone	TS	Floor	Teston to Templemore Seams	111.0	111.3	0.3	7.40	146	0.03		7.5	0.9	-6.6	8.2	Non-Acid Forming (Barren)	3
18	02/11/2023	2023033_036	EB2335701036	BC2572	72008	Carbonaceous Mudstone	THO	Roof	Teston to Templemore Seams	70.0	70.3	0.3	7.40	85	0.12	0.050	6.9	1.5	-5.4	4.5	Non-Acid Forming (Barren)	4
19	02/11/2023	2023033_034	EB2335701034	BC2569	69011	Sandstone	THO	Roof	Teston to Templemore Seams	101.3	102.0	0.7	7.30	105	0.06		9.5	1.8	-7.7	5.2	Non-Acid Forming (Barren)	4
20	02/11/2023	2023033_035	EB2335701035	BC2571	71010	Siltstone	THO	Roof	Teston to Templemore Seams	114.3	114.9	0.6	7.70	67	0.02		10.9	0.6	-10.3	17.8	Non-Acid Forming (Barren)	4
21	02/11/2023	2023033_073	EB2335701073	BC2572	72009	Siltstone	THO	Floor	Teston to Templemore Seams	71.9	72.2	0.3	7.40	124	0.09		10.0	2.8	-7.2	3.6	Non-Acid Forming (Barren)	4
22	02/11/2023	2023033_071	EB2335701071	BC2569	69012	Sandstone	THO	Floor	Teston to Templemore Seams	103.8	104.1	0.3	7.50	69	0.02		12.2	0.6	-11.6	19.9	Non-Acid Forming (Barren)	4
23	02/11/2023	2023033_072	EB2335701072	BC2571	71011	Sandstone	THO	Floor	Teston to Templemore Seams	116.7	117.0	0.3	8.70	208	0.02		45.8	0.6	-45.2	74.8	Non-Acid Forming (Barren)	4
24	02/11/2023	2023033_037	EB2335701037	BC2572	72011	Sandstone	BRU	Roof	Teston to Templemore Seams	109.2	109.5	0.3	7.40	123	0.06		9.9	1.8	-8.1	5.4	Non-Acid Forming (Barren)	5
25	02/11/2023	2023033_038	EB2335701038	BC2569	69014	Siltstone	BRU	Roof	Teston to Templemore Seams	131.4	132.1	0.7	6.50	336	0.22	0.198	7.6	6.1	-1.5	1.3	Uncertain	5
26	02/11/2023	2023033_039	EB2335701039	BC2571	71013	Siltstone	BRU	Roof	Teston to Templemore Seams	148.6	149.1	0.5	7.20	88	0.04		6.4	1.2	-5.2	5.2	Non-Acid Forming (Barren)	5
27	02/11/2023	2023033_074	EB2335701074	BC2572	72012	Sandstone	BR	Floor	Teston to Templemore Seams	117.5	117.8	0.3	7.00	37	0.02		8.5	0.6	-7.9	13.9	Non-Acid Forming (Barren)	6
28	02/11/2023	2023033_075	EB2335701075	BC2569	69015	Siltstone	BR	Floor	Teston to Templemore Seams	141.3	141.9	0.6	7.00	45	0.05		8.8	1.5	-7.3	5.7	Non-Acid Forming (Barren)	6
29	02/11/2023	2023033_076	EB2335701076	BC2571	71014	Siltstone	BR	Floor	Teston to Templemore Seams	157.4	157.7	0.3	6.90	50	0.06		9.4	1.8	-7.6	5.1	Non-Acid Forming (Barren)	6
30	02/11/2023	2023033_042	EB2335701042	BC2572	72014	Claystone	JE	Roof	Teston to Templemore Seams	148.0	148.3	0.3	8.00	64	0.04		11.1	1.2	-9.9	9.1	Non-Acid Forming (Barren)	7
31	02/11/2023	2023033_040	EB2335701040	BC2569	69017	Conglomerate	JE	Roof	Teston to Templemore Seams	176.4	176.7	0.3	7.40	272	0.09		7.7	2.8	-4.9	2.8	Non-Acid Forming (Barren)	7
32	02/11/2023	2023033_041	EB2335701041	BC2571	71016	Conglomerate	JE	Roof	Teston to Templemore Seams	189.6	189.9	0.3	7.90	102	0.03		15.2	0.9	-14.3	16.5	Non-Acid Forming (Barren)	7
33	02/11/2023	2023033_079	EB2335701079	BC2572	72015	Carbonaceous Mudstone	JE	Floor	Teston to Templemore Seams	151.6	152.0	0.3	7.20	73	0.03		6.6	0.9	-5.7	7.2	Non-Acid Forming (Barren)	7
34	02/11/2023	2023033_078	EB2335701078	BC2569	69018	Carbonaceous Mudstone	JE	Floor	Teston to Templemore Seams	178.9	179.3	0.4	7.70	38	0.02		5.0	0.6	-4.4	8.2	Non-Acid Forming (Barren)	7
35	02/11/2023	2023033_077	EB2335701077	BC2571	71017	Sandstone	JE	Floor	Teston to Templemore Seams	192.3	192.5	0.3	7.20	22	0.02		4.9	0.6	-4.3	8.0	Non-Acid Forming (Barren)	7
36	02/11/2023	2023033_043	EB2335701043	BC2572	72016	Conglomerate	MN	Roof	Teston to Templemore Seams	168.7	169.1	0.3	7.00	174	0.06		7.4	1.8	-5.6	4.0	Non-Acid Forming (Barren)	8
37	02/11/2023	2023033_044	EB2335701044	BC2569	69019	Siltstone	MN	Roof	Teston to Templemore Seams	185.9	186.2	0.3	7.70	60	0.04		9.4	1.2	-8.2	7.7	Non-Acid Forming (Barren)	8
38	02/11/2023	2023033_045	EB2335701045	BC2571	71018	Siltstone	MN	Roof	Teston to Templemore Seams	202.7	203.0	0.3	7.80	62	0.03		9.2	0.9	-8.3	10.0	Non-Acid Forming (Barren)	8
39	02/11/2023	2023033_081	EB2335701081	BC2572	72017	Siltstone	MN	Floor	Teston to Templemore Seams	172.0	172.3	0.3	7.10	144	0.07		9.4	2.1	-7.3	4.4	Non-Acid Forming (Barren)	8
40	02/11/2023	2023033_080	EB2335701080	BC2569	69020	Sandstone	MN	Floor	Teston to Templemore Seams	189.5	189.8	0.3	7.50	50	0.03		7.6	0.9	-6.7	8.3	Non-Acid Forming (Barren)	8
41	02/11/2023	2023033_082	EB2335701082	BC2571	71019	Siltstone	MN	Floor	Teston to Templemore Seams	206.0	206.3	0.3	7.40	35	0.02		8.8	0.6	-8.2	14.4	Non-Acid Forming (Barren)	8
42	02/11/2023	2023033_048	EB2335701048	BC2572	72019	Conglomerate	VY	Roof	Teston to Templemore Seams	214.5	214.9	0.4	8.10	138	0.09		11.8	2.8	-9.0	4.3	Non-Acid Forming (Barren)	9
43	02/11/2023	2023033_046	EB2335701046	BC2569	69022	Conglomerate	VY	Roof	Teston to Templemore Seams	216.9	217.2	0.3	8.50	282	0.03		23.2	0.9	-22.3	25.3	Non-Acid Forming (Barren)	9
44	02/11/2023	2023033_047	EB2335701047	BC2571	71020	Conglomerate	VY	Roof	Teston to Templemore Seams	236.3	236.6	0.3	8.80	254	0.03		30.0	0.9	-29.1	32.7	Non-Acid Forming (Barren)	9
45	02/11/2023	2023033_085	EB2335701085	BC2572	72020	Siltstone	VY	Floor	Teston to Templemore Seams	215.6	215.9	0.3	7.90	70	0.03		11.5	0.9	-10.6	12.5	Non-Acid Forming (Barren)	9
46	02/11/2023	2023033_083	EB2335701083	BC2569	69023	Siltstone	VY	Floor	Teston to Templemore Seams	218.9	219.2	0.3	7.80	86	0.02		12.5	0.6	-11.9	20.4	Non-Acid Forming (Barren)	9
47	02/11/2023	2023033_084	EB2335701084	BC2571	71021	Siltstone	VY	Floor	Teston to Templemore Seams	238.3	239.0	0.8	8.40	234	0.03		20.3	0.9	-19.4	22.1	Non-Acid Forming (Barren)	9
48	02/11/2023	2023033_051	EB2335701051	BC2572	72021	Carbonaceous Mudstone	NG	Roof	Teston to Templemore Seams	218.1	218.4	0.3	8.00	94	0.08		12.9	2.5	-10.5	5.3	Non-Acid Forming (Barren)	10
49	02/11/2023	2023033_049	EB2335701049	BC2569	69024	Conglomerate	NG	Roof	Teston to Templemore Seams	229.0	229.7	0.7	8.80	205	0.02		30.6	0.6	-30.0	50.0	Non-Acid Forming (Barren)	10
50	02/11/2023	2023033_050	EB2335701050	BC2571	71022	Siderite	NG	Roof	Teston to Templemore Seams	244.4	244.8	0.3	8.40	122	0.02		26.7	0.6	-26.1	43.6	Non-Acid Forming (Barren)	10

Table C1: Acid Base Account Results for Samples from the Boggabri Modification Project

Sample No.	Date	RGS Sample ID	ALS Lab ID	Drill Hole ID	Client Sample ID	Sample Lithology	Coal Seam	Sample Type	Sample Period	From	To	Interval	pH (1:5)	EC (1:5)	Total S	Scr	ANC[2]	MPA[2]	NAPP[2]	ANC: MPA Ratio	Sample Classification[3]	Composite
										(m)				(µS/cm)	(%)		kg H_2SO_4/t					
51	02/11/2023	2023033_086	EB2335701086	BC2572	72022	Mudstone	NG	Floor	Teston to Templemore Seams	219.6	219.9	0.3	7.70	91	0.07		19.6	2.1	-17.5	9.1	Non-Acid Forming (Barren)	10
52	02/11/2023	2023033_087	EB2335701087	BC2569	69025	Siltstone	NG	Floor	Teston to Templemore Seams	231.5	231.8	0.3	8.80	277	0.03		379.0	0.9	-378.1	412.5	Non-Acid Forming (Barren)	10
53	02/11/2023	2023033_088	EB2335701088	BC2571	71023	Carbonaceous Mudstone	NG	Floor	Teston to Templemore Seams	246.1	246.4	0.3	8.00	100	0.04		14.5	1.2	-13.3	11.8	Non-Acid Forming (Barren)	10
54	02/11/2023	2023033_056	EB2335701056	BC2572	72023	Siltstone	NT	Roof	Teston to Templemore Seams	219.9	220.2	0.3	7.90	78	0.02		15.6	0.6	-15.0	25.5	Non-Acid Forming (Barren)	11
55	02/11/2023	2023033_052	EB2335701052	BC2569	69026	Sandstone	NT	Roof	Teston to Templemore Seams	232.0	232.3	0.3	8.00	78	0.02		14.1	0.6	-13.5	23.0	Non-Acid Forming (Barren)	11
56	02/11/2023	2023033_053	EB2335701053	BC2571	71024	Sandstone	NT	Roof	Teston to Templemore Seams	246.5	246.8	0.3	8.00	106	0.03		22.6	0.9	-21.7	24.6	Non-Acid Forming (Barren)	11
57	02/11/2023	2023033_055	EB2335701055	BC2569	69029	Siltstone	NT	Roof	Teston to Templemore Seams	247.4	248.0	0.6	7.90	152	0.04		15.7	1.2	-14.5	12.8	Non-Acid Forming (Barren)	11
58	02/11/2023	2023033_054	EB2335701054	BC2571	71027	Sandstone	NT	Roof	Teston to Templemore Seams	265.6	266.0	0.4	8.20	125	0.01		18.9	0.3	-18.6	61.7	Non-Acid Forming (Barren)	11
59	02/11/2023	2023033_089	EB2335701089	BC2569	69027	Siltstone	NT	Floor	Teston to Templemore Seams	234.5	235.2	0.7	8.30	252	0.03		20.6	0.9	-19.7	22.4	Non-Acid Forming (Barren)	11
60	02/11/2023	2023033_061	EB2335701061	BC2572	72024	Mudstone	NT/TH	Floor/Roof	Teston to Templemore Seams	249.7	250.0	0.3	7.70	55	0.05		14.8	1.5	-13.3	9.7	Non-Acid Forming (Barren)	12
61	02/11/2023	2023033_090	EB2335701090	BC2569	69030	Mudstone	TH	Floor	Teston to Templemore Seams	251.7	252.2	0.5	8.20	253	0.02		18.6	0.6	-18.0	30.4	Non-Acid Forming (Barren)	12
62	02/11/2023	2023033_092	EB2335701092	BC2572	72025	Sandstone	TH	Floor	Teston to Templemore Seams	252.5	252.7	0.3	8.20	121	0.03		13.8	0.9	-12.9	15.0	Non-Acid Forming (Barren)	12
63	02/11/2023	2023033_091	EB2335701091	BC2571	71028	Sandstone	TH	Floor	Teston to Templemore Seams	269.1	269.4	0.3	7.80	42	0.01		9.2	0.3	-8.9	30.0	Non-Acid Forming (Barren)	12
64	02/11/2023	2023033_057	EB2335701057	BC2569	69032	Siltstone	FX	Roof	Teston to Templemore Seams	275.1	275.7	0.6	7.80	86	0.03		17.2	0.9	-16.3	18.7	Non-Acid Forming (Barren)	13
65	02/11/2023	2023033_059	EB2335701059	BC2572	72027	Siltstone	FX	Roof	Teston to Templemore Seams	276.3	276.6	0.3	8.10	84	0.02		16.4	0.6	-15.8	26.8	Non-Acid Forming (Barren)	13
66	02/11/2023	2023033_058	EB2335701058	BC2571	71031	Siltstone	FX	Roof	Teston to Templemore Seams	310.0	310.3	0.3	7.90	84	0.03		13.2	0.9	-12.3	14.4	Non-Acid Forming (Barren)	13
67	02/11/2023	2023033_062	EB2335701062	BC2572	72028	Carbonaceous Mudstone	FX/TA	Floor/Roof	Teston to Templemore Seams	278.5	278.7	0.2	7.80	50	0.03		12.3	0.9	-11.4	13.4	Non-Acid Forming (Barren)	14
68	02/11/2023	2023033_093	EB2335701093	BC2569	69033	Siltstone	TA	Floor	Teston to Templemore Seams	282.8	283.1	0.3	7.70	267	0.07		13.6	2.1	-11.5	6.3	Non-Acid Forming (Barren)	14
69	02/11/2023	2023033_094	EB2335701094	BC2572	72029	Siltstone	TA	Floor	Teston to Templemore Seams	283.1	283.4	0.3	7.90	74	0.03		16.8	0.9	-15.9	18.3	Non-Acid Forming (Barren)	14
70	02/11/2023	2023033_060	EB2335701060	BC2572	72030	Sandstone	TP	Roof	Teston to Templemore Seams	303.5	303.8	0.3	7.80	131	0.05		16.6	1.5	-15.1	10.8	Non-Acid Forming (Barren)	15
71	02/11/2023	2023033_095	EB2335701095	BC2572	72031	Pellet Claystone	TP	Floor	Teston to Templemore Seams	306.2	306.5	0.3	6.70	87	0.03		12.9	0.9	-12.0	14.0	Non-Acid Forming (Barren)	15
72	02/11/2023	2023033_096	EB2335701096	BC2571	71032	Carbonaceous Claystone	TAK	Floor	Teston to Templemore Seams	317.2	317.5	0.3	7.20	151	0.05		9.7	1.5	-8.2	6.3	Non-Acid Forming (Barren)	16
73	02/11/2023	2023033_003	EB2335701003	BC2569	69001	Sandstone		Overburden	Overburden	15.5	15.8	0.3	8.80	223	0.02		53.4	0.6	-52.8	87.2	Non-Acid Forming (Barren)	17
74	02/11/2023	2023033_001	EB2335701001	BC2569	69002	Conglomerate		Overburden	Overburden	21.3	21.6	0.3	8.80	192	0.02		81.9	0.6	-81.3	133.7	Non-Acid Forming (Barren)	17
75	02/11/2023	2023033_002	EB2335701002	BC2571	71001	Conglomerate		Overburden	Overburden	24.8	25.1	0.3	8.50	214	0.03		24.2	0.9	-23.3	26.3	Non-Acid Forming (Barren)	17
76	02/11/2023	2023033_018	EB2335701018	BC2572	72002	Sandstone		Interburden	Interburden	20.6	20.8	0.3	8.70	228	0.01		42.4	0.3	-42.1	138.4	Non-Acid Forming (Barren)	18
77	02/11/2023	2023033_004	EB2335701004	BC2569	69005	Conglomerate		Interburden	Interburden	33.4	33.7	0.3	8.30	411	0.10	0.054	32.0	1.7	-30.3	19.3	Non-Acid Forming (Barren)	18
78	02/11/2023	2023033_011	EB2335701011	BC2572	72005	Conglomerate		Interburden	Interburden	48.1	48.4	0.3	8.90	198	0.02		35.6	0.6	-35.0	58.1	Non-Acid Forming (Barren)	18
79	02/11/2023	2023033_016	EB2335701016	BC2571	71004	Sandstone		Interburden	Interburden	51.4	51.7	0.3	7.90	235	0.04		14.8	1.2	-13.6	12.1	Non-Acid Forming (Barren)	18
80	02/11/2023	2023033_005	EB2335701005	BC2569	69008	Conglomerate		Interburden	Interburden	66.4	66.7	0.3	8.90	165	0.02		129.0	0.6	-128.4	210.6	Non-Acid Forming (Barren)	18
81	02/11/2023	2023033_019	EB2335701019	BC2572	72010	Sandstone		Interburden	Interburden	75.7	76.0	0.3	8.10	79	0.02		19.0	0.6	-18.4	31.0	Non-Acid Forming (Barren)	18
82	02/11/2023	2023033_007	EB2335701007	BC2571	71007	Conglomerate		Interburden	Interburden	84.3	84.6	0.3	8.80	197	0.02		35.5	0.6	-34.9	58.0	Non-Acid Forming (Barren)	18
83	02/11/2023	2023033_021	EB2335701021	BC2569	69013	Siltstone		Interburden	Interburden	109.8	110.1	0.3	8.80	304	0.03		500.0	0.9	-499.1	544.2	Non-Acid Forming (Barren)	18
84	02/11/2023	2023033_023	EB2335701023	BC2571	71012	Siltstone		Interburden	Interburden	123.4	123.7	0.3	8.30	194	0.03		25.2	0.9	-24.3	27.4	Non-Acid Forming (Barren)	18
85	02/11/2023	2023033_012	EB2335701012	BC2572	72013	Conglomerate		Interburden	Interburden	133.0	133.2	0.3	8.90	181	0.02		28.8	0.6	-28.2	47.0	Non-Acid Forming (Barren)	18
86	02/11/2023	2023033_022	EB2335701022	BC2569	69016	Siltstone		Interburden	Interburden	143.6	143.9	0.3	7.50	96	0.03		13.9	0.9	-13.0	15.1	Non-Acid Forming (Barren)	19
87	02/11/2023	2023033_008	EB2335701008	BC2571	71015	Conglomerate		Interburden	Interburden	168.3	168.6	0.3	8.80	189	0.02		23.8	0.6	-23.2	38.9	Non-Acid Forming (Barren)	19
88	02/11/2023	2023033_020	EB2335701020	BC2572	72018	Sandstone		Interburden	Interburden	194.3	194.6	0.3	8.50	109	0.02		18.6	0.6	-18.0	30.4	Non-Acid Forming (Barren)	19
89	02/11/2023	2023033_006	EB2335701006	BC2569	69021	Conglomerate		Interburden	Interburden	200.8	201.1	0.3	8.80	213	0.02		30.4	0.6	-29.8	49.6	Non-Acid Forming (Barren)	19
90	02/11/2023	2023033_014	EB2335701014	BC2569	69028	Sandstone		Interburden	Interburden	240.9	241.2	0.3	8.80	251	0.02		338.0	0.6	-337.4	551.8	Non-Acid Forming (Barren)	19
91	02/11/2023	2023033_024	EB2335701024	BC2571	71025	Siltstone		Interburden	Interburden	248.4	248.7	0.4	8.20	77	0.02		16.3	0.6	-15.7	26.6	Non-Acid Forming (Barren)	19
92	02/11/2023	2023033_017	EB2335701017	BC2571	71026	Sandstone		Interburden	Interburden	249.4	249.7	0.3	8.60	194	0.02		16.9	0.6	-16.3	27.6	Non-Acid Forming (Barren)	19
93	02/11/2023	2023033_013	EB2335701013	BC2572	72026	Conglomerate		Interburden	Interburden	255.1	255.5	0.4	9.00	215	0.02		41.0	0.6	-40.4	66.9	Non-Acid Forming (Barren)	19
94	02/11/2023	2023033_015	EB2335701015	BC2569	69031	Sandstone		Interburden	Interburden	271.1	271.4	0.3	8.60	204	0.02		54.1	0.6	-53.5	88.3	Non-Acid Forming (Barren)	19
95	02/11/2023	2023033_009	EB2335701009	BC2571	71029	Conglomerate		Interburden	Interburden	283.5	283.9	0.3	8.90	174	0.01		96.4	0.3	-96.1	314.8	Non-Acid Forming (Barren)	19
96	02/11/2023	2023033_010	EB2335701010	BC2571	71030	Conglomerate		Interburden	Interburden	303.8	304.1	0.3	8.80	171	0.01		307.0	0.3	-306.7	1002.4	Non-Acid Forming (Barren)	19

Notes:

1. Current pH and EC Provided for 1:5 sample:water extracts
2. Scr = Chromium Reducible Sulfur; MPA = Maximum Potential Acidity; ANC = Acid Neutralising Capacity; 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 .

Table C2: Multi-Element and Exchangeable Cation Results for Samples from the Boggabri Modification Project

		RGS Sample Number →	2023033_C001	2023033_C002	2023033_C003	2023033_C004	2023033_C005	2023033_C006	2023033_C007	2023033_C008	2023033_C009	2023033_C010
		ALS Laboratory ID →	EB2338913001	EB2338913002	EB2338913003	EB2338913004	EB2338913005	EB2338913006	EB2338913007	EB2338913008	EB2338913009	EB2338913010
		Sampling Date →	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023
		Client ID →	HE Seam	ON Seam	TS Seam	THO Seam	BRU Seam	BR Seam	JE Seam	MN Seam	VY Seam	NG Seam
Parameters	**Limit of Reporting**	NEPC[1] Health-Based Investigation Level (HILs)-C	Roof/Floor	Roof/Floor	Roof/Floor	Roof/Floor	Roof	Floor	Roof/Floor	Roof/Floor	Roof/Floor	Roof/Floor
Major Cations		-	All units mg/kg									
Calcium (Ca)	50	-	810	1,000	1,460	2,490	1,260	770	980	1,080	3,100	7,200
Magnesium (Mg)	50	-	780	900	1,370	2,020	800	350	590	450	1,810	5,020
Potassium (K)	50	-	1,670	1,880	1,820	2,040	1,830	1,490	1,620	1,940	2,180	2,480
Sodium (Na)	50	-	100	80	70	90	50	<50	50	50	300	280
Aluminium (Al)	50	-	6,040	7,610	7,670	7,200	7,090	11,800	8,890	8,300	7,500	7,420
Iron (Fe)	50	-	28,900	10,100	21,300	14,400	5,020	3,150	7,310	3,020	13,600	36,600
Minor and Trace Elements		-	All units mg/kg									
Arsenic (As)	5	300	6	4	5	7	10	2	2	2	4	5
Boron (B)	50	20,000	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Barium (Ba)	10	-	46	90	64	669	310	62	138	78	114	82
Beryllium (Be)	0.1	90	0.7	1.0	0.7	0.7	0.9	0.7	1.1	0.9	0.7	1.1
Cadmium (Cd)	0.1	90	<0.1	<0.1	0.1	<0.1	0.1	<0.1	<0.1	0.1	<0.1	0.1
Cobalt (Co)	2	300	3.2	3.4	3.0	3.8	4.2	4.5	1.3	2.7	4.9	7.4
Chromium (Cr) **	2	300	6.0	5.6	6.7	6.4	4.9	4.6	4.3	4.2	8.4	6.1
Copper (Cu)	5	17,000	9.7	13.5	17.7	13.1	21.2	14.5	14.7	19.1	16.9	26.4
Mercury (Hg)	0.1	80	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese (Mn)	5	19,000	199	80	132	83	39	24	86	24	101	373
Molybdenum (Mo)	2	-	1.4	0.3	0.4	0.8	0.4	0.2	0.2	0.2	0.6	0.2
Nickel (Ni)	2	1,200	16.0	7.1	8.1	12.8	15.0	7.7	3.4	7.2	15.2	24.9
Lead (Pb)	5	600	10.7	14.5	15.7	17.3	20.9	15.6	16.9	15.0	14.9	17.8
Antimony (Sb)	5	-	0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Selenium (Se)	5	700	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Thorium (Th)	0.1	-	4.1	3.6	4.2	4.7	1.4	1.9	4.0	2.0	2.8	2.1
Uranium (U)	0.1	-	0.6	0.7	0.9	1.1	0.6	0.5	0.6	0.5	0.7	0.7
Vanadium (V)	5	-	11	12	20	21	15	9	9	9	15	28
Zinc (Zn)	5	30,000	34	69	59	65	103	12	19	49	52	62
Exchangeable Cations		-	All units meq/100g (except Exchangable Sodium Percentage (%))									
Exchangeable Calcium	0.2	-										
Exchangeable Magnesium	0.2	-										
Exchangeable Potassium	0.2	-										
Exchangeable Sodium	0.2	-										
Cation Exchange Capacity	0.2	-										
Exchangeable Sodium Percent	0.2	-										
Calcium/Magnesium Ratio	0.2	-										
Magnesium/Potassium Ratio	0.2	-										

Notes: < indicates less than the laboratory limit of reporting. Shaded cells exceed applied guideline limit. ** Guideline level for Cr(VI) = 300 mg/kg.

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 C2: Multi-Element and Exchangeable Cation Results for Samples from the Boggabri Modification Project

	RGS Sample Number →		2023033_C011	2023033_C012	2023033_C013	2023033_C014	2023033_C015	2023033_C016	2023033_C017	2023033_C018	2023033_C019
	ALS Laboratory ID →		EB2338913011	EB2338913012	EB2338913013	EB2338913014	EB2338913015	EB2338913016	EB2338913017	EB2338913018	EB2338913019
	Sampling Date →		06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023
	Client ID →		NT Seam	TH Seam	FX Seam	TA Seam	TP Seam	TAK Seam	Overburden	Interburden	Interburden
Parameters	**Limit of Reporting**	NEPC[1] Health-Based Investigation Level (HILs)-C	Roof	Roof/Floor	Roof/Floor	Roof/Floor	Roof/Floor	Floor	Conglomerate/ Sandstone	Conglomerate/ Sandstone/ Siltstone	Conglomerate/ Sandstone/ Siltstone
Major Cations		-	All units mg/kg								
Calcium (Ca)	50	-	2,290	2,240	1,910	2,890	2,260	1,810	8,390	11,200	19,400
Magnesium (Mg)	50	-	2,200	1,570	1,180	510	440	340	2,420	4,260	2,660
Potassium (K)	50	-	2,310	2,360	2,650	960	510	220	1,730	1,820	1,740
Sodium (Na)	50	-	220	210	120	180	220	150	180	210	250
Aluminium (Al)	50	-	7,880	8,660	9,600	9,530	18,000	14,000	4,690	5,470	5,290
Iron (Fe)	50	-	31,600	13,300	7,640	5,900	35,900	3,960	8,840	19,100	13,400
Minor and Trace Elements		-	All units mg/kg								
Arsenic (As)	5	300	7	4	19	4	1	12	4	3	4
Boron (B)	50	20,000	<50	<50	<50	<50	<50	<50	<50	<50	<50
Barium (Ba)	10	-	302	142	85	62	99	53	220	143	116
Beryllium (Be)	0.1	90	0.7	0.9	0.7	0.8	1.0	0.6	0.3	0.7	0.6
Cadmium (Cd)	0.1	90	0.1	0.1	0.1	0.2	0.1	0.2	<0.1	<0.1	<0.1
Cobalt (Co)	2	300	4.9	3.5	6.1	3.4	28.9	5.6	3.5	4.2	4.4
Chromium (Cr) **	2	300	7.3	8.7	6.4	7.9	18.6	11.6	5.6	5.5	7.5
Copper (Cu)	5	17,000	21.6	25.9	24.1	49.8	64.6	66.3	9.3	10.6	11.8
Mercury (Hg)	0.1	80	<0.1	0.10	0.1	<0.1	0.2	0.2	<0.1	<0.1	<0.1
Manganese (Mn)	5	19,000	544	99	134	85	990	17	119	196	179
Molybdenum (Mo)	2	-	0.3	0.2	0.4	0.2	0.4	0.2	0.5	0.4	0.4
Nickel (Ni)	2	1,200	21.2	13.8	23.7	10.1	37.1	9.0	12.5	10.6	10.2
Lead (Pb)	5	600	16.4	17.5	16.4	19.9	14.8	23.6	8.4	13.3	12.7
Antimony (Sb)	5	-	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1
Selenium (Se)	5	700	<1	<1	<1	1	1	1	<1	<1	<1
Thorium (Th)	0.1	-	2.2	2.0	1.5	7.6	5.4	12.9	4.3	3.9	4.1
Uranium (U)	0.1	-	0.7	0.5	0.7	0.6	0.4	0.6	0.9	1.5	0.7
Vanadium (V)	5	-	22	18	16	45	53	42	7	14	13
Zinc (Zn)	5	30,000	100	95	82	76	163	133	26	63	45
Exchangeable Cations		-	All units meq/100g (except Exchangable Sodium Percentage (%))								
Exchangeable Calcium	0.2	-							0.8	2.1	2.4
Exchangeable Magnesium	0.2	-							0.7	0.8	0.6
Exchangeable Potassium	0.2	-							0.2	0.3	0.2
Exchangeable Sodium	0.2	-							<0.2	<0.2	<0.2
Cation Exchange Capacity	0.2	-							1.7	3.3	3.2
Exchangeable Sodium Percent	0.2	-							<0.2	<0.2	<0.2
Calcium/Magnesium Ratio	0.2	-							1.1	2.6	3.6
Magnesium/Potassium Ratio	0.2	-							2.8	2.4	3.0

Notes: < indicates less than the laboratory limit of reporting. Shaded cells exceed applied guideline limit. ** Guideline level for Cr(VI) = 300 mg/kg.

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 C3: Geochemical Abundance Index Results for Samples from the Boggabri Modification Project

		RGS Sample Number →	2023033_C001	2023033_C002	2023033_C003	2023033_C004	2023033_C005	2023033_C006	2023033_C007	2023033_C008	2023033_C009	2023033_C010
		Sampling Date →	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023
		ALS Laboratory ID →	EB2338913001	EB2338913002	EB2338913003	EB2338913004	EB2338913005	EB2338913006	EB2338913007	EB2338913008	EB2338913009	EB2338913010
		Client ID →	HE Seam	ON Seam	TS Seam	THO Seam	BRU Seam	BR Seam	JE Seam	MN Seam	VY Seam	NG Seam
Parameters	**Limit of Reporting**	Median Crustal Abundance[1,2,3]	Roof/Floor	Roof/Floor	Roof/Floor	Roof/Floor	Roof	Floor	Roof/Floor	Roof/Floor	Roof/Floor	Roof/Floor
Major Cations	(All units in 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
Aluminium (Al)	50	71,000	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
Minor and Trace Elements	(All units in mg/kg)		Geochemical Abundance Index									
Arsenic (As)	5	6	0	0	0	0	0	0	0	0	0	0
Boron (B)	50	20	0	0	0	0	0	0	0	0	0	0
Barium (Ba)	10	500	0	0	0	0	0	0	0	0	0	0
Beryllium (Be)	0.1	0.3	1	1	1	1	1	1	1	1	1	1
Cadmium (Cd)	0.1	0.35	0	0	0	0	0	0	0	0	0	0
Cobalt (Co)	2	8	0	0	0	0	0	0	0	0	0	0
Chromium (Cr)	2	70	0	0	0	0	0	0	0	0	0	0
Copper (Cu)	5	30	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
Manganese (Mn)	5	1000	0	0	0	0	0	0	0	0	0	0
Molybdenum (Mo)	2	1.2	0	0	0	0	0	0	0	0	0	0
Nickel (Ni)	2	50	0	0	0	0	0	0	0	0	0	0
Lead (Pb)	5	35	0	0	0	0	0	0	0	0	0	0
Antimony (Sb)	5	1	0	0	0	0	0	0	0	0	0	0
Selenium (Se)	5	0.4	0	0	0	0	0	0	0	0	0	0
Thorium (Th)	0.1	9	0	0	0	0	0	0	0	0	0	0
Uranium (U)	0.1	2	0	0	0	0	0	0	0	0	0	0
Vanadium (V)	5	90	0	0	0	0	0	0	0	0	0	0
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. Apparent gold enrichment is an artifact of the laboratory Limit of Reporting (LoR)

1. Median Crustal Abundance values sourced from the "GARD Guide" (INAP, 2024).

2. When no GARD Guide value is available for particular element, then values are taken from Bowen (1979) Environmental Chemistry of the Elements, p 60-61.

3. If no guide value from GARD or Bowen H.J.M. (1979) exists, up to date, curated data is provided by CRC Handbook of Chemistry and Physics (2000).

Table C3: Geochemical Abundance Index Results for Samples from the Boggabri Modification Project

		RGS Sample Number →	2023033_C011	2023033_C012	2023033_C013	2023033_C014	2023033_C015	2023033_C016	2023033_C017	2023033_C018	2023033_C019
		Sampling Date →	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023
		ALS Laboratory ID →	EB2338913011	EB2338913012	EB2338913013	EB2338913014	EB2338913015	EB2338913016	EB2338913017	EB2338913018	EB2338913019
		Client ID →	NT Seam	TH Seam	FX Seam	TA Seam	TP Seam	TAK Seam	Overburden	Interburden	Interburden
Parameters	**Limit of Reporting**	Median Crustal Abundance[1,2,3]	Roof	Roof/Floor	Roof/Floor	Roof/Floor	Roof/Floor	Floor	Conglomerate/ Sandstone	Conglomerate/ Sandstone/ Siltstone	Conglomerate/ Sandstone/ Siltstone
Major Cations	(All units in mg/kg)		Geochemical Abundance Index								
Calcium (Ca)	50	15,000	0	0	0	0	0	0	0	0	0
Magnesium (Mg)	50	5,000	0	0	0	0	0	0	0	0	0
Potassium (K)	50	14,000	0	0	0	0	0	0	0	0	0
Sodium (Na)	50	5,000	0	0	0	0	0	0	0	0	0
Aluminium (Al)	50	71,000	0	0	0	0	0	0	0	0	0
Iron (Fe)	50	40,000	0	0	0	0	0	0	0	0	0
Minor and Trace Elements	(All units in mg/kg)		Geochemical Abundance Index								
Arsenic (As)	5	6	0	0	1	0	0	0	0	0	0
Boron (B)	50	20	0	0	0	0	0	0	0	0	0
Barium (Ba)	10	500	0	0	0	0	0	0	0	0	0
Beryllium (Be)	0.1	0.3	1	1	1	1	1	0	0	1	0
Cadmium (Cd)	0.1	0.35	0	0	0	0	0	0	0	0	0
Cobalt (Co)	2	8	0	0	0	0	1	0	0	0	0
Chromium (Cr)	2	70	0	0	0	0	0	0	0	0	0
Copper (Cu)	5	30	0	0	0	0	1	1	0	0	0
Mercury (Hg)	0.1	0.06	0	0	0	0	1	1	0	0	0
Manganese (Mn)	5	1000	0	0	0	0	0	0	0	0	0
Molybdenum (Mo)	2	1.2	0	0	0	0	0	0	0	0	0
Nickel (Ni)	2	50	0	0	0	0	0	0	0	0	0
Lead (Pb)	5	35	0	0	0	0	0	0	0	0	0
Antimony (Sb)	5	1	0	0	0	0	0	0	0	0	0
Selenium (Se)	5	0.4	0	0	0	1	1	1	0	0	0
Thorium (Th)	0.1	9	0	0	0	0	0	0	0	0	0
Uranium (U)	0.1	2	0	0	0	0	0	0	0	0	0
Vanadium (V)	5	90	0	0	0	0	0	0	0	0	0
Zinc (Zn)	5	90	0	0	0	0	0	0	0	0	0

Notes: GAI's greater than or equal to 3 are highlighted. Apparent gold enrichment is an artifact of the laboratory Limit of Reporting (LoR)

1. Median Crustal Abundance values sourced from the "GARD Guide" (INAP, 2024).

2. When no GARD Guide value is available for particular element, then values are taken from Bowen (1979) Environmental Chemistry of the Elements, p 60-61.

3. If no guide value from GARD or Bowen H.J.M. (1979) exists, up to date, curated data is provided by CRC Handbook of Chemistry and Physics (2000).

Table C4: Multi-Element Test Results for Water Extracts from Samples from the Boggabri Modification Project

		RGS Sample Number →	2023033_C001	2023033_C002	2023033_C003	2023033_C004	2023033_C005	2023033_C006	2023033_C007	2023033_C008	2023033_C009	2023033_C010
		ALS Laboratory ID →	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023
		Sample Date →	EB2338913001	EB2338913002	EB2338913003	EB2338913004	EB2338913005	EB2338913006	EB2338913007	EB2338913008	EB2338913009	EB2338913010
		Client Sample ID →	HE Seam	ON Seam	TS Seam	THO Seam	BRU Seam	BR Seam	JE Seam	MN Seam	VY Seam	NG Seam
Parameters	**Limit of Reporting**	Aquatic Ecosystems (freshwater)[1]	Livestock Drinking Water[2]	Roof/Floor	Roof/Floor	Roof/Floor	Roof/Floor	Roof	Floor	Roof/Floor	Roof/Floor	Roof/Floor	Roof/Floor
pH	0.01 pH unit	6 to 9	-	4.3	6.1	7.5	7.9	6.9	6.8	7.2	7.2	8.5	8.5
Electrical Conductivity	1 µS/cm	<1,000#	3,580^	985	398	154	183	196	51	99	99	252	275
Carbonate Alkalinity (mg $CaCO_3$/L)	1 mg/L	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	34
Bicarbonate Alkalinity (mg $CaCO_3$/L)	1 mg/L	-	-	<1	197	396	888	296	179	272	342	996	7,720
Total Alkalinity (mg $CaCO_3$/L)	1 mg/L	-	-	<1	197	396	888	296	179	272	342	996	7,760
Acidity (mg $CaCO_3$/L)	1 mg/L	-	-	858	188	108	87	108	72	43	65	7	<1
Net Alkalinity (mg $CaCO_3$/L)	1 mg/L	-	-	-858	10	288	801	188	107	229	277	989	7,759
Major Ions				All units mg/L									
Calcium (Ca)	2	-	1,000	64	24	6	14	6	<2	<2	<2	12	16
Magnesium (Mg)	2	-	-	38	10	2	6	2	<2	<2	<2	4	6
Potassium (K)	2	-	-	36	40	26	30	26	10	18	18	26	30
Sodium (Na)	2	-	-	4	6	4	4	4	2	2	4	16	16
Chloride (Cl)	2	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Fluoride (F)	0.2	-	2	0.4	<0.2	0.4	0.6	0.2	0.2	0.2	0.4	0.6	1.0
Sulfate (SO_4^{2-})	2	-	1,000	580	180	32	22	70	6	28	26	44	14
Silica (Si)	0.2	-	-	28.6	13.0	9.0	9.0	15.8	20.4	14.4	16.4	8.2	8.0
Reactive Phosphorus (P)	0.02	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Trace Metals/Metalloids				All units mg/L									
Aluminium (Al)	0.02	0.055	5	5.34	<0.02	<0.02	<0.02	<0.02	0.06	0.02	0.04	0.04	<0.02
Arsenic (As)	0.002	0.024 (trivalent)*	0.5	<0.002	<0.002	<0.002	0.004	0.004	<0.002	<0.002	0.002	0.008	0.010
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
Barium (Ba)	0.002	-	-	0.024	0.034	0.034	0.198	0.048	0.008	0.044	0.012	0.078	0.034
Beryllium (Be)	0.002	-	-	0.008	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
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
Cobalt (Co)	0.002	-	1	0.122	0.006	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	0.002	0.001 (hexavalent	1 (total)	<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	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Iron (Fe)	0.2	-	-	104.8	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
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
Manganese (Mn)	0.002	1.9	-	3.48	0.364	0.008	0.008	0.014	0.004	0.006	0.004	0.006	0.004
Molybdenum (Mo)	0.002	-	0.15	<0.002	<0.002	0.016	0.032	0.014	0.002	0.008	0.01	0.046	0.022
Nickel (Ni)	0.002	0.011	1	0.400	0.012	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
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
Antimony (Sb)	0.002	-	-	<0.002	<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
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	-	0.1	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	0.414	0.022	<0.01	<0.01	0.018	<0.01	<0.01	<0.01	<0.01	<0.01

Notes: < indicates concentration less than the detection limit. Shaded cells exceed applied guideline values. * Cr (VI) = hexavalent. ** 0.013 mg/L for pentavalent Arsenic (V).
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. pH and EC of composites are median pH and EC values of individual samples

1. ANZG (2018). Trigger values for freshwater aquatic ecosystems (95% species protection level)
2. ANZG (2018). Recommended guideline limits for Livestock Drinking Water.

Table C4: Multi-Element Test Results for Water Extracts from Samples from the Boggabri Modification Project

		RGS Sample Number →		2023033_C011	2023033_C012	2023033_C013	2023033_C014	2023033_C015	2023033_C016	2023033_C017	2023033_C018	2023033_C019
		ALS Laboratory ID →		06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023	06/12/2023
		Sample Date →		EB2338913011	EB2338913012	EB2338913013	EB2338913014	EB2338913015	EB2338913016	EB2338913017	EB2338913018	EB2338913019
		Client Sample ID →		NT Seam	TH Seam	FX Seam	TA Seam	TP Seam	TAK Seam	Overburden	Interburden	Interburden
Parameters	**Limit of Reporting**	Aquatic Ecosystems (freshwater)[1]	Livestock Drinking Water[2]	Roof	Roof/Floor	Roof/Floor	Roof/Floor	Roof/Floor	Floor	Conglomerate/ Sandstone	Conglomerate/ Sandstone/ Siltstone	Conglomerate/ Sandstone/ Siltstone
pH	0.01 pH unit	6 to 9	-	8.2	8.2	7.9	7.9	7.0	7.1	8.9	8.7	8.7
Electrical Conductivity	1 µS/cm	<1,000#	3,580^	199	191	78	234	94	149	204	265	210
Carbonate Alkalinity (mg $CaCO_3$/L)	1 mg/L	-	-	<1	<1	<1	<1	<1	<1	34	34	34
Bicarbonate Alkalinity (mg $CaCO_3$/L)	1 mg/L	-	-	608	530	404	608	304	436	4,860	7,220	9,240
Total Alkalinity (mg $CaCO_3$/L)	1 mg/L	-	-	608	530	404	608	304	436	4,880	7,240	9,280
Acidity (mg $CaCO_3$/L)	1 mg/L	-	-	17	31	29	58	130	123	<1	<1	<1
Net Alkalinity (mg $CaCO_3$/L)	1 mg/L	-	-	591	499	375	550	174	313	4,879	7,239	9,279
Major Ions				All units mg/L								
Calcium (Ca)	2	-	1,000	6	6	<2	16	2	14	12	16	10
Magnesium (Mg)	2	-	-	<2	<2	<2	2	<2	2	4	6	2
Potassium (K)	2	-	-	24	24	14	22	12	2	26	30	24
Sodium (Na)	2	-	-	14	14	4	16	12	14	4	6	12
Chloride (Cl)	2	-	-	<2	<2	<2	<2	<2	<2	<2	<2	<2
Fluoride (F)	0.2	-	2	0.8	0.6	1.0	0.8	0.4	0.8	0.6	0.8	0.8
Sulfate (SO_4^{2-})	2	-	1,000	26	16	14	8	34	10	42	48	18
Silica (Si)	0.2	-	-	9.4	10.2	13.6	10.6	18.4	18.2	7.4	6.6	7.2
Reactive Phosphorus (P)	0.02	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Trace Metals/Metalloids				All units mg/L								
Aluminium (Al)	0.02	0.055	5	0.02	0.02	0.38	<0.02	<0.02	<0.02	0.02	0.02	0.02
Arsenic (As)	0.002	0.024 (trivalent)*	0.5	0.020	0.010	0.120	0.014	<0.002	0.008	0.012	0.004	0.014
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
Barium (Ba)	0.002	-	-	0.066	0.038	0.004	0.032	0.05	0.064	0.07	0.062	0.062
Beryllium (Be)	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
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
Cobalt (Co)	0.002	-	1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	0.002	0.001 (hexavalent	1 (total)	<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	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<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
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
Manganese (Mn)	0.002	1.9	-	0.006	0.004	0.004	0.004	0.004	0.002	<0.002	0.004	<0.002
Molybdenum (Mo)	0.002	-	0.15	0.032	0.008	0.024	0.024	0.018	0.008	0.018	0.02	0.026
Nickel (Ni)	0.002	0.011	1	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
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
Antimony (Sb)	0.002	-	-	0.002	0.002	0.004	<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
Thorium (Th)	0.002	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Uranium (U)	0.002	-	0.1	<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
Zinc (Zn)	0.01	0.008	20	0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes: < indicates concentration less than the detection limit. Shaded cells exceed applied guideline values. * Cr (VI) = hexavalent. ** 0.013 mg/L for pentavalent Arsenic (V).
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. pH and EC of composites are median pH and EC values of individual samples

1. ANZG (2018). Trigger values for freshwater aquatic ecosystems (95% species protection level)
2. ANZG (2018). Recommended guideline limits for Livestock Drinking Water.

Attachment D: KLC Test Results and Data Trends

KLC 1 PAF Herndale and Onavale Seams Roof/Floor

Weight (kg)	2.00	Total S (%)	0.838	ANC	9.8
pH (1:5)	7.20	Scr (%)	1.294	NAPP	29.8
EC (µS/cm)	200	MPA	39.64	ANC:MPA	0.2

	Water Quality Guidelines													
Date			19-Jan-24	21-Feb-24	21-Mar-24	18-Apr-24	15-May-24	20-Jun-24	18-Jul-24	08-Aug-24	11-Sep-24	08-Oct-24	07-Nov-24	05-Dec-24	09-Jan-25
Number of Weeks			0	5	9	13	17	22	26	29	34	38	42	46	51
Leach Number			1	2	3	4	5	6	7	8	9	10	11	12	13
ALS Laboratory Number			EB2401895001	EB2405911001	EB2409666001	EB2413082001	EB2416487001	EB2421205001	EB2424599001	EB2427111001	EB2431310001	EB2434698001	EB2438598001	EB2442712001	EB2500777001
Volume On (L)			1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)			0.718	0.790	0.738	0.783	0.778	0.776	0.792	0.848	0.754	0.755	0.754	0.747	0.751
Cum. Volume (L)			0.7	1.508	2.246	3.029	3.807	4.583	5.375	6.223	6.977	7.732	8.486	9.233	9.984
Pore Volumes			0.532	1.117	1.664	2.244	2.820	3.395	3.981	4.610	5.168	5.728	6.286	6.839	7.396
pH (RGS Measurement)		-	3.22	2.92	3.14	3.03	2.98	3.09	3.04	2.26	2.98	2.98	2.75	2.82	2.78
pH (ALS Measurement)	6 to 9	-	3.11	2.76	2.73	2.80	2.85	2.83	2.85	2.71	2.83	2.76	2.74	2.69	2.64
pH (deionised water used in test)		-	6.32	7.15	5.08	5.63	6.04	6.94	6.22	6.42	6.28	6.07	7.61	6.90	6.80
EC (RGS Measurement) (µS/cm)	<1,000 #	3,580^	1,182	1,870	1,656	1,538	1,551	1,413	1,668	1,589	2,440	2,386	2,339	2,034	1,905
EC (ALS Measurement) (µS/cm)			1,360	2,040	1,790	1,820	1,860	1,890	2,150	1,870	2,410	2,300	2,240	2,140	2,240
Acidity (mg/L as $CaCO_3$)*	-	-	450	1030	603	507	511	533	613	595	868.0	695.0	742.0	572.0	600.0
Alkalinity (mg/L as $CaCO_3$)*	-	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Net Alkalinity (mg/L as $CaCO_3$)*			-450	-1030	-603	-507	-511	-533	-613	-595	-867.5	-694.5	-741.5	-571.5	-599.5

Major Ions (mg/L)	Elements	LoR	Aquatic Ecosystems (Freshwater)[1]	Livestock Drinking Water[2]											
Calcium	Ca	1	-	1,000	40	34	24	31	25	24	28	49	37	35	43	44	40
Potassium	K	1	-	-	13	3	1	<1	<1	<1	<1	24	1	<1	<1	<1	<1
Magnesium	Mg	1	-	-	17	24	40	60	71	80	115	78	125	101	98	69	56
Sodium	Na	1	-	-	4	<1	<1	3	<1	<1	<1	<1	<1	<1	3	<1	<1
Chloride	Cl	1	-	-	1	<1	<1	<1	<1	1	<1	2	<1	<1	<1	2	<1
Fluoride	F	0.1	-	2	<0.1	0.2	<1.0	<1.0	0.2	0.2	0.2	0.3	<1.0	0.2	0.2	0.3	0.3
Sulfate	SO_4	1	-	1,000	716	969	880	895	965	980	1,090	993	1370	1190	1110	968	991
Trace metals/ metalloids (mg/L)	**Elements**	**LoR**	**Aquatic Ecosystems (Freshwater)[1]**	**Livestock Drinking Water[2]**											
Aluminium	Al	0.01	0.055	5	31.7	24.8	19.8	25.7	27.4	28.4	46.6	35.4	52.7	46.9	58.3	41.6	36
Arsenic	As	0.001	0.024	0.5	0.006	0.005	0.002	0.003	0.004	0.008	0.017	0.011	0.022	0.019	0.025	0.021	0.02
Boron	B	0.05	0.37	5	<0.05	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	Ba	0.001	-	-	0.046	0.007	0.005	0.004	0.003	0.004	0.002	0.002	0.004	0.001	0.002	0.001	0.002
Beryllium	Be	0.001	-	-	0.01	0.022	0.024	0.03	0.032	0.035	0.053	0.054	0.054	0.058	0.062	0.051	0.045
Cadmium	Cd	1E-04	0.0002	0.01	0.0014	0.0031	0.0037	0.0046	0.0058	0.0063	0.008	0.0078	0.0111	0.0091	0.0092	0.0065	0.0059
Cobalt	Co	0.001	-	1	0.116	0.201	0.311	0.396	0.403	0.428	0.497	0.255	0.534	0.387	0.353	0.208	0.187
Chromium	Cr	0.001	0.001	1	0.013	0.015	0.012	0.014	0.014	0.016	0.023	0.018	0.023	0.026	0.031	0.025	0.023
Copper	Cu	0.001	0.0014	1	0.128	0.264	0.337	0.411	0.409	0.495	0.61	0.401	0.961	0.639	0.636	0.501	0.497
Iron	Fe	0.05	-	-	142	270	188	187	162	146	171	104	179	133	149	121	110
Mercury	Hg	1E-04	0.0006	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese	Mn	0.001	1.9	-	0.895	2.25	3.78	6.09	7.25	8.23	11.9	8.12	15	12.2	13.3	10	8.39
Molybdenum	Mo	0.001	-	0.15	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001	0.001	0.001	0.001	<0.001	0.001
Nickel	Ni	0.001	0.011	1	0.38	0.697	0.946	1.15	1.26	1.35	1.71	0.91	1.72	1.42	1.31	0.852	0.717
Lead	Pb	0.001	0.0034	0.1	0.031	0.02	0.004	0.008	0.006	0.02	0.002	0.007	0.059	0.002	0.002	0.008	0.004
Antimony	Sb	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	Se	0.01	0.011	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	Th	0.001	-	-	0.008	0.017	0.013	0.014	0.018	0.019	0.03	0.043	0.033	0.047	0.048	0.046	0.044
Uranium	U	0.001	-	0.1	0.006	0.011	0.013	0.013	0.018	0.019	0.026	0.031	0.033	0.039	0.033	0.026	0.025
Vanadium	V	0.01	-	-	<0.01	<0.01	<0.01	<0.01	0.01	0.02	0.04	0.01	0.03	0.04	0.04	0.03	0.03
Zinc	Zn	0.005	0.008	-	0.524	1.54	2.77	4.05	4.76	5.22	7.24	4.55	8.3	6.42	6.53	4.19	3.71

Calculations**	Elements												
SO_4 Release Rate	SO_4	257	383	325	350	375	380	432	421	517	449	418	362	372
Cumulative SO_4 Release	Cum. SO_4	257	640	965	1315	1690	2071	2502	2923	3440	3889	4308	4669	5041
Ca Release Rate	Ca	14.4	13.4	8.9	12.1	9.7	9.3	11.1	20.8	13.95	13.21	16.21	16.43	15.02
Cumulative Ca Release	Cum. Ca	14.4	27.8	36.6	48.8	58.5	67.8	78.9	99.7	113.64	126.85	143.06	159.50	174.52
Mg Release Rate	Mg	6.1	9.5	14.8	23.5	27.6	31.0	45.5	33.1	47.14	38.13	36.95	25.77	21.03
Cumulative Mg Release	Cum. Mg	6.1	15.6	30.3	53.8	81.5	112.5	158.0	191.1	238.25	276.37	313.32	339.09	360.12
Residual ANC (%)	Res. ANC	99.4	98.7	97.8	96.6	95.2	93.7	91.6	89.7	87.4	85.5	83.6	82.1	80.9
Residual Sulfur (%)	Res. S	99.0	97.5	96.2	94.8	93.3	91.8	90.0	88.4	86.3	84.5	82.8	81.4	79.9
SO_4/(Ca+Mg) molar ratio	SO_4/(Ca+Mg)	4.4	5.5	4.1	2.9	2.8	2.6	2.1	2.3	2.4	2.5	2.3	2.6	3.1

Notes: ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines 1. Trigger values for aquatic ecosystems (95% species protection level). 2. Recommended guideline limits for Livestock Drinking Water.

< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.
Shaded cells exceed applied guideline values. (tri)* 0.024 g/L for trivalent Arsenic (III) and 0.013 g/L for pentavalent Arsenic (V). (hex)* Cr (VI) = hexavalent.
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 2,400 mg/L for livestock drinking water.
** SO_4, Ca and Mg release rates calculated in mg/kg/flush. Residual ANC assumes that all leached Mg and Ca is due to dissolution of calcite or dolomite.
Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity. MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential.

KLC 2 NAF Teston to TAK Seams Roof/Floor

	Weight (kg)	2.00	Total S (%)	0.034	ANC	29.6
	pH (1:5)	7.80	Scr (%)	0.034	NAPP	-28.5
	EC (µS/cm)	84	MPA	1.05	ANC:MPA	28.2

Date				19-Jan-24	21-Feb-24	21-Mar-24	18-Apr-24	15-May-24	20-Jun-24	18-Jul-24
Number of Weeks				0	5	9	13	17	22	26
Leach Number				1	2	3	4	5	6	7
ALS Laboratory Number				EB2401895002	EB2405911002	EB2409666002	EB2413082002	EB2416487002	EB2421205002	EB2424599002
Volume On (L)				1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)				0.714	0.719	0.760	0.729	0.750	0.730	0.718
Cum. Volume (L)				0.7	1.433	2.193	2.922	3.672	4.402	5.120
Pore Volumes				0.529	1.061	1.624	2.164	2.720	3.261	3.793
pH (RGS Measurement)	Water Quality Guidelines			5.90	5.56	4.90	5.73	5.24	5.65	5.62
pH (ALS Measurement)	6 to 9		-	6.79	6.65	5.53	6.19	6.13	6.52	5.92
pH (deionised water used in test)			-	6.32	7.15	5.08	5.63	6.04	6.94	6.22
EC (RGS Measurement) (µS/cm)	<1,000 #		3,580^	47	65	56	63	64	58	38
EC (ALS Measurement) (µS/cm)				52	60	53	66	53	46	43
Acidity (mg/L as $CaCO_3$)*	-		-	2	3	2	3	2	3	2
Alkalinity (mg/L as $CaCO_3$)*	-		-	<1	<1	<1	6	7	3	2
Net Alkalinity (mg/L as $CaCO_3$)*				-2	-3	-2	3	5	0	0
Major Ions (mg/L)	**Elements**	**LoR**	**Aquatic Ecosystems (Freshwater)[1]**	**Livestock Drinking Water[2]**						
Calcium	Ca	1	-	1,000	3	4	4	4	4	3	3
Potassium	K	1	-	-	2	2	2	2	1	1	1
Magnesium	Mg	1	-	-	<1	<1	<1	<1	<1	<1	<1
Sodium	Na	1	-	-	9	4	4	7	4	3	4
Chloride	Cl	1	-	-	<1	<1	<1	<1	<1	<1	<1
Fluoride	F	0.1	-	2	0.1	0.2	<0.1	0.2	0.2	0.1	<0.1
Sulfate	SO_4	1	-	1,000	10	19	17	20	16	21	12
Trace metals/ metalloids (mg/L)	**Elements**	**LoR**	**Aquatic Ecosystems (Freshwater)[1]**	**Livestock Drinking Water[2]**						
Aluminium	Al	0.01	0.055	5	0.13	0.09	0.07	0.16	0.12	0.21	0.12
Arsenic	As	0.001	0.024	0.5	0.002	0.004	0.004	0.005	0.004	0.004	0.003
Boron	B	0.05	0.37	5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	Ba	0.001	-	-	0.164	0.014	0.012	0.024	0.01	0.011	0.01
Beryllium	Be	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	Cd	1E-04	0.0002	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	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	Cu	0.001	0.0014	1	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Iron	Fe	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	0.06	<0.05
Mercury	Hg	1E-04	0.0006	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese	Mn	0.001	1.9	-	0.004	0.002	0.002	0.006	0.002	0.003	0.002
Molybdenum	Mo	0.001	-	0.15	0.006	0.004	0.004	0.004	0.004	0.004	0.003
Nickel	Ni	0.001	0.011	1	<0.001	0.002	0.001	0.003	0.001	0.001	0.001
Lead	Pb	0.001	0.0034	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	0.011	0.02	<0.01	0.02	0.02	0.01	0.01	<0.01	<0.01
Thorium	Th	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	U	0.001	-	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	V	0.01	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	Zn	0.005	0.008	-	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005
Calculations**	**Elements**									
SO_4 Release Rate	SO_4				4	7	6	7	6	8	4
Cumulative SO_4 Release	Cum. SO_4				4	10	17	24	30	38	42
Ca Release Rate	Ca				1.1	1.4	1.5	1.5	1.5	1.1	1.1
Cumulative Ca Release	Cum. Ca				1.1	2.5	4.0	5.5	7.0	8.1	9.2
Mg Release Rate	Mg				0.2	0.2	0.2	0.2	0.2	0.2	0.2
Cumulative Mg Release	Cum. Mg				0.2	0.4	0.5	0.7	0.9	1.1	1.3
Residual ANC (%)	Res. ANC				100.0	100.0	100.0	99.9	99.9	99.9	99.9
Residual Sulfur (%)	Res. S				99.7	99.0	98.4	97.7	97.1	96.3	95.9
SO_4/(Ca+Mg) molar ratio	SO_4/(Ca+Mg)				1.1	1.6	1.5	1.7	1.4	2.3	1.3

Notes: ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines 1. Trigger values for aquatic ecosystems (95% species protection level). 2. Recommended guideline limits for Livestock Drinking Water.

< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.
Shaded cells exceed applied guideline values. (tri)* 0.024 g/L for trivalent Arsenic (III) and 0.013 g/L for pentavalent Arsenic (V). (hex)* Cr (VI) = hexavalent.
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.
** SO4, Ca and Mg release rates calculated in mg/kg/flush. Residual ANC assumes that all leached Mg and Ca is due to dissolution of calcite or dolomite.
Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity. MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential.

KLC 3 NAF Overburden

Weight (kg)	2.00	Total S (%)	0.023	ANC	53.2
pH (1:5)	8.80	Scr (%)	0.023	NAPP	-52.5
EC (µS/cm)	214	MPA	0.71	ANC:MPA	74.5

Date					19-Jan-24	21-Feb-24	21-Mar-24	18-Apr-24	15-May-24	20-Jun-24	18-Jul-24
Number of Weeks					0	5	9	13	17	22	26
Leach Number					1	2	3	4	5	6	7
ALS Laboratory Number					EB2401895003	EB2405911003	EB2409666003	EB2413082003	EB2416487003	EB2421205003	EB2424599003
Volume On (L)					1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)					0.713	0.757	0.732	0.786	0.761	0.772	0.774
Cum. Volume (L)					0.7	1.470	2.202	2.988	3.749	4.521	5.295
Pore Volumes			Water Quality Guidelines		0.528	1.089	1.631	2.213	2.777	3.349	3.922
pH (RGS Measurement)			6 to 9	-	7.00	6.34	6.71	6.38	6.21	6.36	6.33
pH (ALS Measurement)					7.63	7.07	6.36	6.68	6.52	6.59	6.80
pH (deionised water used in test)				-	6.32	7.15	5.08	5.63	6.04	6.94	6.22
EC (RGS Measurement) (µS/cm)			<1,000 #	3,580^	100	140	138	88	78	59	67
EC (ALS Measurement) (µS/cm)					119	160	117	107	93	84	88
Acidity (mg/L as $CaCO_3$)*			-	-	1	2	2	2	2	3	2
Alkalinity (mg/L as $CaCO_3$)*			-	-	<1	<1	<1	14	14	10	9
Net Alkalinity (mg/L as $CaCO_3$)*					-1	-2	-2	12	12	7	7
Major Ions (mg/L)	Elements	LoR	Aquatic Ecosystems (Freshwater)[1]	Livestock Drinking Water[2]							
Calcium	Ca	1	-	1,000	11	12	10	9	7	6	5
Potassium	K	1	-	-	6	7	6	5	4	4	3
Magnesium	Mg	1	-	-	3	5	5	4	3	3	4
Sodium	Na	1	-	-	3	4	2	3	1	1	2
Chloride	Cl	1	-	-	<1	4	<1	<1	<1	<1	<1
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	31	46	40	32	27	26	27
Trace metals/ metalloids (mg/L)	Elements	LoR	Aquatic Ecosystems (Freshwater)[1]	Livestock Drinking Water[2]							
Aluminium	Al	0.01	0.055	5	0.10	0.04	0.04	0.03	0.06	0.08	0.07
Arsenic	As	0.001	0.024	0.5	0.002	0.003	0.001	0.002	0.002	0.002	0.001
Boron	B	0.05	0.37	5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	Ba	0.001	-	-	0.023	0.015	0.012	0.011	0.01	0.01	0.01
Beryllium	Be	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	Cd	1E-04	0.0002	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	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	Cu	0.001	0.0014	1	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Iron	Fe	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury	Hg	1E-04	0.0006	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese	Mn	0.001	1.9	-	0.007	0.007	0.005	0.010	0.004	0.003	0.003
Molybdenum	Mo	0.001	-	0.15	0.003	0.005	0.006	0.006	0.007	0.007	0.007
Nickel	Ni	0.001	0.011	1	0.001	<0.001	<0.001	0.002	0.001	<0.001	0.001
Lead	Pb	0.001	0.0034	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	0.011	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	Th	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	U	0.001	-	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	V	0.01	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	Zn	0.005	0.008	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calculations**	Elements										
SO_4 Release Rate	SO_4				11	17	15	13	10	10	10
Cumulative SO_4 Release	Cum. SO_4				11	28	43	56	66	76	86
Ca Release Rate	Ca				3.9	4.5	3.7	3.5	2.7	2.3	1.9
Cumulative Ca Release	Cum. Ca				3.9	8.5	12.1	15.7	18.3	20.6	22.6
Mg Release Rate	Mg				1.1	1.9	1.8	1.6	1.1	1.2	1.5
Cumulative Mg Release	Cum. Mg				1.1	3.0	4.8	6.4	7.5	8.7	10.2
Residual ANC (%)	Res. ANC				100.0	99.9	99.9	99.9	99.9	99.8	99.8
Residual Sulfur (%)	Res. S				98.4	95.9	93.8	92.0	90.6	89.1	87.6
SO_4/(Ca+Mg) molar ratio	SO_4/(Ca+Mg)				0.8	0.9	0.9	0.9	0.9	1.0	1.0

Notes: ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines 1. Trigger values for aquatic ecosystems (95% species protection level). 2. Recommended guideline limits for Livestock Drinking Water.

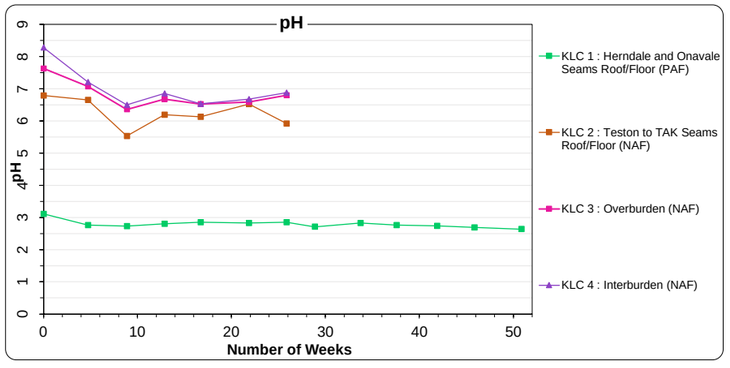
< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.
Shaded cells exceed applied guideline values. (tri)* 0.024 g/L for trivalent Arsenic (III) and 0.013 g/L for pentavalent Arsenic (V). (hex)* Cr (VI) = hexavalent.
for still water bodies only, 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.
** SO4, Ca and Mg release rates calculated in mg/kg/flush. Residual ANC assumes that all leached Mg and Ca is due to dissolution of calcite or dolomite.
Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity. MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential.

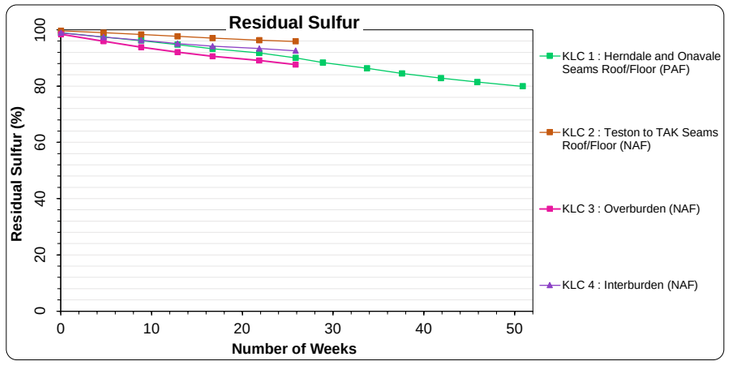
KLC 4 NAF Interburden

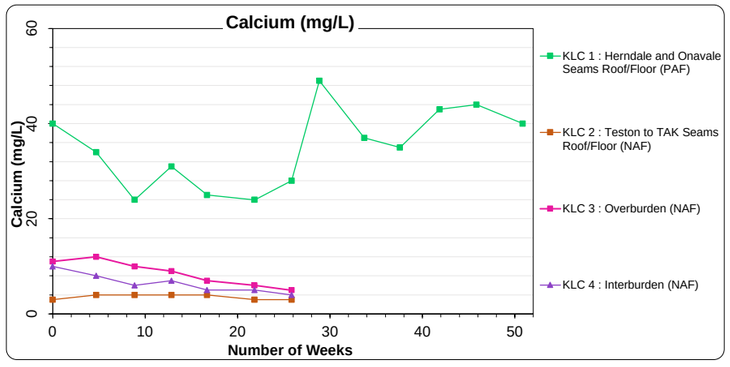
	Weight (kg)	2.00	Total S (%)	0.025	ANC	86.6	
	pH (1:5)	8.80	Scr (%)	0.025	NAPP	-85.8	
	EC (µS/cm)	194	MPA	0.76	ANC:MPA	114.0	

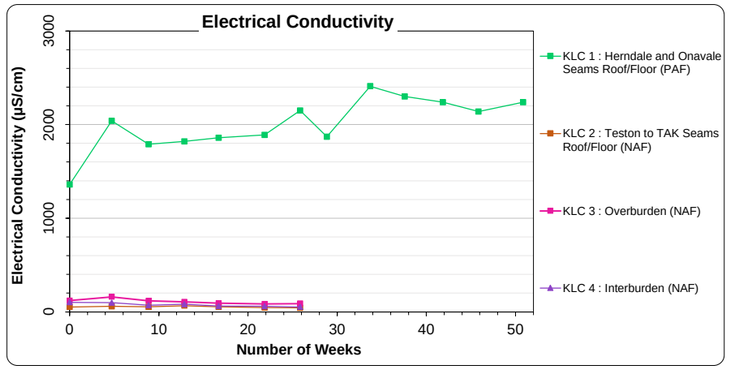
Date				19-Jan-24	21-Feb-24	21-Mar-24	18-Apr-24	15-May-24	20-Jun-24	18-Jul-24
Number of Weeks				0	5	9	13	17	22	26
Leach Number				1	2	3	4	5	6	7
ALS Laboratory Number				EB2401895004	EB2405911004	EB2409666004	EB2413082004	EB2416487004	EB2421205004	EB2424599004
Volume On (L)				1.0	1.0	1.0	1.0	1.0	1.0	1.0
Volume Off (L)				0.780	0.812	0.798	0.826	0.791	0.790	0.800
Cum. Volume (L)				0.8	1.592	2.390	3.216	4.007	4.797	5.597
Pore Volumes				0.578	1.179	1.770	2.382	2.968	3.553	4.146
pH (RGS Measurement)	Water Quality Guidelines			7.77	6.95	5.97	6.73	6.74	6.80	6.60
pH (ALS Measurement)	6 to 9			8.28	7.21	6.50	6.85	6.53	6.68	6.88
pH (deionised water used in test)			-	6.32	7.15	5.08	5.63	6.04	6.94	6.22
EC (RGS Measurement) (µS/cm)	<1,000 #		3,580^	81	85	66	65	49	40	41
EC (ALS Measurement) (µS/cm)				102	97	69	82	62	60	53
Acidity (mg/L as $CaCO_3$)*	-		-	<1	2	2	2	2	2	2.0
Alkalinity (mg/L as $CaCO_3$)*	-		-	<1	<1	<1	15	11	11	8.0
Net Alkalinity (mg/L as $CaCO_3$)*				0	-2	-2	13	9	9	6
Major Ions (mg/L)	Elements	LoR	Aquatic Ecosystems (Freshwater)[1]	Livestock Drinking Water[2]						
Calcium	Ca	1	-	1,000	10	8	6	7	5	5	4
Potassium	K	1	-	-	4	3	3	3	2	2	2
Magnesium	Mg	1	-	-	2	1	1	1	<1	<1	<1
Sodium	Na	1	-	-	12	4	4	5	3	3	3
Chloride	Cl	1	-	-	<1	<1	<1	<1	<1	<1	<1
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	20	29	20	22	16	16	14
Trace metals/ metalloids (mg/L)	Elements	LoR	Aquatic Ecosystems (Freshwater)[1]	Livestock Drinking Water[2]						
Aluminium	Al	0.01	0.055	5	0.14	0.08	0.08	0.10	0.11	0.16	0.11
Arsenic	As	0.001	0.024	0.5	0.003	0.002	<0.001	0.002	0.002	0.002	<0.001
Boron	B	0.05	0.37	5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Barium	Ba	0.001	-	-	0.041	0.02	0.018	0.023	0.012	0.014	0.01
Beryllium	Be	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	Cd	1E-04	0.0002	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	0.001	1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	Cu	0.001	0.0014	1	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Iron	Fe	0.05	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Mercury	Hg	1E-04	0.0006	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese	Mn	0.001	1.9	-	0.005	0.003	0.003	0.007	0.003	0.002	0.003
Molybdenum	Mo	0.001	-	0.15	0.005	0.004	0.002	0.003	0.003	0.003	0.003
Nickel	Ni	0.001	0.011	1	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Lead	Pb	0.001	0.0034	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	0.011	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	Th	0.001	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Uranium	U	0.001	-	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Vanadium	V	0.01	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	Zn	0.005	0.008	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calculations**	Elements									
SO_4 Release Rate	SO_4				8	12	8	9	6	6	6
Cumulative SO_4 Release	Cum. SO_4				8	20	28	37	43	49	55
Ca Release Rate	Ca				3.9	3.2	2.4	2.9	2.0	2.0	1.6
Cumulative Ca Release	Cum. Ca				3.9	7.1	9.5	12.4	14.4	16.4	18.0
Mg Release Rate	Mg				0.8	0.4	0.4	0.4	0.2	0.2	0.2
Cumulative Mg Release	Cum. Mg				0.8	1.2	1.6	2.0	2.2	2.4	2.6
Residual ANC (%)	Res. ANC				100.0	100.0	100.0	100.0	99.9	99.9	99.9
Residual Sulfur (%)	Res. S				98.9	97.4	96.3	95.1	94.2	93.4	92.6
SO_4/(Ca+Mg) molar ratio	SO_4/(Ca+Mg)				0.6	1.3	1.1	1.1	1.1	1.1	1.2

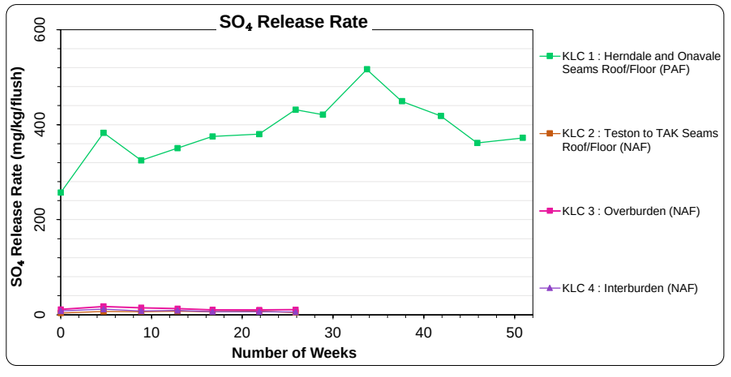
Notes: ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines 1. Trigger values for aquatic ecosystems (95% species protection level). 2. Recommended guideline limits for Livestock Drinking Water.
< indicates less than the analytical detection limit. * Acidity and alkalinity data calculated in mg $CaCO_3$/L.
Shaded cells exceed applied guideline values. (tri)* 0.024 g/L for trivalent Arsenic (III) and 0.013 g/L for pentavalent Arsenic (V). (hex)* Cr (VI) = hexavalent.
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.
** SO4, Ca and Mg release rates calculated in mg/kg/flush. Residual ANC assumes that all leached Mg and Ca is due to dissolution of calcite or dolomite.
Total S = Total Sulfur; Scr = Chromium Reducible Sulfur; and ANC = Acid Neutralising Capacity. MPA = Maximum Potential Acidity, and NAPP = Net Acid Producing Potential.

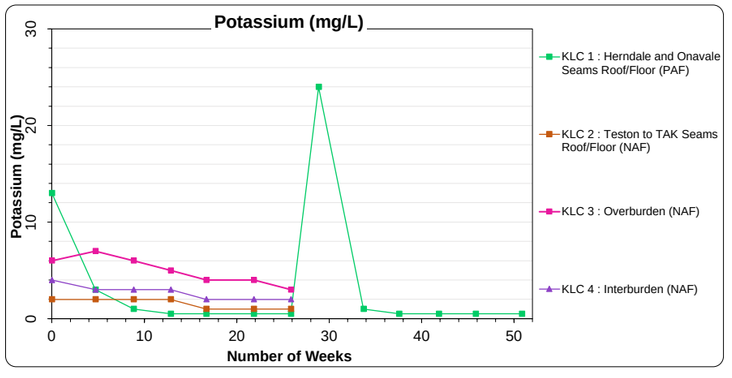

pH
pH
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

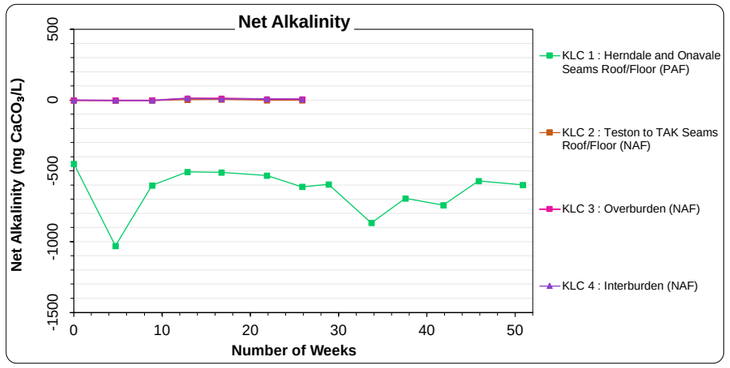

Residual Sulfur
Residual Sulfur (%)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

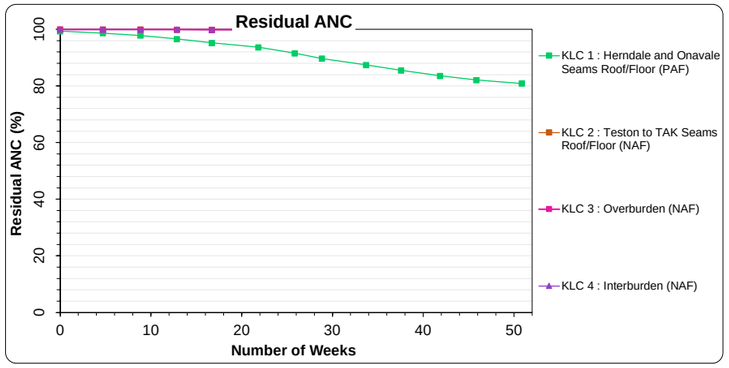

Calcium (mg/L)
Calcium (mg/L)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

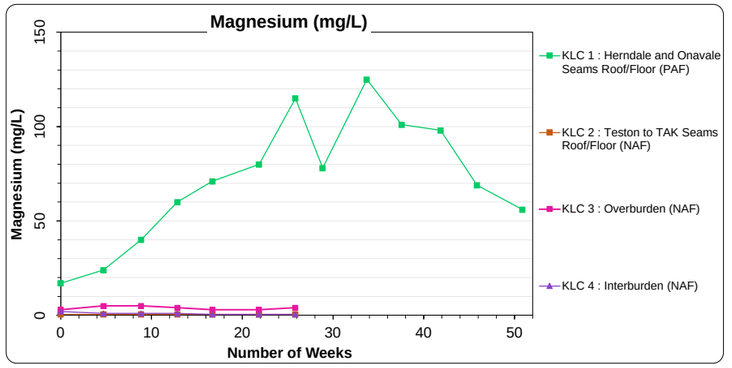

Electrical Conductivity
Electrical Conductivity (µS/cm)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

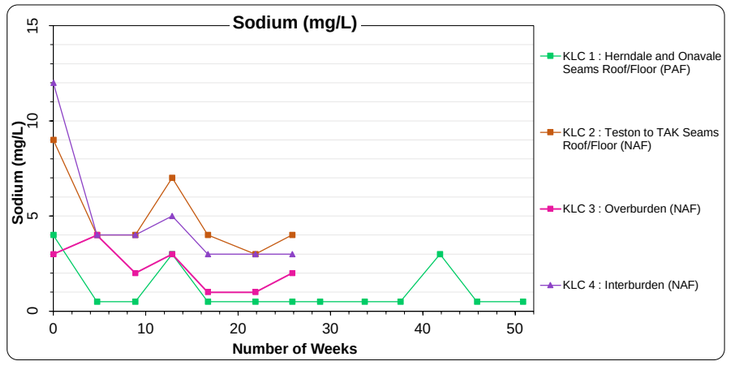

SO4 Release Rate
SO4 Release Rate (mg/kg/flush)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

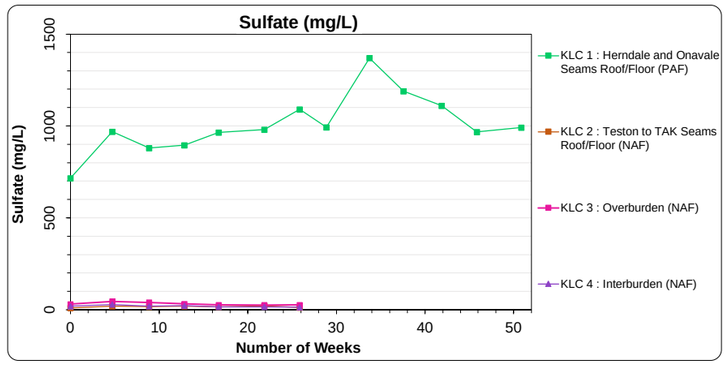

Potassium (mg/L)
Potassium (mg/L)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

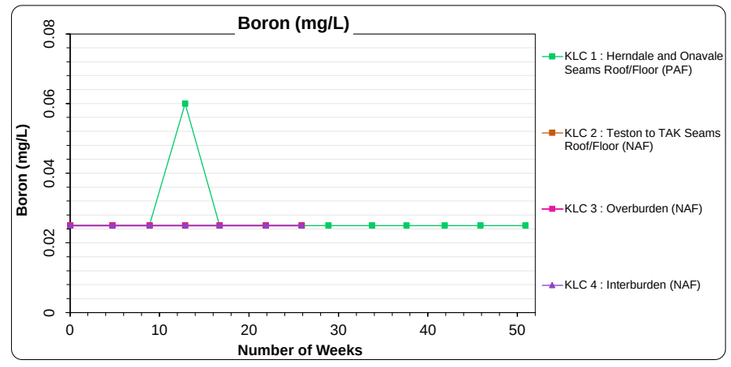

Net Alkalinity
Net Alkalinity (mg CaCO3/L)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

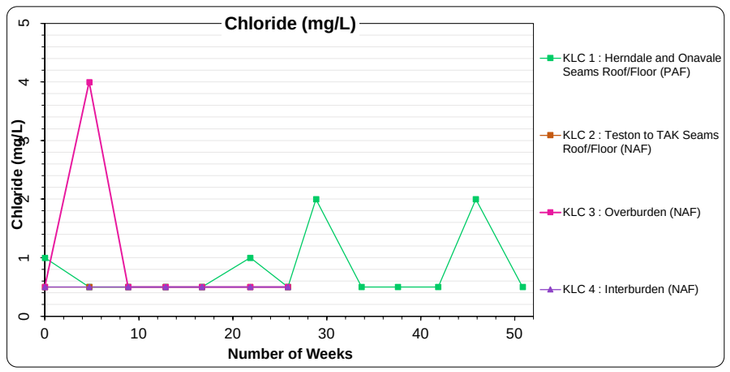

Residual ANC
Residual ANC (%)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

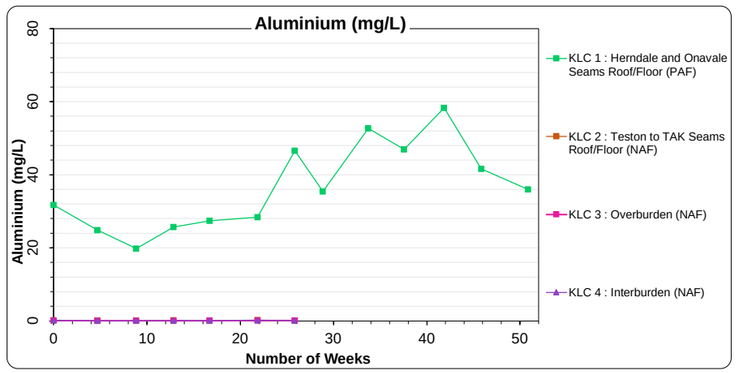

Magnesium (mg/L)
Magnesium (mg/L)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

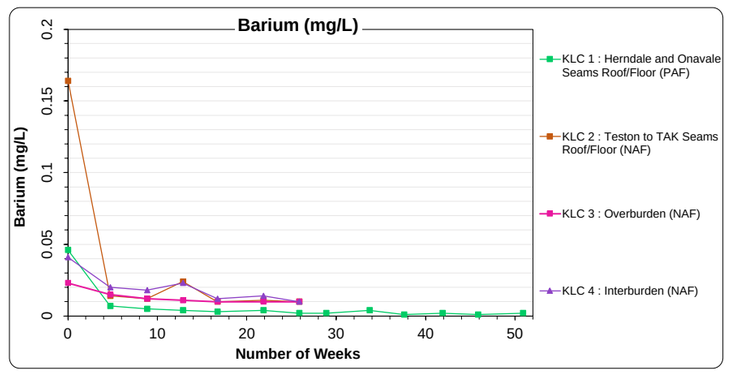

Sodium (mg/L)
Sodium (mg/L)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

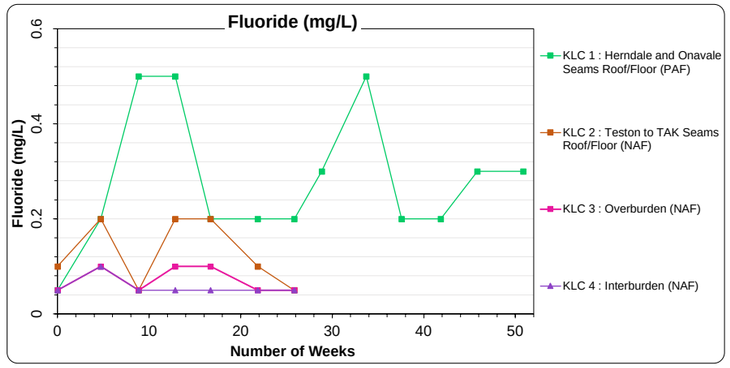

Sulfate (mg/L)
Sulfate (mg/L)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

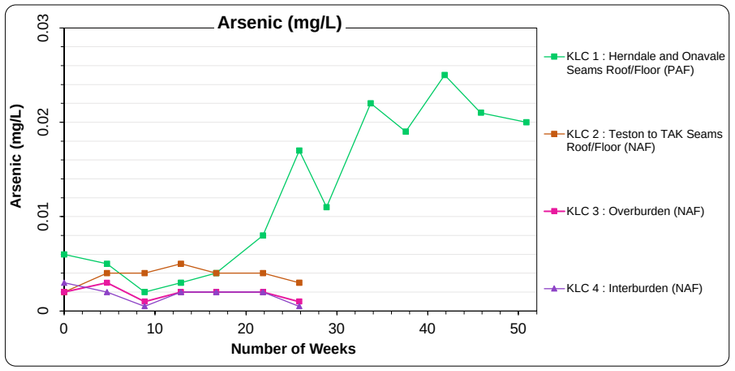

Boron (mg/L)
Boron (mg/L)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

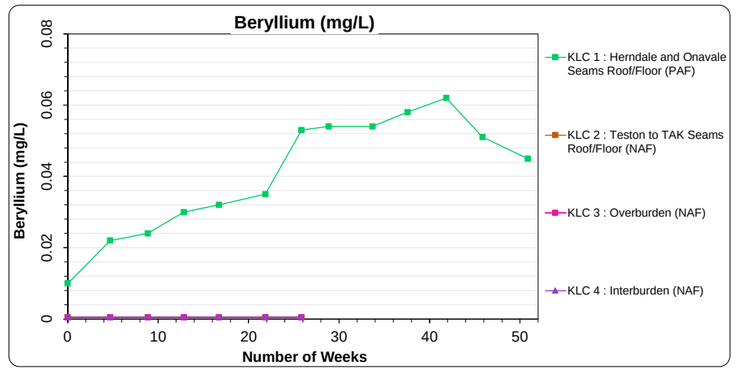

Chloride (mg/L)
Chloride (mg/L)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

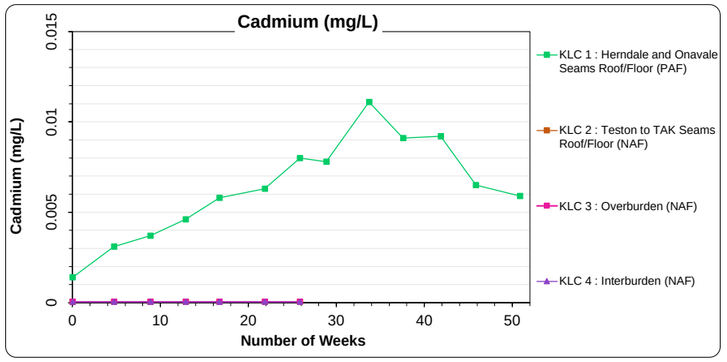

Aluminium (mg/L)
Aluminium (mg/L)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

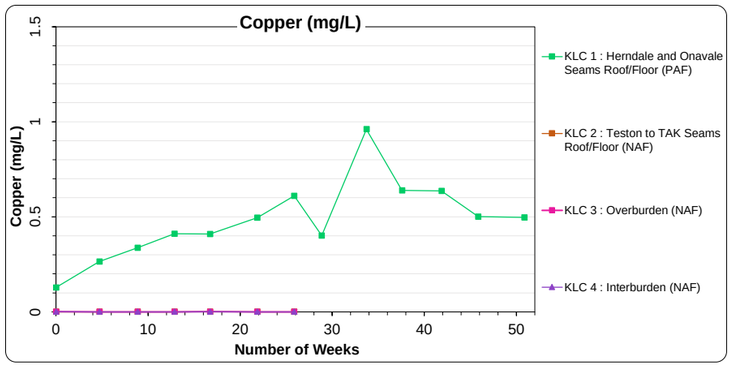

Barium (mg/L)
Barium (mg/L)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

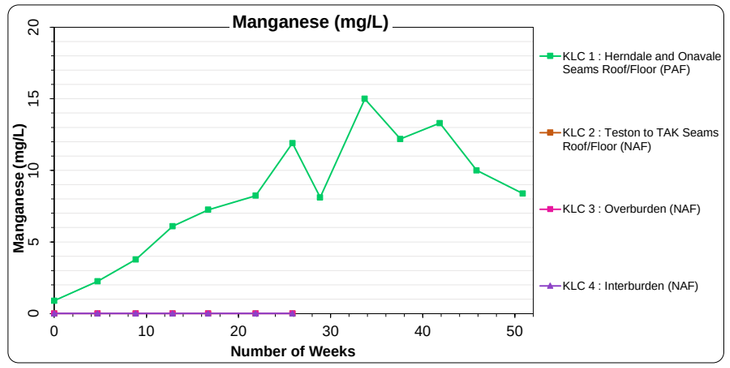

Fluoride (mg/L)
Fluoride (mg/L)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

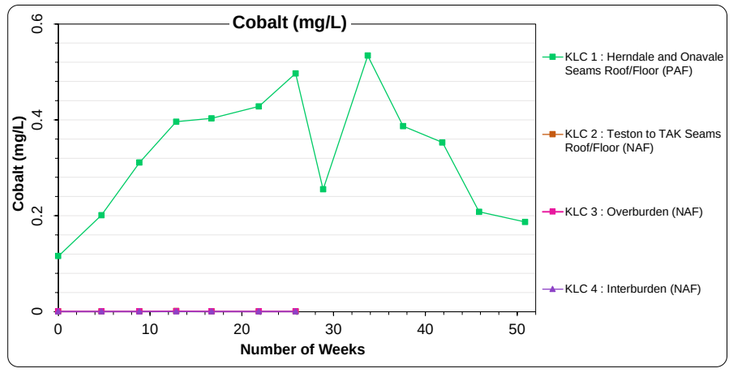

Arsenic (mg/L)
Arsenic (mg/L)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

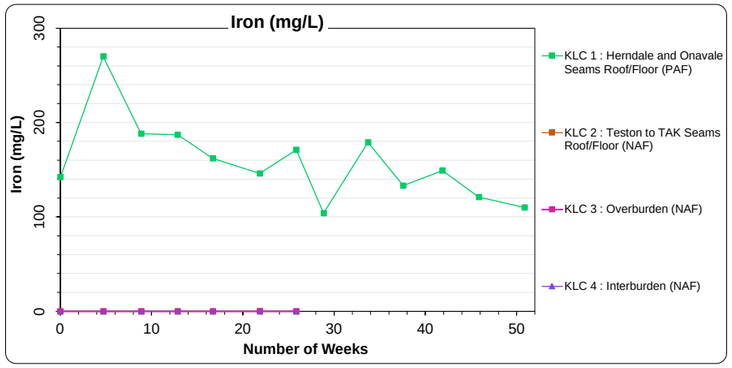

Beryllium (mg/L)
Beryllium (mg/L)
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

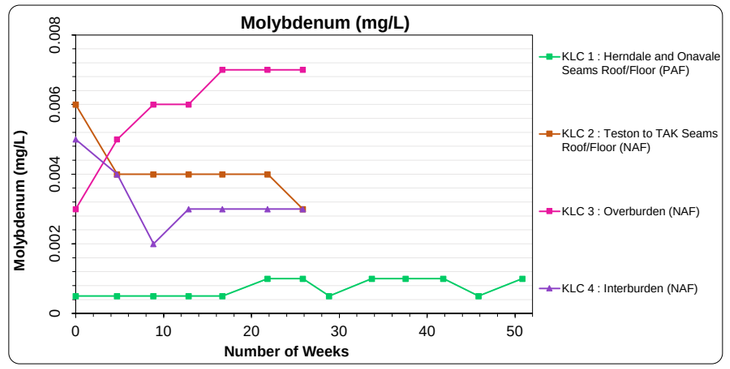

Cadmium (mg/L)
Cadmium (mg/L)
0
0.005
0.01
0.015
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

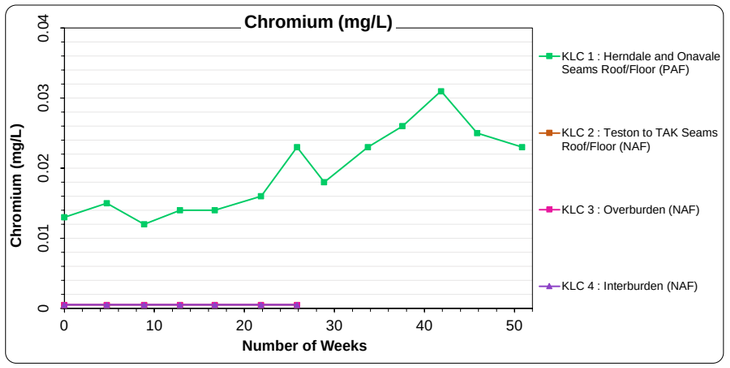

Copper (mg/L)
Copper (mg/L)
0
0.5
1
1.5
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

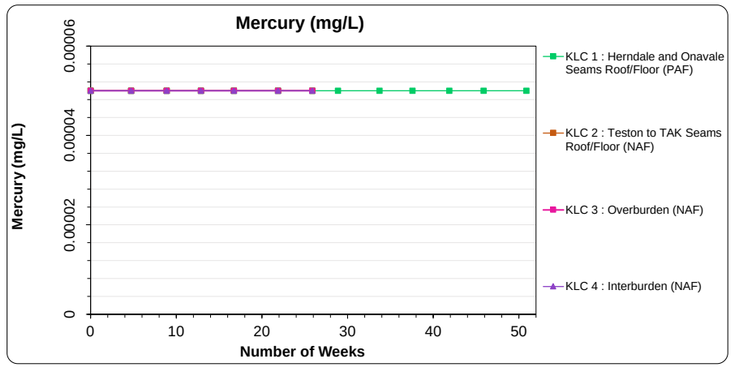

Manganese (mg/L)
Manganese (mg/L)
0
5
10
15
20
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

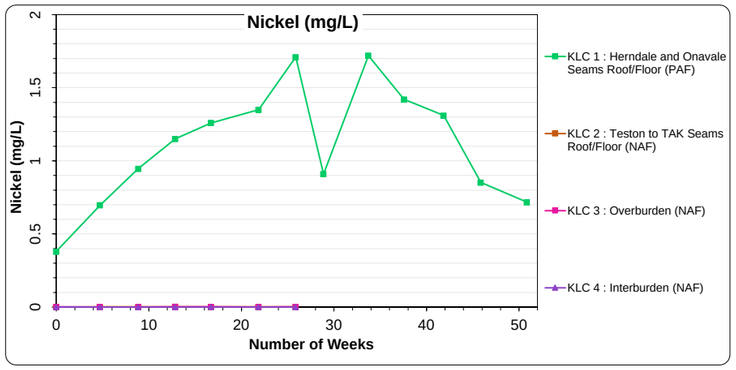

Cobalt (mg/L)
Cobalt (mg/L)
0
0.2
0.4
0.6
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

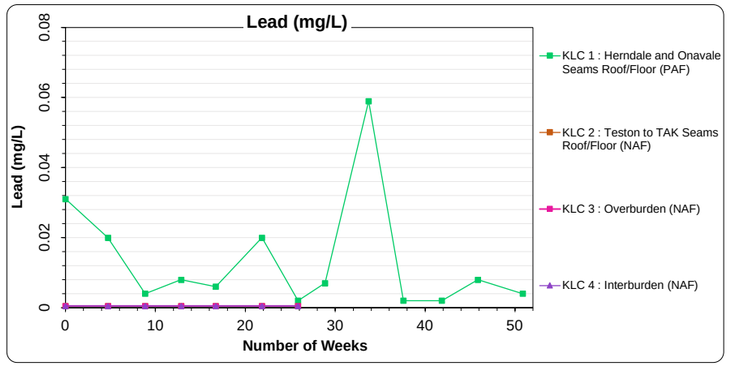

Iron (mg/L)
Iron (mg/L)
0
100
200
300
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

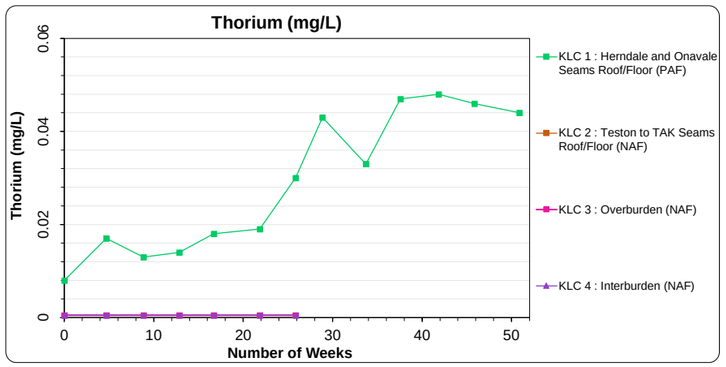

Molybdenum (mg/L)
Molybdenum (mg/L)
0
0.002
0.004
0.006
0.008
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

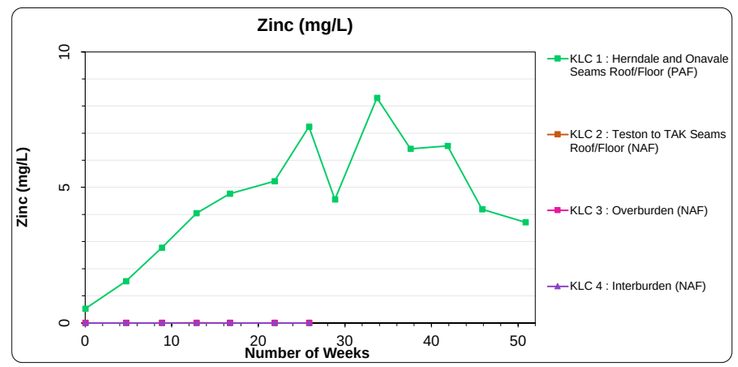

Chromium (mg/L)
Chromium (mg/L)
0
0.01
0.02
0.03
0.04
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

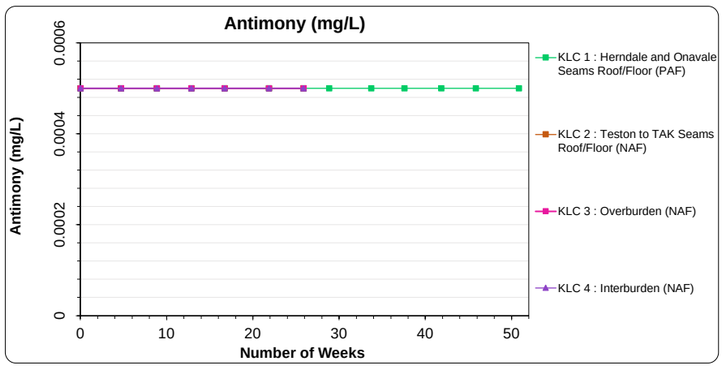

Mercury (mg/L)
Mercury (mg/L)
0
0.00002
0.00004
0.00006
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

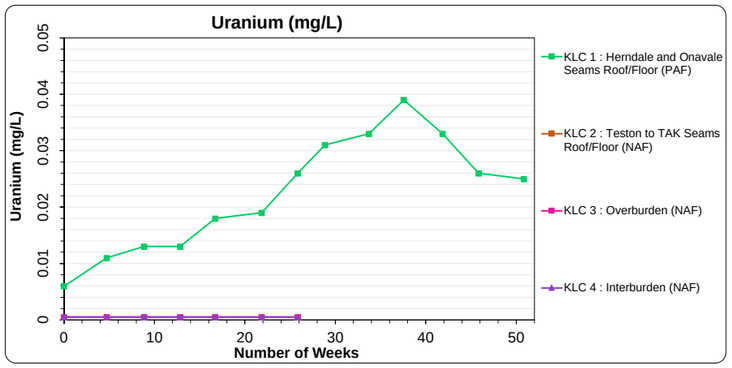

Nickel (mg/L)
Nickel (mg/L)
0
0.5
1
1.5
2
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

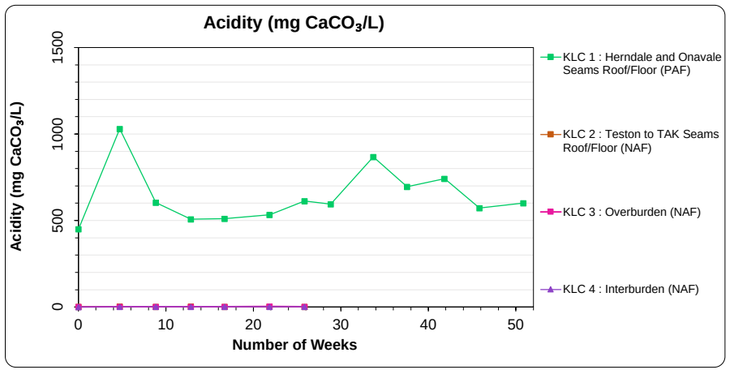

Lead (mg/L)
Lead (mg/L)
0
0.02
0.04
0.06
0.08
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

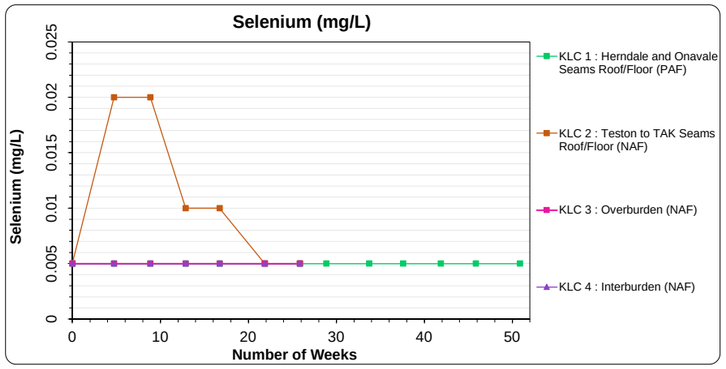

Thorium (mg/L)
Thorium (mg/L)
0
0.02
0.04
0.06
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

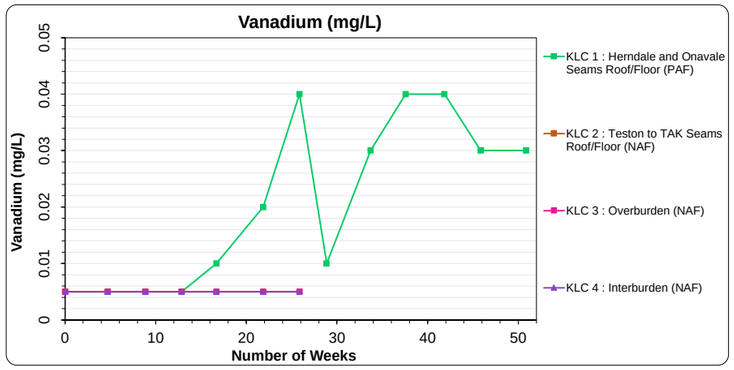

Zinc (mg/L)
Zinc (mg/L)
0
5
10
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

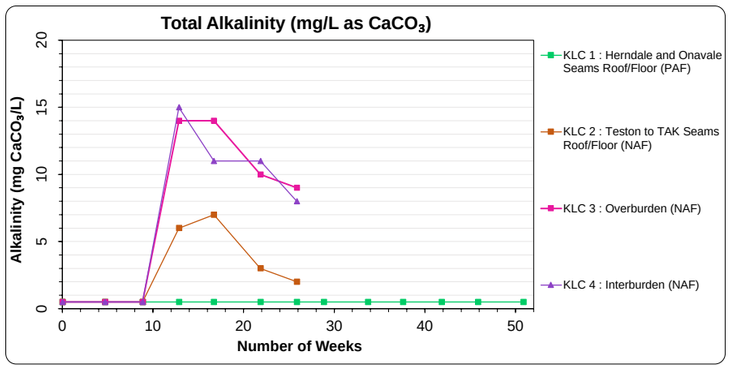

Antimony (mg/L)
Antimony (mg/L)
0
0.0002
0.0004
0.0006
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)


Uranium (mg/L)
Uranium (mg/L)
0
0.01
0.02
0.03
0.04
0.05
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)


Acidity (mg CaCO3/L)
Acidity (mg CaCO3/L)
0
500
1000
1500
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)


Selenium (mg/L)
Selenium (mg/L)
0
0.005
0.01
0.015
0.02
0.025
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)


Vanadium (mg/L)
Vanadium (mg/L)
0
0.01
0.02
0.03
0.04
0.05
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)


Total Alkalinity (mg/L as CaCO3)
Alkalinity (mg CaCO3/L)
0
5
10
15
20
0
10
20
30
40
50
Number of Weeks
KLC 1 : Herndale and Onavale Seams Roof/Floor (PAF)
KLC 2 : Teston to TAK Seams Roof/Floor (NAF)
KLC 3 : Overburden (NAF)
KLC 4 : Interburden (NAF)

Attachment E: Laboratory Certificates of Analysis

CERTIFICATE OF ANALYSIS

Work Order	: **EB2335701**	Page	: 1 of 22
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 15-Nov-2023 09:00
Order number	: ----	Date Analysis Commenced	: 17-Nov-2023
C-O-C number	: ----	Issue Date	: 22-Nov-2023 17:09
Sampler	: Tyler Contor		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 97		
No. of samples analysed	: 97		

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, unless the sampling was conducted by ALS. 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*
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, 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 Contract 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.

- ASS: EA013 (ANC) Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong; 5- Lime.

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	2023033_001 69002 BC2569	2023033_002 71001 BC2571	2023033_003 69001 BC2569	2023033_004 69005 BC2569	2023033_005 69008 BC2569
				Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
					EB2335701-001	EB2335701-002	EB2335701-003	EB2335701-004	EB2335701-005
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**8.8**	**8.5**	**8.8**	**8.3**	**8.9**
EA009: Net Acid Production Potential									
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-81.3**	**-23.3**	**-52.8**	**-28.9**	**-128**
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		**192**	**214**	**223**	**411**	**165**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**81.9**	**24.2**	**53.4**	**32.0**	**129**
ANC as CaCO3	----	0.1	% CaCO3		**8.4**	**2.5**	**5.4**	**3.3**	**13.2**
Fizz Rating	----	0	Fizz Unit		**2**	**1**	**2**	**1**	**2**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.02**	**0.03**	**0.02**	**0.10**	**0.02**

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_006 69021 BC2569	2023033_007 71007 BC2571	2023033_008 71015 BC2571	2023033_009 71029 BC2571	2023033_010 71030 BC2571
			Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
Compound	CAS Number	LOR	Unit	EB2335701-006	EB2335701-007	EB2335701-008	EB2335701-009	EB2335701-010
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	8.8	8.8	8.8	8.9	8.8
EA009: Net Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-29.8	-34.9	-23.2	-96.1	-307
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	213	197	189	174	171
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	30.4	35.5	23.8	96.4	307
ANC as CaCO3	----	0.1	% CaCO3	3.1	3.6	2.4	9.8	31.4
Fizz Rating	----	0	Fizz Unit	1	2	1	2	4
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: PULP (Matrix: SOIL)			Sample ID	2023033_011 72005 BC2572	2023033_012 72013 BC2572	2023033_013 72026 BC2572	2023033_014 69028 BC2569	2023033_015 69031 BC2569
			Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
Compound	CAS Number	LOR	Unit	EB2335701-011	EB2335701-012	EB2335701-013	EB2335701-014	EB2335701-015
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	8.9	8.9	9.0	8.8	8.6
EA009: Net Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-35.0	-28.2	-40.4	-337	-53.5
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	198	181	215	251	204
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	35.6	28.8	41.0	338	54.1
ANC as CaCO3	----	0.1	% CaCO3	3.6	2.9	4.2	34.5	5.5
Fizz Rating	----	0	Fizz Unit	2	1	2	4	2
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.02	0.02	0.02	0.02

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	2023033_016 71004 BC2571	2023033_017 71026 BC2571	2023033_018 72002 BC2572	2023033_019 72010 BC2572	2023033_020 72018 BC2572
				Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
					EB2335701-016	EB2335701-017	EB2335701-018	EB2335701-019	EB2335701-020
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**7.9**	**8.6**	**8.7**	**8.1**	**8.5**
EA009: Net Acid Production Potential									
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-13.6**	**-16.3**	**-42.1**	**-18.4**	**-18.0**
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		**235**	**194**	**228**	**79**	**109**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**14.8**	**16.9**	**42.4**	**19.0**	**18.6**
ANC as CaCO3	----	0.1	% CaCO3		**1.5**	**1.7**	**4.3**	**1.9**	**1.9**
Fizz Rating	----	0	Fizz Unit		**1**	**1**	**2**	**1**	**1**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.04**	**0.02**	**0.01**	**0.02**	**0.02**

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	2023033_021 69013 BC2569	2023033_022 69016 BC2569	2023033_023 71012 BC2571	2023033_024 71025 BC2571	2023033_025 69003 BC2569
				Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
					EB2335701-021	EB2335701-022	EB2335701-023	EB2335701-024	EB2335701-025
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**8.8**	**7.5**	**8.3**	**8.2**	**7.5**
EA009: Net Acid Production Potential									
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-499**	**-13.0**	**-24.3**	**-15.7**	**-18.3**
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		**304**	**96**	**194**	**77**	**160**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**500**	**13.9**	**25.2**	**16.3**	**19.2**
ANC as CaCO3	----	0.1	% CaCO3		**51.0**	**1.4**	**2.6**	**1.7**	**2.0**
Fizz Rating	----	0	Fizz Unit		**5**	**1**	**1**	**1**	**1**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.03**	**0.03**	**0.03**	**0.02**	**0.03**

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	2023033_026 71002 BC2571	2023033_027 72001 BC2572	2023033_028 69006 BC2569	2023033_029 71005 BC2571	2023033_030 72003 BC2572
				Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
					EB2335701-026	EB2335701-027	EB2335701-028	EB2335701-029	EB2335701-030
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**7.3**	**4.3**	**6.0**	**6.2**	**7.4**
EA009: Net Acid Production Potential									
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-11.8**	**207**	**-2.0**	**4.8**	**-10.0**
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		**200**	**2790**	**718**	**923**	**122**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**13.6**	<0.5	**9.6**	**8.4**	**12.1**
ANC as CaCO3	----	0.1	% CaCO3		**1.4**	<0.1	**1.0**	**0.9**	**1.2**
Fizz Rating	----	0	Fizz Unit		**1**	**0**	**1**	**1**	**1**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.06**	**6.76**	**0.25**	**0.43**	**0.07**

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_031 72006 BC2572	2023033_032 69009 BC2569	2023033_033 71008 BC2571	2023033_034 69011 BC2569	2023033_035 71010 BC2571
			Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
Compound	CAS Number	LOR	Unit	EB2335701-031	EB2335701-032	EB2335701-033	EB2335701-034	EB2335701-035
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**8.1**	**7.7**	**8.2**	**7.3**	**7.7**
EA009: Net Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-13.1**	**-14.6**	**-9.8**	**-7.7**	**-10.3**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**188**	**63**	**210**	**105**	**67**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**14.3**	**15.2**	**11.0**	**9.5**	**10.9**
ANC as CaCO3	----	0.1	% CaCO3	**1.5**	**1.5**	**1.1**	**1.0**	**1.1**
Fizz Rating	----	0	Fizz Unit	**1**	**1**	**1**	**1**	**1**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.04**	**0.02**	**0.04**	**0.06**	**0.02**

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	2023033_036 72008 BC2572	2023033_037 72011 BC2572	2023033_038 69014 BC2569	2023033_039 71013 BC2571	2023033_040 69017 BC2569
				Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
					EB2335701-036	EB2335701-037	EB2335701-038	EB2335701-039	EB2335701-040
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**7.4**	**7.4**	**6.5**	**7.2**	**7.4**
EA009: Net Acid Production Potential									
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-3.2**	**-8.1**	**-0.9**	**-5.2**	**-4.9**
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		**85**	**123**	**336**	**88**	**272**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**6.9**	**9.9**	**7.6**	**6.4**	**7.7**
ANC as CaCO3	----	0.1	% CaCO3		**0.7**	**1.0**	**0.8**	**0.6**	**0.8**
Fizz Rating	----	0	Fizz Unit		**1**	**1**	**1**	**1**	**1**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.12**	**0.06**	**0.22**	**0.04**	**0.09**

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_041 71016 BC2571	2023033_042 72014 BC2572	2023033_043 72016 BC2572	2023033_044 69019 BC2569	2023033_045 71018 BC2571
			Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
Compound	CAS Number	LOR	Unit	EB2335701-041	EB2335701-042	EB2335701-043	EB2335701-044	EB2335701-045
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	7.9	8.0	7.0	7.7	7.8
EA009: Net Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-14.3	-9.9	-5.6	-8.2	-8.3
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	102	64	174	60	62
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	15.2	11.1	7.4	9.4	9.2
ANC as CaCO3	----	0.1	% CaCO3	1.5	1.1	0.7	1.0	0.9
Fizz Rating	----	0	Fizz Unit	1	1	1	1	1
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.03	0.04	0.06	0.04	0.03

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	2023033_046 69022 BC2569	2023033_047 71020 BC2571	2023033_048 72019 BC2572	2023033_049 69024 BC2569	2023033_050 71022 BC2571
				Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
					EB2335701-046	EB2335701-047	EB2335701-048	EB2335701-049	EB2335701-050
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**8.5**	**8.8**	**8.1**	**8.8**	**8.4**
EA009: Net Acid Production Potential									
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-22.3**	**-29.1**	**-9.0**	**-30.0**	**-26.1**
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		**282**	**254**	**138**	**205**	**122**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**23.2**	**30.0**	**11.8**	**30.6**	**26.7**
ANC as CaCO3	----	0.1	% CaCO3		**2.4**	**3.1**	**1.2**	**3.1**	**2.7**
Fizz Rating	----	0	Fizz Unit		**1**	**1**	**1**	**1**	**1**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.03**	**0.03**	**0.09**	**0.02**	**0.02**

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_051 72021 BC2572	2023033_052 69026 BC2569	2023033_053 71024 BC2571	2023033_054 71027 BC2571	2023033_055 69029 BC2569
			Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
Compound	CAS Number	LOR	Unit	EB2335701-051	EB2335701-052	EB2335701-053	EB2335701-054	EB2335701-055
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	8.0	8.0	8.0	8.2	7.9
EA009: Net Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-10.4	-13.5	-21.7	-18.6	-14.5
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	94	78	106	125	152
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	12.9	14.1	22.6	18.9	15.7
ANC as CaCO3	----	0.1	% CaCO3	1.3	1.4	2.3	1.9	1.6
Fizz Rating	----	0	Fizz Unit	1	1	1	1	1
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.08	0.02	0.03	0.01	0.04

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_056 72023 BC2572	2023033_057 69032 BC2569	2023033_058 71031 BC2571	2023033_059 72027 BC2572	2023033_060 72030 BC2572
			Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
Compound	CAS Number	LOR	Unit	EB2335701-056	EB2335701-057	EB2335701-058	EB2335701-059	EB2335701-060
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	7.9	7.8	7.9	8.1	7.8
EA009: Net Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-15.0	-16.3	-12.3	-15.8	-15.1
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	78	86	84	84	131
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	15.6	17.2	13.2	16.4	16.6
ANC as CaCO3	----	0.1	% CaCO3	1.6	1.8	1.4	1.7	1.7
Fizz Rating	----	0	Fizz Unit	1	1	1	1	1
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.02	0.03	0.03	0.02	0.05

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_061 72024 BC2572	2023033_062 72028 BC2572	2023033_063 69004 BC2569	2023033_064 71003 BC2571	2023033_065 69007 BC2569
			Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
Compound	CAS Number	LOR	Unit	EB2335701-061	EB2335701-062	EB2335701-063	EB2335701-064	EB2335701-065
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	7.7	7.8	4.1	6.2	7.2
EA009: Net Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-13.3	-11.4	34.6	2.0	-13.8
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	55	50	1050	354	99
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	14.8	12.3	<0.5	10.5	14.7
ANC as CaCO3	----	0.1	% CaCO3	1.5	1.2	<0.1	1.1	1.5
Fizz Rating	----	0	Fizz Unit	1	1	0	1	1
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.05	0.03	1.13	0.41	0.03

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	2023033_066 72004 BC2572	2023033_067 71006 BC2571	2023033_068 71009 BC2571	2023033_069 69010 BC2569	2023033_070 72007 BC2572
				Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
					EB2335701-066	EB2335701-067	EB2335701-068	EB2335701-069	EB2335701-070
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**7.6**	**7.4**	**7.4**	**7.4**	**7.5**
EA009: Net Acid Production Potential									
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-10.4**	**-7.8**	**-6.6**	**-8.3**	**-9.3**
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		**72**	**80**	**146**	**84**	**58**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**11.0**	**8.7**	**7.5**	**8.9**	**9.9**
ANC as CaCO3	----	0.1	% CaCO3		**1.1**	**0.9**	**0.8**	**0.9**	**1.0**
Fizz Rating	----	0	Fizz Unit		**1**	**0**	**1**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.02**	**0.03**	**0.03**	**0.02**	**0.02**

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	2023033_071 69012 BC2569	2023033_072 71011 BC2571	2023033_073 72009 BC2572	2023033_074 72012 BC2572	2023033_075 69015 BC2569
				Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
					EB2335701-071	EB2335701-072	EB2335701-073	EB2335701-074	EB2335701-075
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**7.5**	**8.7**	**7.4**	**7.0**	**7.0**
EA009: Net Acid Production Potential									
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-11.6**	**-45.2**	**-7.2**	**-7.9**	**-7.3**
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		**69**	**208**	**124**	**37**	**45**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**12.2**	**45.8**	**10.0**	**8.5**	**8.8**
ANC as CaCO3	----	0.1	% CaCO3		**1.2**	**4.7**	**1.0**	**0.9**	**0.9**
Fizz Rating	----	0	Fizz Unit		**1**	**2**	**0**	**0**	**0**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.02**	**0.02**	**0.09**	**0.02**	**0.05**

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_076 71014 BC2571	2023033_077 71017 BC2571	2023033_078 69018 BC2569	2023033_079 72015 BC2572	2023033_080 69020 BC2569
			Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
Compound	CAS Number	LOR	Unit	EB2335701-076	EB2335701-077	EB2335701-078	EB2335701-079	EB2335701-080
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	6.9	7.2	7.7	7.2	7.5
EA009: Net Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-7.6	-4.3	-4.4	-5.7	-6.7
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	50	22	38	73	50
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	9.4	4.9	5.0	6.6	7.6
ANC as CaCO3	----	0.1	% CaCO3	1.0	0.5	0.5	0.7	0.8
Fizz Rating	----	0	Fizz Unit	0	0	0	0	0
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.06	0.02	0.02	0.03	0.03

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_081 72017 BC2572	2023033_082 71019 BC2571	2023033_083 69023 BC2569	2023033_084 71021 BC2571	2023033_085 72020 BC2572
			Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
Compound	CAS Number	LOR	Unit	EB2335701-081	EB2335701-082	EB2335701-083	EB2335701-084	EB2335701-085
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	7.1	7.4	7.8	8.4	7.9
EA009: Net Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-7.2	-8.2	-11.9	-19.4	-10.6
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	144	35	86	234	70
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	9.4	8.8	12.5	20.3	11.5
ANC as CaCO3	----	0.1	% CaCO3	1.0	0.9	1.3	2.1	1.2
Fizz Rating	----	0	Fizz Unit	0	1	1	1	1
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.07	0.02	0.02	0.03	0.03

Analytical Results

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

Compound	CAS Number	LOR	Unit	Sample ID	2023033_086 72022 BC2572	2023033_087 69025 BC2569	2023033_088 71023 BC2571	2023033_089 69027 BC2569	2023033_090 69030 BC2569
				Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
					EB2335701-086	EB2335701-087	EB2335701-088	EB2335701-089	EB2335701-090
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		**7.7**	**8.8**	**8.0**	**8.3**	**8.2**
EA009: Net Acid Production Potential									
Net Acid Production Potential	----	0.5	kg H2SO4/t		**-17.4**	**-378**	**-13.3**	**-19.7**	**-18.0**
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		**91**	**277**	**100**	**252**	**253**
EA013: Acid Neutralising Capacity									
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t		**19.6**	**379**	**14.5**	**20.6**	**18.6**
ANC as CaCO3	----	0.1	% CaCO3		**2.0**	**38.6**	**1.5**	**2.1**	**1.9**
Fizz Rating	----	0	Fizz Unit		**1**	**4**	**1**	**1**	**1**
ED042T: Total Sulfur by LECO									
Sulfur - Total as S (LECO)	----	0.01	%		**0.07**	**0.03**	**0.04**	**0.03**	**0.02**

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_091 71028 BC2571	2023033_092 72025 BC2572	2023033_093 69033 BC2569	2023033_094 72029 BC2572	2023033_095 72031 BC2572
			Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00	02-Nov-2023 00:00
Compound	CAS Number	LOR	Unit	EB2335701-091	EB2335701-092	EB2335701-093	EB2335701-094	EB2335701-095
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	7.8	8.2	7.7	7.9	6.7
EA009: Net Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	-8.9	-12.9	-11.4	-15.9	-12.0
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	42	121	267	74	87
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	9.2	13.8	13.6	16.8	12.9
ANC as CaCO3	----	0.1	% CaCO3	0.9	1.4	1.4	1.7	1.3
Fizz Rating	----	0	Fizz Unit	1	1	1	1	1
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	0.01	0.03	0.07	0.03	0.03

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_096 71032 BC2571	pH and EC of DI water	----	----	----
			Sampling date / time	02-Nov-2023 00:00	02-Nov-2023 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EB2335701-096	EB2335701-097	--------	--------	--------
				Result	Result	----	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**7.2**	**5.7**	**----**	**----**	**----**
EA009: Net Acid Production Potential								
Net Acid Production Potential	----	0.5	kg H2SO4/t	**-8.2**	**----**	**----**	**----**	**----**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**151**	<1	**----**	**----**	**----**
EA013: Acid Neutralising Capacity								
ANC as H2SO4	----	0.5	kg H2SO4 equiv./t	**9.7**	**----**	**----**	**----**	**----**
ANC as CaCO3	----	0.1	% CaCO3	**1.0**	**----**	**----**	**----**	**----**
Fizz Rating	----	0	Fizz Unit	**1**	**----**	**----**	**----**	**----**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.05**	**----**	**----**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB2337203**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 27-Nov-2023 13:20
Order number	: ----	Date Analysis Commenced	: 01-Dec-2023
C-O-C number	: ----	Issue Date	: 01-Dec-2023 11:54
Sampler	: Tyler Contor		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 8		
No. of samples analysed	: 8		

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, unless the sampling was conducted by ALS. 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

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 Contract 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.

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_004 69005 BC2569	2023033_027 72001 BC2572	2023033_028 69006 BC2569	2023033_029 71005 BC2571	2023033_036 72008 BC2572
			Sampling date / time	27-Nov-2023 00:00	27-Nov-2023 00:00	27-Nov-2023 00:00	27-Nov-2023 00:00	27-Nov-2023 00:00
Compound	CAS Number	LOR	Unit	EB2337203-001	EB2337203-002	EB2337203-003	EB2337203-004	EB2337203-005
				Result	Result	Result	Result	Result
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	**0.054**	**4.96**	**0.152**	**0.246**	**0.050**

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Sample ID	2023033_038 69014 BC2569	2023033_063 69004 BC2569	2023033_064 71003 BC2571	----	----
				Sampling date / time	27-Nov-2023 00:00	27-Nov-2023 00:00	27-Nov-2023 00:00	----	----
Compound	CAS Number	LOR	Unit		EB2337203-006	EB2337203-007	EB2337203-008	--------	--------
					Result	Result	Result	----	----
EA026 : Chromium Reducible Sulfur									
Chromium Reducible Sulphur	----	0.005	%		**0.198**	**0.735**	**0.379**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB2338913**	Page	: 1 of 14
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 07-Dec-2023 17:16
Order number	: ----	Date Analysis Commenced	: 12-Dec-2023
C-O-C number	: ----	Issue Date	: 18-Dec-2023 15:38
Sampler	: Tyler Contor		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 19		
No. of samples analysed	: 19		

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, unless the sampling was conducted by ALS. 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 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 Contract 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.
- EG005T (Total Metals by ICP-AES): 2023033_C007 (EB2338913-007) shows poor duplicate results due to sample heterogeneity. This has been confirmed by visual inspection.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_C001 HE Seam	2023033_C002 ON Seam	2023033_C003 TS Seam	2023033_C004 THO Seam	2023033_C005 BRU Seam
			Sampling date / time	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00
Compound	CAS Number	LOR	Unit	EB2338913-001	EB2338913-002	EB2338913-003	EB2338913-004	EB2338913-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	4.3	6.1	7.5	7.9	6.9
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	985	398	154	183	196
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	<5	986	1980	4440	1480
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	<5	986	1980	4440	1480
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	<5	<5	<5	<5	<5
ED038A: Acidity								
Acidity	----	1	mg/kg	4290	938	538	435	541
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	2900	900	160	110	350
Silica	7631-86-9	1	mg/kg	143	65	45	45	79
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	<10	<10	<10	<10
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	320	120	30	70	30
Magnesium	7439-95-4	10	mg/kg	190	50	10	30	10
Sodium	7440-23-5	10	mg/kg	20	30	20	20	20
Potassium	7440-09-7	10	mg/kg	180	200	130	150	130
ED093T: Total Major Cations								
Sodium	7440-23-5	50	mg/kg	100	80	70	90	50
Potassium	7440-09-7	50	mg/kg	1670	1880	1820	2040	1830
Calcium	7440-70-2	50	mg/kg	810	1000	1460	2490	1260
Magnesium	7439-95-4	50	mg/kg	780	900	1370	2020	800
EG005(ED093)S : Soluble Metals by ICPAES								
Boron	7440-42-8	1	mg/kg	<1	<1	<1	<1	<1
Iron	7439-89-6	1	mg/kg	524	<1	<1	<1	<1

Analytical Results

Sub-Matrix: PULP
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Sample ID	2023033_C001 HE Seam	2023033_C002 ON Seam	2023033_C003 TS Seam	2023033_C004 THO Seam	2023033_C005 BRU Seam
				Sampling date / time	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00
					EB2338913-001	EB2338913-002	EB2338913-003	EB2338913-004	EB2338913-005
					Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		**6040**	**7610**	**7670**	**7200**	**7090**
Boron	7440-42-8	50	mg/kg		<50	<50	<50	<50	<50
Iron	7439-89-6	50	mg/kg		**28900**	**10100**	**21300**	**14400**	**5020**
EG020S: Soluble Metals by ICPMS									
Arsenic	7440-38-2	0.01	mg/kg		<0.01	<0.01	<0.01	**0.02**	**0.02**
Selenium	7782-49-2	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Barium	7440-39-3	0.01	mg/kg		**0.12**	**0.17**	**0.17**	**0.99**	**0.24**
Beryllium	7440-41-7	0.01	mg/kg		**0.04**	<0.01	<0.01	<0.01	<0.01
Cadmium	7440-43-9	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	7440-48-4	0.01	mg/kg		**0.61**	**0.03**	<0.01	<0.01	<0.01
Chromium	7440-47-3	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	7440-29-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Copper	7440-50-8	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Manganese	7439-96-5	0.01	mg/kg		**17.4**	**1.82**	**0.04**	**0.04**	**0.07**
Molybdenum	7439-98-7	0.01	mg/kg		<0.01	<0.01	**0.08**	**0.16**	**0.07**
Nickel	7440-02-0	0.01	mg/kg		**2.00**	**0.06**	<0.01	<0.01	<0.01
Lead	7439-92-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.01	mg/kg		<0.01	<0.01	<0.01	**0.01**	**0.01**
Uranium	7440-61-1	0.01	mg/kg		**0.01**	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.05	mg/kg		**2.07**	**0.11**	<0.05	<0.05	**0.09**
Vanadium	7440-62-2	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Aluminium	7429-90-5	0.1	mg/kg		**26.7**	<0.1	<0.1	<0.1	<0.1
EG020T: Total Metals by ICP-MS									
Arsenic	7440-38-2	0.1	mg/kg		**6.2**	**3.9**	**4.8**	**6.8**	**10.3**
Selenium	7782-49-2	1	mg/kg		<1	<1	<1	<1	<1
Barium	7440-39-3	0.1	mg/kg		**46.0**	**89.8**	**63.7**	**669**	**310**
Beryllium	7440-41-7	0.1	mg/kg		**0.7**	**1.0**	**0.7**	**0.7**	**0.9**

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Sample ID	2023033_C001 HE Seam	2023033_C002 ON Seam	2023033_C003 TS Seam	2023033_C004 THO Seam	2023033_C005 BRU Seam
				Sampling date / time	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00
Compound	CAS Number	LOR	Unit		EB2338913-001	EB2338913-002	EB2338913-003	EB2338913-004	EB2338913-005
					Result	Result	Result	Result	Result
EG020T: Total Metals by ICP-MS - Continued									
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	**0.1**	<0.1	**0.1**
Cobalt	7440-48-4	0.1	mg/kg		**3.2**	**3.4**	**3.0**	**3.8**	**4.2**
Chromium	7440-47-3	0.1	mg/kg		**6.0**	**5.6**	**6.7**	**6.4**	**4.9**
Copper	7440-50-8	0.1	mg/kg		**9.7**	**13.5**	**17.7**	**13.1**	**21.2**
Thorium	7440-29-1	0.1	mg/kg		**4.1**	**3.6**	**4.2**	**4.7**	**1.4**
Manganese	7439-96-5	0.1	mg/kg		**199**	**80.3**	**132**	**82.7**	**39.0**
Molybdenum	7439-98-7	0.1	mg/kg		**1.4**	**0.3**	**0.4**	**0.8**	**0.4**
Nickel	7440-02-0	0.1	mg/kg		**16.0**	**7.1**	**8.1**	**12.8**	**15.0**
Lead	7439-92-1	0.1	mg/kg		**10.7**	**14.5**	**15.7**	**17.3**	**20.9**
Antimony	7440-36-0	0.1	mg/kg		**0.1**	**0.1**	<0.1	**0.1**	<0.1
Uranium	7440-61-1	0.1	mg/kg		**0.6**	**0.7**	**0.9**	**1.1**	**0.6**
Zinc	7440-66-6	0.5	mg/kg		**33.6**	**68.7**	**59.1**	**65.1**	**103**
Vanadium	7440-62-2	1	mg/kg		**11**	**12**	**20**	**21**	**15**
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		<0.0005	<0.0005	<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	<0.1	<0.1
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		**2**	<1	**2**	**3**	**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	<0.1	<0.1

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_C006 BR Seam	2023033_C007 JE Seam	2023033_C008 MN Seam	2023033_C009 VY Seam	2023033_C010 NG Seam
			Sampling date / time	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00
Compound	CAS Number	LOR	Unit	EB2338913-006	EB2338913-007	EB2338913-008	EB2338913-009	EB2338913-010
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	6.8	7.2	7.2	8.5	8.5
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	51	99	99	252	275
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	895	1360	1710	4980	38800
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	895	1360	1710	4980	38600
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	<5	<5	<5	<5	168
ED038A: Acidity								
Acidity	----	1	mg/kg	360	216	324	36	<5
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	30	140	130	220	70
Silica	7631-86-9	1	mg/kg	102	72	82	41	40
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	<10	<10	<10	<10
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	<10	<10	<10	60	80
Magnesium	7439-95-4	10	mg/kg	<10	<10	<10	20	30
Sodium	7440-23-5	10	mg/kg	10	10	20	80	80
Potassium	7440-09-7	10	mg/kg	50	90	90	130	150
ED093T: Total Major Cations								
Sodium	7440-23-5	50	mg/kg	<50	50	50	300	280
Potassium	7440-09-7	50	mg/kg	1490	1620	1940	2180	2480
Calcium	7440-70-2	50	mg/kg	770	980	1080	3100	7200
Magnesium	7439-95-4	50	mg/kg	350	590	450	1810	5020
EG005(ED093)S : Soluble Metals by ICPAES								
Boron	7440-42-8	1	mg/kg	<1	<1	<1	<1	<1
Iron	7439-89-6	1	mg/kg	<1	<1	<1	<1	<1

Analytical Results

Sub-Matrix: PULP
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Sample ID	2023033_C006 BR Seam	2023033_C007 JE Seam	2023033_C008 MN Seam	2023033_C009 VY Seam	2023033_C010 NG Seam
				Sampling date / time	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00
					EB2338913-006	EB2338913-007	EB2338913-008	EB2338913-009	EB2338913-010
					Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		**11800**	**8890**	**8300**	**7500**	**7420**
Boron	7440-42-8	50	mg/kg		<50	<50	<50	<50	<50
Iron	7439-89-6	50	mg/kg		**3150**	**7310**	**3020**	**13600**	**36600**
EG020S: Soluble Metals by ICPMS									
Arsenic	7440-38-2	0.01	mg/kg		<0.01	<0.01	**0.01**	**0.04**	**0.05**
Selenium	7782-49-2	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Barium	7440-39-3	0.01	mg/kg		**0.04**	**0.22**	**0.06**	**0.39**	**0.17**
Beryllium	7440-41-7	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	7440-43-9	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	7440-48-4	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	7440-47-3	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	7440-29-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Copper	7440-50-8	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Manganese	7439-96-5	0.01	mg/kg		**0.02**	**0.03**	**0.02**	**0.03**	**0.02**
Molybdenum	7439-98-7	0.01	mg/kg		**0.01**	**0.04**	**0.05**	**0.23**	**0.11**
Nickel	7440-02-0	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Lead	7439-92-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.01	mg/kg		<0.01	<0.01	<0.01	**0.01**	<0.01
Uranium	7440-61-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	<0.05
Vanadium	7440-62-2	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Aluminium	7429-90-5	0.1	mg/kg		**0.3**	**0.1**	**0.2**	**0.2**	<0.1
EG020T: Total Metals by ICP-MS									
Arsenic	7440-38-2	0.1	mg/kg		**1.7**	**1.5**	**1.6**	**4.4**	**5.4**
Selenium	7782-49-2	1	mg/kg		<1	<1	<1	<1	<1
Barium	7440-39-3	0.1	mg/kg		**61.6**	**138**	**78.1**	**114**	**81.9**
Beryllium	7440-41-7	0.1	mg/kg		**0.7**	**1.1**	**0.9**	**0.7**	**1.1**

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Sample ID	2023033_C006 BR Seam	2023033_C007 JE Seam	2023033_C008 MN Seam	2023033_C009 VY Seam	2023033_C010 NG Seam
				Sampling date / time	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00
Compound	CAS Number	LOR	Unit		EB2338913-006	EB2338913-007	EB2338913-008	EB2338913-009	EB2338913-010
					Result	Result	Result	Result	Result
EG020T: Total Metals by ICP-MS - Continued									
Cadmium	7440-43-9	0.1	mg/kg		<0.1	<0.1	0.1	<0.1	0.1
Cobalt	7440-48-4	0.1	mg/kg		4.5	1.3	2.7	4.9	7.4
Chromium	7440-47-3	0.1	mg/kg		4.6	4.3	4.2	8.4	6.1
Copper	7440-50-8	0.1	mg/kg		14.5	14.7	19.1	16.9	26.4
Thorium	7440-29-1	0.1	mg/kg		1.9	4.0	2.0	2.8	2.1
Manganese	7439-96-5	0.1	mg/kg		24.4	85.8	24.3	101	373
Molybdenum	7439-98-7	0.1	mg/kg		0.2	0.2	0.2	0.6	0.2
Nickel	7440-02-0	0.1	mg/kg		7.7	3.4	7.2	15.2	24.9
Lead	7439-92-1	0.1	mg/kg		15.6	16.9	15.0	14.9	17.8
Antimony	7440-36-0	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	7440-61-1	0.1	mg/kg		0.5	0.6	0.5	0.7	0.7
Zinc	7440-66-6	0.5	mg/kg		11.5	18.8	48.7	51.5	62.2
Vanadium	7440-62-2	1	mg/kg		9	9	9	15	28
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		<0.0005	<0.0005	<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	<0.1	<0.1
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		1	1	2	3	5
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	<0.1	<0.1

Analytical Results

Sub-Matrix: PULP
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Sample ID	2023033_C011 NT Seam	2023033_C012 TH Seam	2023033_C013 FX Seam	2023033_C014 TA Seam	2023033_C015 TP Seam
				Sampling date / time	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00
					EB2338913-011	EB2338913-012	EB2338913-013	EB2338913-014	EB2338913-015
					Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)									
pH Value	----	0.1	pH Unit		8.2	8.2	7.9	7.9	7.0
EA010: Conductivity (1:5)									
Electrical Conductivity @ 25°C	----	1	µS/cm		199	191	78	234	94
ED037: Alkalinity									
ø Total Alkalinity as CaCO3	----	1	mg/kg		3040	2650	2020	3040	1520
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg		3040	2650	2020	3040	1520
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg		<5	<5	<5	<5	<5
ED038A: Acidity									
Acidity	----	1	mg/kg		86	153	144	288	650
ED040S : Soluble Sulfate by ICPAES									
Sulfate as SO4 2-	14808-79-8	10	mg/kg		130	80	70	40	170
Silica	7631-86-9	1	mg/kg		47	51	68	53	92
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	10	mg/kg		<10	<10	<10	<10	<10
ED093S: Soluble Major Cations									
Calcium	7440-70-2	10	mg/kg		30	30	<10	80	10
Magnesium	7439-95-4	10	mg/kg		<10	<10	<10	10	<10
Sodium	7440-23-5	10	mg/kg		70	70	20	80	60
Potassium	7440-09-7	10	mg/kg		120	120	70	110	60
ED093T: Total Major Cations									
Sodium	7440-23-5	50	mg/kg		220	210	120	180	220
Potassium	7440-09-7	50	mg/kg		2310	2360	2650	960	510
Calcium	7440-70-2	50	mg/kg		2290	2240	1910	2890	2260
Magnesium	7439-95-4	50	mg/kg		2200	1570	1180	510	440
EG005(ED093)S : Soluble Metals by ICPAES									
Boron	7440-42-8	1	mg/kg		<1	<1	<1	<1	<1
Iron	7439-89-6	1	mg/kg		<1	<1	<1	<1	<1

Analytical Results

Sub-Matrix: PULP
(Matrix: SOIL)

Compound	CAS Number	LOR	Unit	Sample ID	2023033_C011 NT Seam	2023033_C012 TH Seam	2023033_C013 FX Seam	2023033_C014 TA Seam	2023033_C015 TP Seam
				Sampling date / time	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00
					EB2338913-011	EB2338913-012	EB2338913-013	EB2338913-014	EB2338913-015
					Result	Result	Result	Result	Result
EG005(ED093)T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		**7880**	**8660**	**9600**	**9530**	**18000**
Boron	7440-42-8	50	mg/kg		<50	<50	<50	<50	<50
Iron	7439-89-6	50	mg/kg		**31600**	**13300**	**7640**	**5900**	**35900**
EG020S: Soluble Metals by ICPMS									
Arsenic	7440-38-2	0.01	mg/kg		**0.10**	**0.05**	**0.60**	**0.07**	<0.01
Selenium	7782-49-2	0.1	mg/kg		<0.1	<0.1	**0.1**	<0.1	<0.1
Barium	7440-39-3	0.01	mg/kg		**0.33**	**0.19**	**0.02**	**0.16**	**0.25**
Beryllium	7440-41-7	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	7440-43-9	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	7440-48-4	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	7440-47-3	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	7440-29-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Copper	7440-50-8	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Manganese	7439-96-5	0.01	mg/kg		**0.03**	**0.02**	**0.02**	**0.02**	**0.02**
Molybdenum	7439-98-7	0.01	mg/kg		**0.16**	**0.04**	**0.12**	**0.12**	**0.09**
Nickel	7440-02-0	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Lead	7439-92-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Antimony	7440-36-0	0.01	mg/kg		**0.01**	**0.01**	**0.02**	<0.01	<0.01
Uranium	7440-61-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	<0.01
Zinc	7440-66-6	0.05	mg/kg		**0.05**	<0.05	<0.05	<0.05	<0.05
Vanadium	7440-62-2	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	<0.1
Aluminium	7429-90-5	0.1	mg/kg		**0.1**	**0.1**	**1.9**	<0.1	<0.1
EG020T: Total Metals by ICP-MS									
Arsenic	7440-38-2	0.1	mg/kg		**6.5**	**3.8**	**18.9**	**4.3**	**1.3**
Selenium	7782-49-2	1	mg/kg		<1	<1	<1	**1**	**1**
Barium	7440-39-3	0.1	mg/kg		**302**	**142**	**84.6**	**61.5**	**98.8**
Beryllium	7440-41-7	0.1	mg/kg		**0.7**	**0.9**	**0.7**	**0.8**	**1.0**

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Sample ID	2023033_C011 NT Seam	2023033_C012 TH Seam	2023033_C013 FX Seam	2023033_C014 TA Seam	2023033_C015 TP Seam
				Sampling date / time	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00
Compound	CAS Number	LOR	Unit		EB2338913-011	EB2338913-012	EB2338913-013	EB2338913-014	EB2338913-015
					Result	Result	Result	Result	Result
EG020T: Total Metals by ICP-MS - Continued									
Cadmium	7440-43-9	0.1	mg/kg		0.1	0.1	0.1	0.2	0.1
Cobalt	7440-48-4	0.1	mg/kg		4.9	3.5	6.1	3.4	28.9
Chromium	7440-47-3	0.1	mg/kg		7.3	8.7	6.4	7.9	18.6
Copper	7440-50-8	0.1	mg/kg		21.6	25.9	24.1	49.8	64.6
Thorium	7440-29-1	0.1	mg/kg		2.2	2.0	1.5	7.6	5.4
Manganese	7439-96-5	0.1	mg/kg		544	99.0	134	85.3	990
Molybdenum	7439-98-7	0.1	mg/kg		0.3	0.2	0.4	0.2	0.4
Nickel	7440-02-0	0.1	mg/kg		21.2	13.8	23.7	10.1	37.1
Lead	7439-92-1	0.1	mg/kg		16.4	17.5	16.4	19.9	14.8
Antimony	7440-36-0	0.1	mg/kg		<0.1	<0.1	0.1	<0.1	<0.1
Uranium	7440-61-1	0.1	mg/kg		0.7	0.5	0.7	0.6	0.4
Zinc	7440-66-6	0.5	mg/kg		99.8	94.5	82.3	75.5	163
Vanadium	7440-62-2	1	mg/kg		22	18	16	45	53
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		<0.0005	<0.0005	<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	<0.1	0.2
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		4	3	5	4	2
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	<0.1	<0.1

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)			Sample ID	2023033_C016 TAK Seam	2023033_C017 Overburden	2023033_C018 Interburden	2023033_C019 Interburden	----
			Sampling date / time	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	----
Compound	CAS Number	LOR	Unit	EB2338913-016	EB2338913-017	EB2338913-018	EB2338913-019	--------
				Result	Result	Result	Result	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**7.1**	**8.9**	**8.7**	**8.7**	**----**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**149**	**204**	**265**	**210**	**----**
ED037: Alkalinity								
ø Total Alkalinity as CaCO3	----	1	mg/kg	**2180**	**24400**	**36200**	**46400**	**----**
ø Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/kg	**2180**	**24300**	**36100**	**46200**	**----**
ø Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/kg	<5	**168**	**168**	**168**	**----**
ED038A: Acidity								
Acidity	----	1	mg/kg	**613**	<5	<5	<5	**----**
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**50**	**210**	**240**	**90**	**----**
Silica	7631-86-9	1	mg/kg	**91**	**37**	**33**	**36**	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	<10	<10	<10	**----**
ED093S: Soluble Major Cations								
Calcium	7440-70-2	10	mg/kg	**70**	**60**	**80**	**50**	**----**
Magnesium	7439-95-4	10	mg/kg	**10**	**20**	**30**	**10**	**----**
Sodium	7440-23-5	10	mg/kg	**70**	**20**	**30**	**60**	**----**
Potassium	7440-09-7	10	mg/kg	**10**	**130**	**150**	**120**	**----**
ED093T: Total Major Cations								
Sodium	7440-23-5	50	mg/kg	**150**	**180**	**210**	**250**	**----**
Potassium	7440-09-7	50	mg/kg	**220**	**1730**	**1820**	**1740**	**----**
Calcium	7440-70-2	50	mg/kg	**1810**	**8390**	**11200**	**19400**	**----**
Magnesium	7439-95-4	50	mg/kg	**340**	**2420**	**4260**	**2660**	**----**
EG005(ED093)S : Soluble Metals by ICPAES								
Boron	7440-42-8	1	mg/kg	<1	<1	<1	<1	**----**
Iron	7439-89-6	1	mg/kg	<1	<1	<1	<1	**----**

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Sample ID	2023033_C016 TAK Seam	2023033_C017 Overburden	2023033_C018 Interburden	2023033_C019 Interburden	----
				Sampling date / time	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	----
Compound	CAS Number	LOR	Unit		EB2338913-016	EB2338913-017	EB2338913-018	EB2338913-019	--------
					Result	Result	Result	Result	----
EG005(ED093)T: Total Metals by ICP-AES									
Aluminium	7429-90-5	50	mg/kg		**14000**	**4690**	**5470**	**5290**	**----**
Boron	7440-42-8	50	mg/kg		<50	<50	<50	<50	**----**
Iron	7439-89-6	50	mg/kg		**3960**	**8840**	**19100**	**13400**	**----**
EG020S: Soluble Metals by ICPMS									
Arsenic	7440-38-2	0.01	mg/kg		**0.04**	**0.06**	**0.02**	**0.07**	**----**
Selenium	7782-49-2	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	**----**
Barium	7440-39-3	0.01	mg/kg		**0.32**	**0.35**	**0.31**	**0.31**	**----**
Beryllium	7440-41-7	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	**----**
Cadmium	7440-43-9	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	**----**
Cobalt	7440-48-4	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	**----**
Chromium	7440-47-3	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	**----**
Thorium	7440-29-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	**----**
Copper	7440-50-8	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	**----**
Manganese	7439-96-5	0.01	mg/kg		**0.01**	<0.01	**0.02**	<0.01	**----**
Molybdenum	7439-98-7	0.01	mg/kg		**0.04**	**0.09**	**0.10**	**0.13**	**----**
Nickel	7440-02-0	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	**----**
Lead	7439-92-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	**----**
Antimony	7440-36-0	0.01	mg/kg		<0.01	<0.01	<0.01	**0.01**	**----**
Uranium	7440-61-1	0.01	mg/kg		<0.01	<0.01	<0.01	<0.01	**----**
Zinc	7440-66-6	0.05	mg/kg		<0.05	<0.05	<0.05	<0.05	**----**
Vanadium	7440-62-2	0.1	mg/kg		<0.1	<0.1	<0.1	<0.1	**----**
Aluminium	7429-90-5	0.1	mg/kg		<0.1	**0.1**	**0.1**	**0.1**	**----**
EG020T: Total Metals by ICP-MS									
Arsenic	7440-38-2	0.1	mg/kg		**11.7**	**3.8**	**3.1**	**3.7**	**----**
Selenium	7782-49-2	1	mg/kg		**1**	<1	<1	<1	**----**
Barium	7440-39-3	0.1	mg/kg		**52.5**	**220**	**143**	**116**	**----**
Beryllium	7440-41-7	0.1	mg/kg		**0.6**	**0.3**	**0.7**	**0.6**	**----**

Analytical Results

Sub-Matrix: PULP (Matrix: SOIL)				Sample ID	2023033_C016 TAK Seam	2023033_C017 Overburden	2023033_C018 Interburden	2023033_C019 Interburden	----
				Sampling date / time	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	----
Compound	CAS Number	LOR	Unit		EB2338913-016	EB2338913-017	EB2338913-018	EB2338913-019	--------
					Result	Result	Result	Result	----
EG020T: Total Metals by ICP-MS - Continued									
Cadmium	7440-43-9	0.1	mg/kg		**0.2**	<0.1	<0.1	<0.1	**----**
Cobalt	7440-48-4	0.1	mg/kg		**5.6**	**3.5**	**4.2**	**4.4**	**----**
Chromium	7440-47-3	0.1	mg/kg		**11.6**	**5.6**	**5.5**	**7.5**	**----**
Copper	7440-50-8	0.1	mg/kg		**66.3**	**9.3**	**10.6**	**11.8**	**----**
Thorium	7440-29-1	0.1	mg/kg		**12.9**	**4.3**	**3.9**	**4.1**	**----**
Manganese	7439-96-5	0.1	mg/kg		**17.3**	**119**	**196**	**179**	**----**
Molybdenum	7439-98-7	0.1	mg/kg		**0.2**	**0.5**	**0.4**	**0.4**	**----**
Nickel	7440-02-0	0.1	mg/kg		**9.0**	**12.5**	**10.6**	**10.2**	**----**
Lead	7439-92-1	0.1	mg/kg		**23.6**	**8.4**	**13.3**	**12.7**	**----**
Antimony	7440-36-0	0.1	mg/kg		<0.1	**0.1**	<0.1	<0.1	**----**
Uranium	7440-61-1	0.1	mg/kg		**0.6**	**0.9**	**1.5**	**0.7**	**----**
Zinc	7440-66-6	0.5	mg/kg		**133**	**26.1**	**62.9**	**45.3**	**----**
Vanadium	7440-62-2	1	mg/kg		**42**	**7**	**14**	**13**	**----**
EG035S: Soluble Mercury by FIMS									
Mercury	7439-97-6	0.0005	mg/kg		<0.0005	<0.0005	<0.0005	<0.0005	**----**
EG035T: Total Recoverable Mercury by FIMS									
Mercury	7439-97-6	0.1	mg/kg		**0.2**	<0.1	<0.1	<0.1	**----**
EK040S: Fluoride Soluble									
Fluoride	16984-48-8	1	mg/kg		**4**	**3**	**4**	**4**	**----**
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	<0.1	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB2338847**	Page	: 1 of 3
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 08-Dec-2023 17:16
Order number	: ----	Date Analysis Commenced	: 14-Dec-2023
C-O-C number	: ----	Issue Date	: 19-Dec-2023 15:59
Sampler	: TYLER CONTOR		
Site	:		
Quote number	: BN/1234/19		
No. of samples received	: 3		
No. of samples analysed	: 3		

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, unless the sampling was conducted by ALS. 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

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 Contract 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.

- 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.
- Particular samples have been crushed prior to preparation and analysis as per client request on the Chain of Custody. Please refer to SRN for further details.
- 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: SOLID (Matrix: SOIL)			Sample ID	2023033_C017 Overburden	2023033_C018 Interburden	2023033_C019 Interburden	----	----
			Sampling date / time	06-Dec-2023 00:00	06-Dec-2023 00:00	06-Dec-2023 00:00	----	----
Compound	CAS Number	LOR	Unit	EB2338847-001	EB2338847-002	EB2338847-003	--------	--------
				Result	Result	Result	----	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**9.0**	**8.9**	**9.0**	**----**	**----**
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	**134**	**117**	**122**	**----**	**----**
ED006: Exchangeable Cations on Alkaline Soils								
ø Exchangeable Calcium	----	0.2	meq/100g	**0.8**	**2.1**	**2.4**	**----**	**----**
ø Exchangeable Magnesium	----	0.2	meq/100g	**0.7**	**0.8**	**0.6**	**----**	**----**
ø Exchangeable Potassium	----	0.2	meq/100g	**0.2**	**0.3**	**0.2**	**----**	**----**
ø Exchangeable Sodium	----	0.2	meq/100g	<0.2	<0.2	<0.2	**----**	**----**
ø Cation Exchange Capacity	----	0.2	meq/100g	**1.7**	**3.3**	**3.2**	**----**	**----**
ø Exchangeable Sodium Percent	----	0.2	%	<0.2	<0.2	<0.2	**----**	**----**
ø Calcium/Magnesium Ratio	----	0.2	-	**1.1**	**2.6**	**3.6**	**----**	**----**
ø Magnesium/Potassium Ratio	----	0.2	-	**2.8**	**2.4**	**3.0**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB2401895**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 19-Jan-2024 16:04
Order number	: ----	Date Analysis Commenced	: 22-Jan-2024
C-O-C number	: ----	Issue Date	: 29-Jan-2024 15:07
Sampler	: TYLER CONTOR		
Site	:		
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, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

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- 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*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD
Vincent Muller		Brisbane Inorganics, Stafford, QLD

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

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WKLC 1 Floor/Roof	WKLC 2 Floor/Roof	WKLC 3 Overburden	WKLC 4 Interburden	----
			Sampling date / time	19-Jan-2024 00:00	19-Jan-2024 00:00	19-Jan-2024 00:00	19-Jan-2024 00:00	----
Compound	CAS Number	LOR	Unit	EB2401895-001	EB2401895-002	EB2401895-003	EB2401895-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**3.11**	**6.79**	**7.63**	**8.28**	**----**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1360**	**52**	**119**	**102**	**----**
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	<1	**10**	**20**	**27**	**----**
Total Alkalinity as CaCO3	----	1	mg/L	<1	**10**	**20**	**27**	**----**
ED038: Acidity								
Acidity as CaCO3	----	1	mg/L	**450**	**2**	**1**	<1	**----**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**716**	**10**	**31**	**20**	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**1**	<1	<1	<1	**----**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**40**	**3**	**11**	**10**	**----**
Magnesium	7439-95-4	1	mg/L	**17**	<1	**3**	**2**	**----**
Sodium	7440-23-5	1	mg/L	**4**	**9**	**3**	**12**	**----**
Potassium	7440-09-7	1	mg/L	**13**	**2**	**6**	**4**	**----**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**31.7**	**0.13**	**0.10**	**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	**0.006**	**0.002**	**0.002**	**0.003**	**----**
Beryllium	7440-41-7	0.001	mg/L	**0.010**	<0.001	<0.001	<0.001	**----**
Barium	7440-39-3	0.001	mg/L	**0.046**	**0.164**	**0.023**	**0.041**	**----**
Cadmium	7440-43-9	0.0001	mg/L	**0.0014**	<0.0001	<0.0001	<0.0001	**----**
Chromium	7440-47-3	0.001	mg/L	**0.013**	<0.001	<0.001	<0.001	**----**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Floor/Roof	WKLC 2 Floor/Roof	WKLC 3 Overburden	WKLC 4 Interburden	----
				Sampling date / time	19-Jan-2024 00:00	19-Jan-2024 00:00	19-Jan-2024 00:00	19-Jan-2024 00:00	----
Compound	CAS Number	LOR	Unit		EB2401895-001	EB2401895-002	EB2401895-003	EB2401895-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Cobalt	7440-48-4	0.001	mg/L		**0.116**	<0.001	<0.001	<0.001	**----**
Copper	7440-50-8	0.001	mg/L		**0.128**	<0.001	**0.001**	**0.001**	**----**
Lead	7439-92-1	0.001	mg/L		**0.031**	<0.001	<0.001	<0.001	**----**
Manganese	7439-96-5	0.001	mg/L		**0.895**	**0.004**	**0.007**	**0.005**	**----**
Molybdenum	7439-98-7	0.001	mg/L		<0.001	**0.006**	**0.003**	**0.005**	**----**
Nickel	7440-02-0	0.001	mg/L		**0.380**	<0.001	**0.001**	<0.001	**----**
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	**----**
Thorium	7440-29-1	0.001	mg/L		**0.008**	<0.001	<0.001	<0.001	**----**
Uranium	7440-61-1	0.001	mg/L		**0.006**	<0.001	<0.001	<0.001	**----**
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	**----**
Zinc	7440-66-6	0.005	mg/L		**0.524**	<0.005	<0.005	<0.005	**----**
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	**----**
Iron	7439-89-6	0.05	mg/L		**142**	<0.05	<0.05	<0.05	**----**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	**----**
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		**14.9**	**0.41**	**1.04**	**0.96**	**----**
ø Total Cations	----	0.01	meq/L		**15.0**	**----**	**----**	**----**	**----**
ø Total Cations	----	0.01	meq/L		**----**	**0.59**	**1.08**	**1.29**	**----**
ø Ionic Balance	----	0.01	%		**0.33**	**----**	**----**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB2405911**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 21-Feb-2024 13:32
Order number	: 2023033	Date Analysis Commenced	: 22-Feb-2024
C-O-C number	: ----	Issue Date	: 28-Feb-2024 13:28
Sampler	: TYLER CONTOR		
Site	:		
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, unless the sampling was conducted by ALS. 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*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
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 Contract 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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	2023033_WKLC 1 Floor/Roof L2	2023033_WKLC 2 Floor/Roof L2	2023033_WKLC 3 Overburden L2	2023033_WKLC 4 Interburden L2	----
			Sampling date / time	21-Feb-2024 00:00	21-Feb-2024 00:00	21-Feb-2024 00:00	21-Feb-2024 00:00	----
Compound	CAS Number	LOR	Unit	EB2405911-001	EB2405911-002	EB2405911-003	EB2405911-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**2.76**	**6.65**	**7.07**	**7.21**	**----**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**2040**	**60**	**160**	**97**	**----**
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	<1	**3**	**14**	**14**	**----**
Total Alkalinity as CaCO3	----	1	mg/L	<1	**3**	**14**	**14**	**----**
ED038: Acidity								
Acidity as CaCO3	----	1	mg/L	**1030**	**3**	**2**	**2**	**----**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**969**	**19**	**46**	**29**	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	<1	**4**	<1	**----**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**34**	**4**	**12**	**8**	**----**
Magnesium	7439-95-4	1	mg/L	**24**	<1	**5**	**1**	**----**
Sodium	7440-23-5	1	mg/L	<1	**4**	**4**	**4**	**----**
Potassium	7440-09-7	1	mg/L	**3**	**2**	**7**	**3**	**----**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**24.8**	**0.09**	**0.04**	**0.08**	**----**
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	**----**
Arsenic	7440-38-2	0.001	mg/L	**0.005**	**0.004**	**0.003**	**0.002**	**----**
Beryllium	7440-41-7	0.001	mg/L	**0.022**	<0.001	<0.001	<0.001	**----**
Barium	7440-39-3	0.001	mg/L	**0.007**	**0.014**	**0.015**	**0.020**	**----**
Cadmium	7440-43-9	0.0001	mg/L	**0.0031**	<0.0001	<0.0001	<0.0001	**----**
Chromium	7440-47-3	0.001	mg/L	**0.015**	<0.001	<0.001	<0.001	**----**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	2023033_WKLC 1 Floor/Roof L2	2023033_WKLC 2 Floor/Roof L2	2023033_WKLC 3 Overburden L2	2023033_WKLC 4 Interburden L2	----
				Sampling date / time	21-Feb-2024 00:00	21-Feb-2024 00:00	21-Feb-2024 00:00	21-Feb-2024 00:00	----
Compound	CAS Number	LOR	Unit		EB2405911-001	EB2405911-002	EB2405911-003	EB2405911-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Cobalt	7440-48-4	0.001	mg/L		**0.201**	<0.001	<0.001	<0.001	**----**
Copper	7440-50-8	0.001	mg/L		**0.264**	<0.001	<0.001	<0.001	**----**
Lead	7439-92-1	0.001	mg/L		**0.020**	<0.001	<0.001	<0.001	**----**
Manganese	7439-96-5	0.001	mg/L		**2.25**	**0.002**	**0.007**	**0.003**	**----**
Molybdenum	7439-98-7	0.001	mg/L		<0.001	**0.004**	**0.005**	**0.004**	**----**
Nickel	7440-02-0	0.001	mg/L		**0.697**	**0.002**	<0.001	<0.001	**----**
Selenium	7782-49-2	0.01	mg/L		<0.01	**0.02**	<0.01	<0.01	**----**
Thorium	7440-29-1	0.001	mg/L		**0.017**	<0.001	<0.001	<0.001	**----**
Uranium	7440-61-1	0.001	mg/L		**0.011**	<0.001	<0.001	<0.001	**----**
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	**----**
Zinc	7440-66-6	0.005	mg/L		**1.54**	<0.005	<0.005	<0.005	**----**
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	**----**
Iron	7439-89-6	0.05	mg/L		**270**	<0.05	<0.05	<0.05	**----**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.2**	**0.1**	**0.1**	**----**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**20.2**	**0.46**	**1.35**	**0.88**	**----**
ø Total Cations	----	0.01	meq/L		**21.0**	**----**	**----**	**----**	**----**
ø Total Cations	----	0.01	meq/L		**----**	**0.42**	**1.36**	**0.73**	**----**
ø Ionic Balance	----	0.01	%		**1.94**	**----**	**----**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB2409666**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 21-Mar-2024 15:47
Order number	: ----	Date Analysis Commenced	: 25-Mar-2024
C-O-C number	: ----	Issue Date	: 28-Mar-2024 12:04
Sampler	: TYLER CONTOR		
Site	:		
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, unless the sampling was conducted by ALS. 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*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
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 Contract 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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- Ionic Balance out of acceptable limits due to analytes not quantified in this report.
- EK040P (Fluoride) - Particular samples required dilution due to matrix interferences. LOR values have been adjusted accordingly.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WKLC 1 Floor/Roof	WKLC 2 Floor/Roof	WKLC 3 Overburden	WKLC 4 Interburden	----
			Sampling date / time	21-Mar-2024 00:00	21-Mar-2024 00:00	21-Mar-2024 00:00	21-Mar-2024 00:00	----
Compound	CAS Number	LOR	Unit	EB2409666-001	EB2409666-002	EB2409666-003	EB2409666-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**2.73**	**5.53**	**6.36**	**6.50**	**----**
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1790**	**53**	**117**	**69**	**----**
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	<1	**3**	**11**	**12**	**----**
Total Alkalinity as CaCO3	----	1	mg/L	<1	**3**	**11**	**12**	**----**
ED038: Acidity								
Acidity as CaCO3	----	1	mg/L	**603**	**2**	**2**	**2**	**----**
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**880**	**17**	**40**	**20**	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	<1	<1	<1	**----**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**24**	**4**	**10**	**6**	**----**
Magnesium	7439-95-4	1	mg/L	**40**	<1	**5**	**1**	**----**
Sodium	7440-23-5	1	mg/L	<1	**4**	**2**	**4**	**----**
Potassium	7440-09-7	1	mg/L	**1**	**2**	**6**	**3**	**----**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**19.8**	**0.07**	**0.04**	**0.08**	**----**
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	**----**
Arsenic	7440-38-2	0.001	mg/L	**0.002**	**0.004**	**0.001**	<0.001	**----**
Beryllium	7440-41-7	0.001	mg/L	**0.024**	<0.001	<0.001	<0.001	**----**
Barium	7440-39-3	0.001	mg/L	**0.005**	**0.012**	**0.012**	**0.018**	**----**
Cadmium	7440-43-9	0.0001	mg/L	**0.0037**	<0.0001	<0.0001	<0.0001	**----**
Chromium	7440-47-3	0.001	mg/L	**0.012**	<0.001	<0.001	<0.001	**----**

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Floor/Roof	WKLC 2 Floor/Roof	WKLC 3 Overburden	WKLC 4 Interburden	----
				Sampling date / time	21-Mar-2024 00:00	21-Mar-2024 00:00	21-Mar-2024 00:00	21-Mar-2024 00:00	----
Compound	CAS Number	LOR	Unit		EB2409666-001	EB2409666-002	EB2409666-003	EB2409666-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Cobalt	7440-48-4	0.001	mg/L		**0.311**	<0.001	<0.001	<0.001	**----**
Copper	7440-50-8	0.001	mg/L		**0.337**	<0.001	<0.001	<0.001	**----**
Lead	7439-92-1	0.001	mg/L		**0.004**	<0.001	<0.001	<0.001	**----**
Manganese	7439-96-5	0.001	mg/L		**3.78**	**0.002**	**0.005**	**0.003**	**----**
Molybdenum	7439-98-7	0.001	mg/L		<0.001	**0.004**	**0.006**	**0.002**	**----**
Nickel	7440-02-0	0.001	mg/L		**0.946**	**0.001**	<0.001	<0.001	**----**
Selenium	7782-49-2	0.01	mg/L		<0.01	**0.02**	<0.01	<0.01	**----**
Thorium	7440-29-1	0.001	mg/L		**0.013**	<0.001	<0.001	<0.001	**----**
Uranium	7440-61-1	0.001	mg/L		**0.013**	<0.001	<0.001	<0.001	**----**
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	**----**
Zinc	7440-66-6	0.005	mg/L		**2.77**	<0.005	<0.005	<0.005	**----**
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	**----**
Iron	7439-89-6	0.05	mg/L		**188**	<0.05	<0.05	<0.05	**----**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<1.0	<0.1	<0.1	<0.1	**----**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**18.3**	**0.41**	**1.05**	**0.66**	**----**
ø Total Cations	----	0.01	meq/L		**13.7**	**----**	**----**	**----**	**----**
ø Total Cations	----	0.01	meq/L		**----**	**0.42**	**1.15**	**0.63**	**----**
ø Ionic Balance	----	0.01	%		**14.4**	**----**	**----**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB2413082**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 18-Apr-2024 15:30
Order number	: ----	Date Analysis Commenced	: 19-Apr-2024
C-O-C number	: ----	Issue Date	: 29-Apr-2024 12:41
Sampler	: TYLER CONTOR		
Site	:		
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, unless the sampling was conducted by ALS. 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
Vincent Muller	Chemist - Inorganics	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 Contract 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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- EK040P (Fluoride) - Particular samples required dilution due to matrix interferences. LOR values have been adjusted accordingly.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WKLC 1 Floor/ L4	WKLC 2 Floor/Roof L4	WKLC 3 Overburden L4	WKLC 4 Interburden L4	----
			Sampling date / time	18-Apr-2024 00:00	18-Apr-2024 00:00	18-Apr-2024 00:00	18-Apr-2024 00:00	----
Compound	CAS Number	LOR	Unit	EB2413082-001	EB2413082-002	EB2413082-003	EB2413082-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**2.80**	**6.19**	**6.68**	**6.85**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1820**	**66**	**107**	**82**	----
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	<1	**6**	**14**	**15**	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	**6**	**14**	**15**	----
ED038: Acidity								
Acidity as CaCO3	----	1	mg/L	**507**	**3**	**2**	**2**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**895**	**20**	**32**	**22**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	<1	<1	<1	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**31**	**4**	**9**	**7**	----
Magnesium	7439-95-4	1	mg/L	**60**	<1	**4**	**1**	----
Sodium	7440-23-5	1	mg/L	**3**	**7**	**3**	**5**	----
Potassium	7440-09-7	1	mg/L	<1	**2**	**5**	**3**	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**25.7**	**0.16**	**0.03**	**0.10**	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L	**0.003**	**0.005**	**0.002**	**0.002**	----
Beryllium	7440-41-7	0.001	mg/L	**0.030**	<0.001	<0.001	<0.001	----
Barium	7440-39-3	0.001	mg/L	**0.004**	**0.024**	**0.011**	**0.023**	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0046**	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	**0.014**	<0.001	<0.001	<0.001	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Floor/ L4	WKLC 2 Floor/Roof L4	WKLC 3 Overburden L4	WKLC 4 Interburden L4	----
				Sampling date / time	18-Apr-2024 00:00	18-Apr-2024 00:00	18-Apr-2024 00:00	18-Apr-2024 00:00	----
Compound	CAS Number	LOR	Unit		EB2413082-001	EB2413082-002	EB2413082-003	EB2413082-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Cobalt	7440-48-4	0.001	mg/L		**0.396**	**0.001**	**0.001**	<0.001	**----**
Copper	7440-50-8	0.001	mg/L		**0.411**	<0.001	<0.001	<0.001	**----**
Lead	7439-92-1	0.001	mg/L		**0.008**	<0.001	<0.001	<0.001	**----**
Manganese	7439-96-5	0.001	mg/L		**6.09**	**0.006**	**0.010**	**0.007**	**----**
Molybdenum	7439-98-7	0.001	mg/L		<0.001	**0.004**	**0.006**	**0.003**	**----**
Nickel	7440-02-0	0.001	mg/L		**1.15**	**0.003**	**0.002**	**0.001**	**----**
Selenium	7782-49-2	0.01	mg/L		<0.01	**0.01**	<0.01	<0.01	**----**
Thorium	7440-29-1	0.001	mg/L		**0.014**	<0.001	<0.001	<0.001	**----**
Uranium	7440-61-1	0.001	mg/L		**0.013**	<0.001	<0.001	<0.001	**----**
Vanadium	7440-62-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	**----**
Zinc	7440-66-6	0.005	mg/L		**4.05**	**0.006**	<0.005	<0.005	**----**
Boron	7440-42-8	0.05	mg/L		**0.06**	<0.05	<0.05	<0.05	**----**
Iron	7439-89-6	0.05	mg/L		**187**	<0.05	<0.05	<0.05	**----**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<1.0	**0.2**	**0.1**	<0.1	**----**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**18.6**	**0.54**	**0.94**	**0.76**	**----**
ø Total Cations	----	0.01	meq/L		**16.2**	**----**	**----**	**----**	**----**
ø Total Cations	----	0.01	meq/L		**----**	**0.56**	**1.04**	**0.72**	**----**
ø Ionic Balance	----	0.01	%		**6.90**	**----**	**----**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB2416487**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 15-May-2024 14:05
Order number	: ----	Date Analysis Commenced	: 16-May-2024
C-O-C number	: ----	Issue Date	: 22-May-2024 10:49
Sampler	: TYLER CONTOR		
Site	:		
Quote number	: BN/1234/19		
No. of samples received	: 4		
No. of samples analysed	: 4		

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
Vincent Muller	Chemist - Inorganics	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 Contract 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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WKLC 1 Roof/Floor L5	WKLC 2 Floor/Roof L5	WKLC 3 Overburden L5	WKLC 4 Interburden L5	----
			Sampling date / time	15-May-2024 00:00	15-May-2024 00:00	15-May-2024 00:00	15-May-2024 00:00	----
Compound	CAS Number	LOR	Unit	EB2416487-001	EB2416487-002	EB2416487-003	EB2416487-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**2.85**	**6.13**	**6.52**	**6.53**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1860**	**53**	**93**	**62**	----
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	<1	**7**	**14**	**11**	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	**7**	**14**	**11**	----
ED038: Acidity								
Acidity as CaCO3	----	1	mg/L	**511**	**2**	**2**	**2**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**965**	**16**	**27**	**16**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	<1	<1	<1	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**25**	**4**	**7**	**5**	----
Magnesium	7439-95-4	1	mg/L	**71**	<1	**3**	<1	----
Sodium	7440-23-5	1	mg/L	<1	**4**	**1**	**3**	----
Potassium	7440-09-7	1	mg/L	<1	**1**	**4**	**2**	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**27.4**	**0.12**	**0.06**	**0.11**	----
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**	**0.004**	**0.002**	**0.002**	----
Beryllium	7440-41-7	0.001	mg/L	**0.032**	<0.001	<0.001	<0.001	----
Barium	7440-39-3	0.001	mg/L	**0.003**	**0.010**	**0.010**	**0.012**	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0058**	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	**0.014**	<0.001	<0.001	<0.001	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Roof/Floor L5	WKLC 2 Floor/Roof L5	WKLC 3 Overburden L5	WKLC 4 Interburden L5	----
				Sampling date / time	15-May-2024 00:00	15-May-2024 00:00	15-May-2024 00:00	15-May-2024 00:00	----
Compound	CAS Number	LOR	Unit		EB2416487-001	EB2416487-002	EB2416487-003	EB2416487-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Cobalt	7440-48-4	0.001	mg/L		**0.403**	<0.001	<0.001	<0.001	**----**
Copper	7440-50-8	0.001	mg/L		**0.409**	**0.001**	**0.001**	**0.001**	**----**
Lead	7439-92-1	0.001	mg/L		**0.006**	<0.001	<0.001	<0.001	**----**
Manganese	7439-96-5	0.001	mg/L		**7.25**	**0.002**	**0.004**	**0.003**	**----**
Molybdenum	7439-98-7	0.001	mg/L		<0.001	**0.004**	**0.007**	**0.003**	**----**
Nickel	7440-02-0	0.001	mg/L		**1.26**	**0.001**	**0.001**	<0.001	**----**
Selenium	7782-49-2	0.01	mg/L		<0.01	**0.01**	<0.01	<0.01	**----**
Thorium	7440-29-1	0.001	mg/L		**0.018**	<0.001	<0.001	<0.001	**----**
Uranium	7440-61-1	0.001	mg/L		**0.018**	<0.001	<0.001	<0.001	**----**
Vanadium	7440-62-2	0.01	mg/L		**0.01**	<0.01	<0.01	<0.01	**----**
Zinc	7440-66-6	0.005	mg/L		**4.76**	<0.005	<0.005	<0.005	**----**
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	**----**
Iron	7439-89-6	0.05	mg/L		**162**	<0.05	<0.05	<0.05	**----**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.2**	**0.1**	<0.1	**----**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**20.1**	**----**	**----**	**----**	**----**
ø Total Anions	----	0.01	meq/L		**----**	**0.47**	**0.84**	**0.55**	**----**
ø Total Cations	----	0.01	meq/L		**17.8**	**----**	**----**	**----**	**----**
ø Total Cations	----	0.01	meq/L		**----**	**0.40**	**0.74**	**0.43**	**----**
ø Ionic Balance	----	0.01	%		**6.05**	**----**	**----**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB2421205**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 20-Jun-2024 16:36
Order number	: ----	Date Analysis Commenced	: 21-Jun-2024
C-O-C number	: ----	Issue Date	: 26-Jun-2024 13:28
Sampler	: TYLER CONTOR		
Site	:		
Quote number	: BN/1234/19		
No. of samples received	: 4		
No. of samples analysed	: 4		

Accreditation No. 825
Accredited for compliance with
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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*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Vincent Muller	Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD

General Comments

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^ = 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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WKLC 1 Floor/Roof	WKLC 2 Floor/Roof	WKLC 3 Overburden	WKLC 4 Interburden	----
			Sampling date / time	20-Jun-2024 00:00	20-Jun-2024 00:00	20-Jun-2024 00:00	20-Jun-2024 00:00	----
Compound	CAS Number	LOR	Unit	EB2421205-001	EB2421205-002	EB2421205-003	EB2421205-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**2.83**	**6.52**	**6.59**	**6.68**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1890**	**46**	**84**	**60**	----
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	<1	**3**	**10**	**11**	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	**3**	**10**	**11**	----
ED038: Acidity								
Acidity as CaCO3	----	1	mg/L	**533**	**3**	**3**	**2**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**980**	**21**	**26**	**16**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**1**	<1	<1	<1	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**24**	**3**	**6**	**5**	----
Magnesium	7439-95-4	1	mg/L	**80**	<1	**3**	<1	----
Sodium	7440-23-5	1	mg/L	<1	**3**	**1**	**3**	----
Potassium	7440-09-7	1	mg/L	<1	**1**	**4**	**2**	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**28.4**	**0.21**	**0.08**	**0.16**	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L	**0.008**	**0.004**	**0.002**	**0.002**	----
Beryllium	7440-41-7	0.001	mg/L	**0.035**	<0.001	<0.001	<0.001	----
Barium	7440-39-3	0.001	mg/L	**0.004**	**0.011**	**0.010**	**0.014**	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0063**	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	**0.016**	<0.001	<0.001	<0.001	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Floor/Roof	WKLC 2 Floor/Roof	WKLC 3 Overburden	WKLC 4 Interburden	----
				Sampling date / time	20-Jun-2024 00:00	20-Jun-2024 00:00	20-Jun-2024 00:00	20-Jun-2024 00:00	----
Compound	CAS Number	LOR	Unit		EB2421205-001	EB2421205-002	EB2421205-003	EB2421205-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Cobalt	7440-48-4	0.001	mg/L		**0.428**	<0.001	<0.001	<0.001	**----**
Copper	7440-50-8	0.001	mg/L		**0.495**	<0.001	<0.001	<0.001	**----**
Lead	7439-92-1	0.001	mg/L		**0.020**	<0.001	<0.001	<0.001	**----**
Manganese	7439-96-5	0.001	mg/L		**8.23**	**0.003**	**0.003**	**0.002**	**----**
Molybdenum	7439-98-7	0.001	mg/L		**0.001**	**0.004**	**0.007**	**0.003**	**----**
Nickel	7440-02-0	0.001	mg/L		**1.35**	**0.001**	<0.001	<0.001	**----**
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	**----**
Thorium	7440-29-1	0.001	mg/L		**0.019**	<0.001	<0.001	<0.001	**----**
Uranium	7440-61-1	0.001	mg/L		**0.019**	<0.001	<0.001	<0.001	**----**
Vanadium	7440-62-2	0.01	mg/L		**0.02**	<0.01	<0.01	<0.01	**----**
Zinc	7440-66-6	0.005	mg/L		**5.22**	<0.005	<0.005	<0.005	**----**
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	**----**
Iron	7439-89-6	0.05	mg/L		**146**	**0.06**	<0.05	<0.05	**----**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	**0.1**	<0.1	<0.1	**----**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**20.4**	**0.50**	**0.74**	**0.55**	**----**
ø Total Cations	----	0.01	meq/L		**18.2**	**----**	**----**	**----**	**----**
ø Total Cations	----	0.01	meq/L		**----**	**0.30**	**0.69**	**0.43**	**----**
ø Ionic Balance	----	0.01	%		**5.89**	**----**	**----**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB2424599**	Page	: 1 of 4
Amendment	: **1**		
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 18-Jul-2024 15:40
Order number	: ----	Date Analysis Commenced	: 19-Jul-2024
C-O-C number	: ----	Issue Date	: 26-Jul-2024 09:40
Sampler	: TYLER CONTOR		
Site	: ----		
Quote number	: EB24RGSENVCON0002		
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, unless the sampling was conducted by ALS. 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 Contract 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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- Amendment (26/07/2024): This report has been amended and re-released to allow the reporting of additional analytical data, specifically Ba, Be, Pb, and V for all samples .
- Unless otherwise stated, analytical work for this work order will be conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WKLC 1 Floor/Roof	WKLC 2 Floor/Roof	WKLC 3 Overburden	WKLC 4 Interburden	----
			Sampling date / time	18-Jul-2024 00:00	18-Jul-2024 00:00	18-Jul-2024 00:00	18-Jul-2024 00:00	----
Compound	CAS Number	LOR	Unit	EB2424599-001	EB2424599-002	EB2424599-003	EB2424599-004	--------
				Result	Result	Result	Result	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**2.85**	**5.92**	**6.80**	**6.88**	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**2150**	**43**	**88**	**53**	----
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	<1	**2**	**9**	**8**	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	**2**	**9**	**8**	----
ED038: Acidity								
Acidity as CaCO3	----	1	mg/L	**613**	**2**	**2**	**2**	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**1090**	**12**	**27**	**14**	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	<1	<1	<1	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**28**	**3**	**5**	**4**	----
Magnesium	7439-95-4	1	mg/L	**115**	<1	**4**	<1	----
Sodium	7440-23-5	1	mg/L	<1	**4**	**2**	**3**	----
Potassium	7440-09-7	1	mg/L	<1	**1**	**3**	**2**	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**46.6**	**0.12**	**0.07**	**0.11**	----
Antimony	7440-36-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	----
Arsenic	7440-38-2	0.001	mg/L	**0.017**	**0.003**	**0.001**	<0.001	----
Beryllium	7440-41-7	0.001	mg/L	**0.053**	<0.001	<0.001	<0.001	----
Barium	7440-39-3	0.001	mg/L	**0.002**	**0.010**	**0.010**	**0.010**	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0080**	<0.0001	<0.0001	<0.0001	----
Chromium	7440-47-3	0.001	mg/L	**0.023**	<0.001	<0.001	<0.001	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Floor/Roof	WKLC 2 Floor/Roof	WKLC 3 Overburden	WKLC 4 Interburden	----
				Sampling date / time	18-Jul-2024 00:00	18-Jul-2024 00:00	18-Jul-2024 00:00	18-Jul-2024 00:00	----
Compound	CAS Number	LOR	Unit		EB2424599-001	EB2424599-002	EB2424599-003	EB2424599-004	--------
					Result	Result	Result	Result	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Cobalt	7440-48-4	0.001	mg/L		**0.497**	<0.001	<0.001	<0.001	**----**
Copper	7440-50-8	0.001	mg/L		**0.610**	<0.001	<0.001	<0.001	**----**
Lead	7439-92-1	0.001	mg/L		**0.002**	<0.001	<0.001	<0.001	**----**
Manganese	7439-96-5	0.001	mg/L		**11.9**	**0.002**	**0.003**	**0.003**	**----**
Molybdenum	7439-98-7	0.001	mg/L		**0.001**	**0.003**	**0.007**	**0.003**	**----**
Nickel	7440-02-0	0.001	mg/L		**1.71**	**0.001**	**0.001**	<0.001	**----**
Selenium	7782-49-2	0.01	mg/L		<0.01	<0.01	<0.01	<0.01	**----**
Thorium	7440-29-1	0.001	mg/L		**0.030**	<0.001	<0.001	<0.001	**----**
Uranium	7440-61-1	0.001	mg/L		**0.026**	<0.001	<0.001	<0.001	**----**
Vanadium	7440-62-2	0.01	mg/L		**0.04**	<0.01	<0.01	<0.01	**----**
Zinc	7440-66-6	0.005	mg/L		**7.24**	<0.005	<0.005	<0.005	**----**
Boron	7440-42-8	0.05	mg/L		<0.05	<0.05	<0.05	<0.05	**----**
Iron	7439-89-6	0.05	mg/L		**171**	<0.05	<0.05	<0.05	**----**
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	<0.0001	<0.0001	<0.0001	**----**
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	<0.1	<0.1	<0.1	**----**
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**22.7**	**0.29**	**0.74**	**0.45**	**----**
ø Total Cations	----	0.01	meq/L		**22.9**	**----**	**----**	**----**	**----**
ø Total Cations	----	0.01	meq/L		**----**	**0.35**	**0.74**	**0.38**	**----**
ø Ionic Balance	----	0.01	%		**0.43**	**----**	**----**	**----**	**----**

CERTIFICATE OF ANALYSIS

Work Order	: **EB2427111**	Page	: 1 of 4
Amendment	: **2**		
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 08-Aug-2024 14:11
Order number	: ----	Date Analysis Commenced	: 08-Aug-2024
C-O-C number	: ----	Issue Date	: 03-Sep-2024 13:03
Sampler	: TYLER CONTOR		
Site	: ----		
Quote number	: EB24RGSENVCON0002		
No. of samples received	: 1		
No. of samples analysed	: 1		

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, unless the sampling was conducted by ALS. 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*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Mark Hallas	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 Contract 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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- Amendment (16/08/2024): This report has been amended and re-released to allow the reporting of additional analytical data, specifically method Ba, Be and V (EG020F)
- Amendment (03/09/2024): This report has been amended following a change to the EA010-P (Conductivity) result reported for sample WKLC 1 (EB2427111-001) due to a procedural error. All details are recorded in client query 24BNCC401 and a full investigation will be detailed in corrective action request 24BNC125.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Floor/Roof	----	----	----	----
				Sampling date / time	08-Aug-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2427111-001	--------	--------	--------	--------
					Result	----	----	----	----
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit		**2.71**	----	----	----	----
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm		**1870**	----	----	----	----
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L		<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L		<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L		<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L		<1	----	----	----	----
ED038: Acidity									
Acidity as CaCO3	----	1	mg/L		**595**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L		**993**	----	----	----	----
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L		**2**	----	----	----	----
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L		**49**	----	----	----	----
Magnesium	7439-95-4	1	mg/L		**78**	----	----	----	----
Sodium	7440-23-5	1	mg/L		<1	----	----	----	----
Potassium	7440-09-7	1	mg/L		**24**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L		**35.4**	----	----	----	----
Antimony	7440-36-0	0.001	mg/L		<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L		**0.011**	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L		**0.054**	----	----	----	----
Barium	7440-39-3	0.001	mg/L		**0.002**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		**0.0078**	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		**0.018**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Floor/Roof	----	----	----	----
				Sampling date / time	08-Aug-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2427111-001	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Cobalt	7440-48-4	0.001	mg/L		**0.255**	----	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.401**	----	----	----	----
Lead	7439-92-1	0.001	mg/L		**0.007**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**8.12**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		**0.910**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Thorium	7440-29-1	0.001	mg/L		**0.043**	----	----	----	----
Uranium	7440-61-1	0.001	mg/L		**0.031**	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		**0.01**	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**4.55**	----	----	----	----
Boron	7440-42-8	0.05	mg/L		<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**104**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.3**	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**20.7**	----	----	----	----
ø Total Cations	----	0.01	meq/L		**19.6**	----	----	----	----
ø Ionic Balance	----	0.01	%		**2.93**	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: **EB2431310**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 11-Sep-2024 13:37
Order number	: ----	Date Analysis Commenced	: 12-Sep-2024
C-O-C number	: ----	Issue Date	: 18-Sep-2024 15:54
Sampler	: KOSHIK GOUNDER		
Site	: ----		
Quote number	: EB24RGSENVCON0002_V2		
No. of samples received	: 1		
No. of samples analysed	: 1		

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, unless the sampling was conducted by ALS. 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*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
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 Contract 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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- EK040-P(Fluoride by Auto titrator): Client ID WKLC 1 (ALS ID EB2431310-001) Sample has been diluted due to matrix effect and LOR has been raised accordingly.
- EG020-F (Dissolved Metals by ICP-MS): The high recovery of Antimony for Laboratory Control Standard is deemed acceptable as associated results are less than the limit of reporting.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WKLC 1 Floor/Roof	----	----	----	----
			Sampling date / time	11-Sep-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2431310-001	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**2.83**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**2410**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----
ED038: Acidity								
Acidity as CaCO3	----	1	mg/L	**868**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**1370**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**37**	----	----	----	----
Magnesium	7439-95-4	1	mg/L	**125**	----	----	----	----
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
Potassium	7440-09-7	1	mg/L	**1**	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**52.7**	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.022**	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	**0.054**	----	----	----	----
Barium	7440-39-3	0.001	mg/L	**0.004**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0111**	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	**0.023**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Floor/Roof	----	----	----	----
				Sampling date / time	11-Sep-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2431310-001	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Cobalt	7440-48-4	0.001	mg/L		**0.534**	----	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.961**	----	----	----	----
Lead	7439-92-1	0.001	mg/L		**0.059**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**15.0**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.001**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		**1.72**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Thorium	7440-29-1	0.001	mg/L		**0.033**	----	----	----	----
Uranium	7440-61-1	0.001	mg/L		**0.033**	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		**0.03**	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**8.30**	----	----	----	----
Boron	7440-42-8	0.05	mg/L		<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**179**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		<1.0	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**28.5**	----	----	----	----
ø Total Cations	----	0.01	meq/L		**27.6**	----	----	----	----
ø Ionic Balance	----	0.01	%		**1.60**	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: **EB2434698**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 09-Oct-2024 16:13
Order number	: 2023033	Date Analysis Commenced	: 10-Oct-2024
C-O-C number	: ----	Issue Date	: 15-Oct-2024 15:49
Sampler	: KOSHIK GOUNDER		
Site	: ----		
Quote number	: EB24RGSENVCON0002_V2		
No. of samples received	: 1		
No. of samples analysed	: 1		

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*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD
Vincent Muller	Chemist - Inorganics	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 Contract 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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Floor/Roof	----	----	----	----
				Sampling date / time	08-Oct-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2434698-001	--------	--------	--------	--------	
				Result	----	----	----	----	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	**2.76**	----	----	----	----	
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	**2300**	----	----	----	----	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----	
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----	
ED038: Acidity									
Acidity as CaCO3	----	1	mg/L	**695**	----	----	----	----	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**1190**	----	----	----	----	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	<1	----	----	----	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	**35**	----	----	----	----	
Magnesium	7439-95-4	1	mg/L	**101**	----	----	----	----	
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----	
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	**46.9**	----	----	----	----	
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----	
Arsenic	7440-38-2	0.001	mg/L	**0.019**	----	----	----	----	
Beryllium	7440-41-7	0.001	mg/L	**0.058**	----	----	----	----	
Barium	7440-39-3	0.001	mg/L	**0.001**	----	----	----	----	
Cadmium	7440-43-9	0.0001	mg/L	**0.0091**	----	----	----	----	
Chromium	7440-47-3	0.001	mg/L	**0.026**	----	----	----	----	

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Floor/Roof	----	----	----	----
				Sampling date / time	08-Oct-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2434698-001	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Cobalt	7440-48-4	0.001	mg/L		**0.387**	----	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.639**	----	----	----	----
Lead	7439-92-1	0.001	mg/L		**0.002**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**12.2**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.001**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		**1.42**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Thorium	7440-29-1	0.001	mg/L		**0.047**	----	----	----	----
Uranium	7440-61-1	0.001	mg/L		**0.039**	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		**0.04**	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**6.42**	----	----	----	----
Boron	7440-42-8	0.05	mg/L		<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**133**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**24.8**	----	----	----	----
ø Total Cations	----	0.01	meq/L		**20.8**	----	----	----	----
ø Ionic Balance	----	0.01	%		**8.87**	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: **EB2438598**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 07-Nov-2024 15:45
Order number	: ----	Date Analysis Commenced	: 08-Nov-2024
C-O-C number	: ----	Issue Date	: 14-Nov-2024 15:49
Sampler	: KOSHIK GOUNDER		
Site	: ----		
Quote number	: EB24RGSENVCON0002_V2		
No. of samples received	: 1		
No. of samples analysed	: 1		

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*
Beatriz Llarinas	Senior Chemist - Inorganics	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 Contract 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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Floor/Roof	----	----	----	----
				Sampling date / time	07-Nov-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2438598-001	--------	--------	--------	--------	
				Result	----	----	----	----	
EA005P: pH by PC Titrator									
pH Value	----	0.01	pH Unit	**2.74**	----	----	----	----	
EA010P: Conductivity by PC Titrator									
Electrical Conductivity @ 25°C	----	1	µS/cm	**2240**	----	----	----	----	
ED037P: Alkalinity by PC Titrator									
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----	
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----	
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----	
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----	
ED038: Acidity									
Acidity as CaCO3	----	1	mg/L	**742**	----	----	----	----	
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA									
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**1110**	----	----	----	----	
ED045G: Chloride by Discrete Analyser									
Chloride	16887-00-6	1	mg/L	<1	----	----	----	----	
ED093F: Dissolved Major Cations									
Calcium	7440-70-2	1	mg/L	**43**	----	----	----	----	
Magnesium	7439-95-4	1	mg/L	**98**	----	----	----	----	
Sodium	7440-23-5	1	mg/L	**3**	----	----	----	----	
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----	
EG020F: Dissolved Metals by ICP-MS									
Aluminium	7429-90-5	0.01	mg/L	**58.3**	----	----	----	----	
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----	
Arsenic	7440-38-2	0.001	mg/L	**0.025**	----	----	----	----	
Beryllium	7440-41-7	0.001	mg/L	**0.062**	----	----	----	----	
Barium	7440-39-3	0.001	mg/L	**0.002**	----	----	----	----	
Cadmium	7440-43-9	0.0001	mg/L	**0.0092**	----	----	----	----	
Chromium	7440-47-3	0.001	mg/L	**0.031**	----	----	----	----	

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Floor/Roof	----	----	----	----
				Sampling date / time	07-Nov-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2438598-001	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Cobalt	7440-48-4	0.001	mg/L		**0.353**	----	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.636**	----	----	----	----
Lead	7439-92-1	0.001	mg/L		**0.002**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**13.3**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.001**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		**1.31**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Thorium	7440-29-1	0.001	mg/L		**0.048**	----	----	----	----
Uranium	7440-61-1	0.001	mg/L		**0.033**	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		**0.04**	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**6.53**	----	----	----	----
Boron	7440-42-8	0.05	mg/L		<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**149**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.2**	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**23.1**	----	----	----	----
ø Total Cations	----	0.01	meq/L		**25.8**	----	----	----	----
ø Ionic Balance	----	0.01	%		**5.52**	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: **EB2442712**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 05-Dec-2024 17:31
Order number	: ----	Date Analysis Commenced	: 06-Dec-2024
C-O-C number	: ----	Issue Date	: 12-Dec-2024 21:55
Sampler	: KOSHIK GOUNDER		
Site	: ----		
Quote number	: EB24RGSENVCON0002_V2		
No. of samples received	: 1		
No. of samples analysed	: 1		

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, unless the sampling was conducted by ALS. 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*
Beatriz Llarinas	Senior Chemist - Inorganics	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 Contract 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.

- As per QWI – EN55-3 Data Interpreting Procedures, Ionic balances are typically calculated using Major Anions - Chloride, Alkalinity and Sulfate; and Major Cations - Calcium, Magnesium, Potassium and Sodium. Where applicable and dependent upon sample matrix, the Ionic Balance may also include the additional contribution of Ammonia, Dissolved Metals by ICPMS and H+ to the Cations and Nitrate, SiO2 and Fluoride to the Anions.
- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WKLC1 Floor/Roof L12	----	----	----	----
			Sampling date / time	05-Dec-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2442712-001	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**2.69**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**2140**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----
ED038: Acidity								
Acidity as CaCO3	----	1	mg/L	**572**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**968**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	**2**	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**44**	----	----	----	----
Magnesium	7439-95-4	1	mg/L	**69**	----	----	----	----
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**41.6**	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.021**	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	**0.051**	----	----	----	----
Barium	7440-39-3	0.001	mg/L	**0.001**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0065**	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	**0.025**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WKLC1 Floor/Roof L12	----	----	----	----
			Sampling date / time	05-Dec-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2442712-001	--------	--------	--------	--------
				Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued								
Cobalt	7440-48-4	0.001	mg/L	**0.208**	----	----	----	----
Copper	7440-50-8	0.001	mg/L	**0.501**	----	----	----	----
Lead	7439-92-1	0.001	mg/L	**0.008**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L	**10.0**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L	<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L	**0.852**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L	<0.01	----	----	----	----
Thorium	7440-29-1	0.001	mg/L	**0.046**	----	----	----	----
Uranium	7440-61-1	0.001	mg/L	**0.026**	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L	**0.03**	----	----	----	----
Zinc	7440-66-6	0.005	mg/L	**4.19**	----	----	----	----
Boron	7440-42-8	0.05	mg/L	<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L	**121**	----	----	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	----	----	----	----
EK040P: Fluoride by PC Titrator								
Fluoride	16984-48-8	0.1	mg/L	**0.3**	----	----	----	----
EN055: Ionic Balance								
ø Total Anions	----	0.01	meq/L	**20.2**	----	----	----	----
ø Total Cations	----	0.01	meq/L	**17.4**	----	----	----	----
ø Ionic Balance	----	0.01	%	**7.55**	----	----	----	----

CERTIFICATE OF ANALYSIS

Work Order	: **EB2500777**	Page	: 1 of 4
Client	: **RGS ENVIRONMENTAL CONSULTANTS PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PETER LONG	Contact	: Carsten Emrich
Address	: 3/30 LENSWORTH STREET COOPERS PLAINS 4108	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: 07 3344 1222	Telephone	: +61 7 3552 8616
Project	: 2023033 Boggabri Extension	Date Samples Received	: 09-Jan-2025 15:50
Order number	: ----	Date Analysis Commenced	: 10-Jan-2025
C-O-C number	: ----	Issue Date	: 14-Jan-2025 22:05
Sampler	: KOSHIK GOUNDER		
Site	: ----		
Quote number	: EB24RGSENVCON0002_V2		
No. of samples received	: 1		
No. of samples analysed	: 1		

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*
Beatriz Llarinas	Senior Chemist - Inorganics	Brisbane Inorganics, Stafford, QLD

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^ = This result is computed from individual analyte detections at or above the level of reporting
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~ = Indicates an estimated value.

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- 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.
- ED045G: The presence of Thiocyanate, Thiosulfate and Sulfite can positively contribute to the chloride result, thereby may bias results higher than expected. Results should be scrutinised accordingly.

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Sample ID	WKLC 1 Floor/Roof L13	----	----	----	----
			Sampling date / time	09-Jan-2025 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2500777-001	--------	--------	--------	--------
				Result	----	----	----	----
EA005P: pH by PC Titrator								
pH Value	----	0.01	pH Unit	**2.64**	----	----	----	----
EA010P: Conductivity by PC Titrator								
Electrical Conductivity @ 25°C	----	1	µS/cm	**2240**	----	----	----	----
ED037P: Alkalinity by PC Titrator								
Hydroxide Alkalinity as CaCO3	DMO-210-001	1	mg/L	<1	----	----	----	----
Carbonate Alkalinity as CaCO3	3812-32-6	1	mg/L	<1	----	----	----	----
Bicarbonate Alkalinity as CaCO3	71-52-3	1	mg/L	<1	----	----	----	----
Total Alkalinity as CaCO3	----	1	mg/L	<1	----	----	----	----
ED038: Acidity								
Acidity as CaCO3	----	1	mg/L	**600**	----	----	----	----
ED041G: Sulfate (Turbidimetric) as SO4 2- by DA								
Sulfate as SO4 - Turbidimetric	14808-79-8	1	mg/L	**991**	----	----	----	----
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	1	mg/L	<1	----	----	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**40**	----	----	----	----
Magnesium	7439-95-4	1	mg/L	**56**	----	----	----	----
Sodium	7440-23-5	1	mg/L	<1	----	----	----	----
Potassium	7440-09-7	1	mg/L	<1	----	----	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**36.0**	----	----	----	----
Antimony	7440-36-0	0.001	mg/L	<0.001	----	----	----	----
Arsenic	7440-38-2	0.001	mg/L	**0.020**	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L	**0.045**	----	----	----	----
Barium	7440-39-3	0.001	mg/L	**0.002**	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0059**	----	----	----	----
Chromium	7440-47-3	0.001	mg/L	**0.023**	----	----	----	----

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Sample ID	WKLC 1 Floor/Roof L13	----	----	----	----
				Sampling date / time	09-Jan-2025 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EB2500777-001	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS - Continued									
Cobalt	7440-48-4	0.001	mg/L		**0.187**	----	----	----	----
Copper	7440-50-8	0.001	mg/L		**0.497**	----	----	----	----
Lead	7439-92-1	0.001	mg/L		**0.004**	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		**8.39**	----	----	----	----
Molybdenum	7439-98-7	0.001	mg/L		**0.001**	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		**0.717**	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Thorium	7440-29-1	0.001	mg/L		**0.044**	----	----	----	----
Uranium	7440-61-1	0.001	mg/L		**0.025**	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		**0.03**	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		**3.71**	----	----	----	----
Boron	7440-42-8	0.05	mg/L		<0.05	----	----	----	----
Iron	7439-89-6	0.05	mg/L		**110**	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EK040P: Fluoride by PC Titrator									
Fluoride	16984-48-8	0.1	mg/L		**0.3**	----	----	----	----
EN055: Ionic Balance									
ø Total Anions	----	0.01	meq/L		**20.6**	----	----	----	----
ø Total Cations	----	0.01	meq/L		**17.3**	----	----	----	----
ø Ionic Balance	----	0.01	%		**8.88**	----	----	----	----

MINE WASTE AND
WATER MANAGEMENT