Annexure D
Geochemistry assessment

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Geochemical Assessment of the Hunter Valley Operations Continuation Project

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List of Abbreviations

Abbreviations Used in Geochemical Assessment

ABA	Acid Base Account
ABCC	Acid Buffering Characteristic Curve
AC	Acid Consuming
AMD	Acid, Metalliferous and Saline Drainage
ANC	Acid Neutralising Capacity in kg H_2SO_4/t
ANC_{ABCC}	Acid Neutralising Capacity in kg H_2SO_4/t estimated from ABCC testing
ARD	Acid Rock Drainage
$CaCO_3$	Calcium Carbonate
CNV	Carbonate Neutralising Value in kg H_2SO_4/t
CRS	Chromium Reducible Sulphur
$EC_{1:2}$	Electrical Conductivity of a sample slurry with a solid to water ratio of 1:2 (by weight)
ECEC	Effective Cation Exchange Capacity
ESP	Exchangeable Sodium Percentage
GAI	Geochemical Abundance Index based on multi-elements of solids
H_2SO_4	Sulphuric Acid
KCl	Potassium Chloride
MPA	Maximum Potential Acidity, calculated from total S in kg H_2SO_4/t
NAF	Non Acid Forming
NAG	Net Acid Generation (test)
NAGpH	pH of NAG solution before titration
$NAG_{(pH4.5)}$	NAG acidity titrated to pH 4.5 in kg H_2SO_4/t
$NAG_{(pH7.0)}$	NAG acidity titrated to pH 7.0 in kg H_2SO_4/t
NAPP	Net Acid Producing Potential, calculated from ANC and total S (or MPA) in kg H_2SO_4/t.
NMD	Neutral and Metalliferous Drainage
PAF	Potentially Acid Forming
PAF-LC	Potentially Acid Forming - Low Capacity
$pH_{1:2}$	pH of a sample slurry with a solid to water ratio of 1:2 (by weight)
S	Sulphur
SO_4	Sulphate

UC	Uncertain

Units of Measurement

%	Percentage
°C	Degrees Celsius
dS	Deci Siemen
g	Gram
kg	Kilogram
L	Litre
m	Metre
mg	Milligram
ml	Millilitre
mm	Millimetre
t	Tonne
µm	Micrometre

Other Abbreviations

ALS	Australian Laboratory Services
EGi	Environmental Geochemistry International Pty Ltd
Indicium	Indicium Laboratories Pty Ltd
Project	Hunter Valley Operations Continuation Project
ROM	Run-of-Mine

Executive Summary

Environmental Geochemistry International Pty Ltd (EGi) was commissioned by Glencore Coal Assets Australia Pty Ltd (Glencore) on behalf of HV Operations Pty Limited to carry out a geochemical assessment of the Hunter Valley Operations (HVO) Continuation Project (the Project), located 24 kilometres (km) northwest of Singleton in the Hunter Valley of New South Wales (NSW). The Project involves the continuation of the HVO North mine beyond the current approved mining extent, depth and life, and continuation of the HVO South mine within the approved mining area and seams but over an extended time. It is understood that this report will be used to support a number of Environmental Impact Statement (EIS) studies for the Project including those related to mine closure and rehabilitation, groundwater and surface water.

The objectives of the work were to assess the potential for acid rock drainage (ARD), salinity and metal/metalloid leaching (including neutral mine drainage) of the proposed mine materials; identify any geochemical issues; and provide recommendations for materials management and any follow up test work if required.

The current West Pit and Mitchell Pit operations of HVO North target from the Broonie to the Barrett Seam Groups, while the previously mined Carrington Pit operations of HVO North targeted the partly stratigraphically higher and overlapping Piercefield to Bayswater Seam Groups. The current HVO South operations are focussed on the Cheshunt Pit with stratigraphy from the Bowfield Seam down to the base of the Bayswater Seam mined and the Riverview Pit which is currently being mined from the Glen Munro Seam to the base of the Bowfield Seam, however mining to the base of the deeper Bayswater Seam is approved.

The Project would involve continuation of mining the same stratigraphic sequence down to the Barrett Seam in the West Pit and Mitchell Pit areas and, as mining progresses down dip towards the southeast, extending the stratigraphic depth of mining in the previously mined Carrington Pit area also down to the Barrett Seam. The Project would involve no changes to the mine stratigraphic sequence currently approved in the Cheshunt and Riverview Pits. Coarse rejects will continue to be dumped amongst the overburden/interburden in intermingled end tips, and paddock dumps in blocks as part of dump construction. Tailings will be disposed in pit voids on site, and off site at the Liddell Coal Operation.

Visual assessment of six cored drill holes with geochemical testing of five of the holes, along with visual assessment of current operations, were undertaken. Three of these holes were continuously sampled, together representing the full overburden/interburden sequence to be mined in the Project. For the other two holes, sampling was generally restricted to intervals where pyrite occurrence was observed, the Archerfield Sandstone, carbonaceous materials, intervals either side of coal seams and, where available, coal seams. The remaining overburden/interburden intervals could be reliably assumed to be non acid forming (NAF) based on observation and correlation with the continuously sampled holes, which cover a similar stratigraphy, and comparison with geochemical assessment work on similar stratigraphy as part of other nearby projects. A total of 401 overburden/interburden and, where available, coal core samples from the four drill holes were tested by EGi. In addition, existing total sulphur (S) results for coal quality samples from the same five drill holes tested were provided by HVO personnel. These samples, which included coal seams and their immediate non-coal roof, floor and partings, were not available for any additional testing as part of this programme.

Results indicate that the vast majority of overburden / interburden materials represented by the samples tested is likely to be NAF, with low S (more than 75% less than 0.1%S), an excess of acid neutralising capacity (ANC) and low leachable salinity. Potentially acid forming (PAF) and PAF - low capacity (PAF-LC) materials are estimated to comprise only 3% of overburden / interburden. Thin pyritic zones of elevated S were identified generally close to coal seams, but dilution and mixing during mining should be sufficient to mitigate any ARD generation. This is supported by water quality monitoring data for West Pit from 2019 to 2020, which shows slightly alkaline pH, with pit water quality primarily controlled by groundwater, and no evidence of ARD impacts.

Key pyritic zones outside of the coal to be mined are associated with the following stratigraphy:

- Roof within 1m of Broonie 3 Seam top
- Interburden between Broonie 4A and 5A Seams
- Archerfield Sandstone, particularly within 5m of the Lemington A Seam roof

- Roof within 1 to 2m of Lemington A Seam top (overlapping with the Archerfield Sandstone)
- Floor within 0.5m of Lemington A Seam base
- >6m thick unit approximately 1m below the base of the Barrett Seam

Overburden / interburden samples tested had a median ANC of 30 kg H_2SO_4/t, providing a potential source of buffering to help mitigate any ARD from PAF materials. Sandstone and siltstone tended to have higher ANC than other lithologies, having medians of 30 and 25 kg H_2SO_4/t respectively, and are also the most common lithologies. Given the expected high proportions of NAF (approximately 97% of overburden / interburden intervals tested were classified NAF) relative to PAF (approximately 3%), operational blending of NAF and PAF overburden/interburden together with the excess alkaline leachate from NAF materials is expected to be a robust approach to controlling ARD from PAF materials.

The majority of coal samples tested were PAF/PAF-LC, however only a limited number of coal intervals were available for sampling and testing, and these were from a limited number of seams not representative of all the seam groups to be extracted at HVO. Approximately half of immediate seam roof, floor and partings materials is also likely to be PAF/PAF-LC, with NAF materials estimated to be 52%. These materials are generally thin (less than 0.3 m) and are expected to report to the raw coal process stream, however if they were to report to overburden / interburden then dilution and mixing during mining is expected to be sufficient to negate any serious ARD risk from these materials.

The majority of rejects generated by the Project are likely to be NAF, however it is noted that although most seam groups were represented within the sample set tested, only a small number of the individual seams and plies within each seam group were tested. Rejects are disposed within in-pit waste dumps. Although 15% of the rejects samples tested were PAF, the thorough intermingling of rejects and overburden observed on site, and the excess ANC in the overburden, suggests that these bulk fill zones are unlikely to result in any significant ARD issues or effects on rehabilitation.

Although most tailings generated by the Project are also likely to be NAF, approximately 30% may be acid forming but with a low acid potential. Tailings have historically been, and are currently being, disposed of within various tailings storage facilities. Tailings have low ANC and are not mixed with neutralising overburden materials, and spigotting tailings can result in preferential deposition and concentration of pyritic materials, potentially resulting in PAF zones.

ABCC results suggest that the ANC measured for sandstone materials represented by the samples tested is likely to be moderate to fast reacting and effective. However, results for other lithology types are more variable, with the ANC measured mostly likely to be slow reacting and largely ineffective due to the likely inclusion of a high proportion of iron carbonate. Results for washery waste samples suggest a moderate to high proportion of the total ANC measured for most rejects and tailings is likely to be readily available but with variable reactivity.

Kinetic NAG testing indicated that the PAF samples tested were relatively fast reacting and, despite varying ANC, lag times of one month or less were indicated. However, it is noted that these samples had opportunity to oxidise prior to testing, and longer lags could be expected from fresher materials before ARD would be generated.

Sulphur speciation testing suggests that the total S in non-coal overburden / interburden samples and in rejects samples is likely to be mainly pyritic, and that coal and tailings samples are likely to include a higher proportion of non-pyritic S forms.

Calibration of full geochemical test results against total S shows that for overburden/interburden materials, a total S cut-off of 0.2%S discriminates well between NAF and PAF-LC / PAF samples. However, total S is a poor discriminator for coal and carbonaceous materials due to the presence of organic S.

The results of water and peroxide extraction tests indicate that significant metal/metalloid release from materials represented by the samples tested would only be associated with generation of ARD. The solubility of metals/metalloids will largely be determined by pH and therefore prevention of acid generation will effectively control metal/metalloid leaching.

Extracts from low S NAF materials indicated that generally drainage from these materials is likely to be slightly saline to moderately saline and is unlikely to contain significant metal/metalloid concentrations, but elevated SO_4 may occur from NAF materials with significant pyrite.

Extracts show that metal/metalloid release associated with any ARD generated from pyritic overburden materials would include Al, Cd, Co, Cr, Cu, Fe, Mn, Ni, Sr and Zn, and possibly As at low pH (less than 3), and from pyritic washery waste materials would include Al, Ba, Cu, Fe, Mn, Sr and Zn and to a lesser extent B, Co, Cr and Ni.

Results have the following implications for mine materials management:

- Operational blending of NAF and PAF overburden/interburden together with the excess alkaline leachate from NAF materials is expected to be a robust approach to controlling ARD and water quality impacts from PAF materials for the bulk of the waste rock dumps.
- Although the PAF mine materials do not appear to represent a concern in terms of water quality impacts, if PAF materials were placed close to final surfaces this could cause local effects on rehabilitation success through upward migration of acid and salinity into the growth horizon. The existing HVO Rehabilitation Management Plan (ERR Australia, 2022) includes completion criteria that are expected to minimise surface placement of PAF.
- Low ARD risk (NAF) materials should be specifically targeted for placement on the upper 5 metres or more of overburden dumps and any cover systems for tailings facilities. Low ARD risk materials could include, but would not be limited to:
    - overburden/interburden generally from the upper stratigraphic sequence from 1m above the Mt Arthur Seam Group and upwards which appears to be almost all NAF with a very low potential for ARD with a freshwater dominated depositional environment; and
    - other reasonably thick (>10m) interburden units lower in the stratigraphic sequence that appear to have low ARD potential, which include, but are not limited to:
        - interburden between the Vaux and Broonie Seam Groups excluding 1m from Vaux Seam Group floor and 1m from Broonie Seam Group roof;
        - interburden between the Lemington and Pikes Gully Seam Groups excluding 2m from Lemington Seam Group floor and 1m from Pikes Gully Seam Group roof;
        - interburden between Pikes Gully and Arties Seam Groups excluding 1m from Pikes Gully Seam Group floor and 1m from Arties Seam Group roof;
        - interburden between Liddell and Barrett Seam Groups excluding 1m from Liddell Seam Group floor and 1m Barrett Seam Group roof.
    - materials outside of the above zones if it can be demonstrated that operational blending is sufficient to control ARD from any contained PAF zones.
- By contrast, the interburden between the base of the Bayswater Seam Group and the Lemington Seam A, which includes the Archerfield Sandstone, have had some marine influence during deposition and greater ARD potential, and should be placed within the bulk fill zone of the dump. In addition, limited testing to date suggests coal seams and/or immediate roof and floor contain some proportion of PAF, and it should be assumed that where coal plies, and immediate roof and floor are treated as waste rock, that they also be placed in the bulk fill zone.
- The stratigraphic trends in ARD potential indicated in results to date are limited to individual holes and have not been correlated across the site. These trends should be confirmed with visual inspection of stored core and/or new core supported with S testing as required.
- HVO North will be developed to the base of the Barrett Seam. Results to date suggest that the immediate floor of the Barrett is not highly pyritic, however, strong pyrite was observed 1m or so below the floor, indicating ARD potential close to the final pit floor, and possibly at the base of the Barrett Seam in part. The overall ARD potential of the final floor of the HVO North pit would require further assessment during operations. The findings would also have implications if development was extended to below the Barrett Seam.
- The final pit floors for the Cheshunt and Riverview Pits are expected to terminate at the base of the Bayswater Seam, which will potentially expose pyritic Archerfield Sandstone, as in the current Carrington Pit (Plate 19). The implications of this on pit water quality was assessed in detail with water

quality modelling (EGi, 2022), and overall is expected to have no significant impact. Monitoring of this water quality may be required during operations if this pit water is pumped out as part of the water management system.

- Testing and site inspection confirms that a portion of tailings (30% of samples tested) may be PAF and require management to prevent ARD effects, particularly close to spigot discharge points. Inspection of currently deposited tailings shows potential for salt migration from these materials, and localised concentrations of pyritic materials close to spigot points. These aspects will need to be a consideration for final rehabilitation design of tailings storage facilities and options. Risks associated with the upward movement of acid and salinity from PAF tailings can be effectively managed through use of an appropriately designed capping system that controls upward water flux, with the options of surface limestone addition to any PAF hotspots to provide additional security if required.
- Although a portion of the rejects samples tested were PAF, the thorough intermingling of rejects and overburden observed on site, and the excess ANC in the overburden, suggests that these bulk fill zones are unlikely to result in any significant ARD issues or effects on rehabilitation, and no specific management is required apart from isolating rejects from the upper 5 metres or more of overburden dumps.
- Any re-handing of tailings and placement in pit will need to consider potential PAF zones, and ensure appropriate management as per coarse rejects and PAF materials above.
- Weathered Permian materials are likely to be NAF, but the 2013 EGi Study for the Mount Owen Complex indicated these materials were sodic and dispersive, and may require treatment (e.g. with gypsum or lime) to reduce erodibility if used as a plant growing horizon, exposed on dump surfaces or used in engineered structures. Finer grained fresh Permian materials may also be partly sodic and require treatment.
- The low salinity potential of NAF overburden/interburden, and the expected relatively minor PAF overburden/interburden and pit wall materials indicate that the Project is not likely to have a significant impact on the existing pit water quality, or require modification of the current saline water management. More detailed assessment of existing surface and groundwater quality, together with geochemical modelling and water quality prediction has been carried out by Engeny (2022) and EGi (2022).

Overall, with the above management strategies implemented the HVO Continuation Project is expected to present a low risk with respect to ARD and metal leaching. This is consistent with site experience to date and as demonstrated in previous work at HVO along with other mine sites with similar stratigraphy. The key focus of materials management will be to ensure any potentially problematic materials are excluded from the near surface region of overburden/interburden dumps and TSF capping layers, and ensure upward migration of salts is controlled to prevent impacts on rehabilitation. This will be readily achievable given the overall low proportion of problematic materials.

Although there is an expected low ARD risk for the site, the following are recommended to help confirm assessment findings and verify predictions:

- Carry out visual inspection supported with S testing as required of stored and any new core drilling in the Project Area for evidence of pyrite occurrence to confirm the strong dominance of NAF overburden/interburden across the deposit, and confirm stratigraphic trends in ARD potential indicated to date.
- Ensure appropriate overburden/interburden ARD mixing in the mine planning and handling schedule to ensure low ARD risk (NAF) materials (as defined above) are placed in the outer 5m or more of the waste rock dump. The existing HVO Rehabilitation Management Plan (ERR Australia, 2022) includes completion criteria that are expected to address the above, and should continue to be followed.
- Inspection of waste rock dump and TSF final rehabilitation areas as part of routine rehabilitation monitoring for any evidence of impacts on vegetation growth die back etc.
- If adverse results from site monitoring are determined to be as a result of ARD, carry out leach column testing of overburden/interburden, washery rejects and tailings, and coal to verify the leaching

characteristics of key materials controlling mine water quality, confirm predictions and improve inputs for any follow-up geochemical modelling.

- Continue collection and total S testing of rejects and tailings discharge streams from the process plant to better represent the variability and proportions of ARD material types. Sampling should focus on washery waste from seams identified as having higher acid forming and salinity potential (such as Upper Liddell, Lower Arties and Barratt Seam Groups), along with seams not yet tested (such as Lemington, Woodlands Hill and Glen Munro Seam Groups), and would need to include sampling of deposited tailings materials to ascertain the potential extent of any segregation and concentration of pyritic materials. This requirement could be phased out over time once a reasonable database is built up.
- Prior to capping of tailings dams, prepare a detailed plan for a cover design system supported with water flux performance modelling. The design should provide adequate control of upward migration of salts and acid so that rehabilitation efforts are not compromised. The detailed cover design should consider:
    - The physical and hydrological characteristic of tailings (using current deposited tailings to represent the range of properties due to gravity segregation effects) and potential cover materials;
    - The optimal thickness, configuration and placement methodology of the cover system based on water flux modelling to assess performance;
    - The distribution and extent of any PAF tailings;
    - The need for incorporation of crushed (agricultural) limestone into the final tailings surface in the zone around the spigot points to ensure neutralisation of any existing acidity; and
    - Maximum rooting depth of selected rehabilitation species.
- Continue routine water quality monitoring of pit water and water storages to check for ARD effects and assist in model calibration.

1. Introduction

Environmental Geochemistry International Pty Ltd (EGi) was commissioned by Glencore Coal Assets Australia Pty Ltd (Glencore) on behalf of HV Operations Pty Ltd to carry out a geochemical assessment of the Hunter Valley Operations (HVO) Continuation Project (the Project), located 24 kilometres (km) north-west of Singleton in the Hunter Valley of New South Wales (NSW). The Project involves the continuation of the HVO North mine beyond the current approved mining extent, depth and life, and continuation of the HVO South mine within the approved mining area and seams but over an extended time. It is understood that this report will be used to support a number of Environmental Impact Statement (EIS) studies for the Project including those related to mine closure and rehabilitation, groundwater and surface water.

The objectives of the work were to assess the acid rock drainage (ARD), salinity and metal/metalloid leaching (including neutral drainage) of the proposed mine materials; identify any geochemical issues; and provide recommendations for materials management and any follow up test work required.

The scope of work involved:

- liaison with relevant project personnel and compilation of background project data, including previous work, water quality data, coal quality data, geological information and project descriptions;
- site visits in August 2019 and June 2020 to examine representative core through the proposed mine stratigraphic sequence, and inspect pits, operations and handling of washery wastes;
- review and assessment of previous data in the context of the materials to be mined and processed as part of the Project;
- preparation of an overburden and interburden sampling programme in conjunction with site geologists to represent the mine stratigraphy and expected geochemical variation of overburden and interburden;
- liaison with site personnel to augment an existing washery wastes sampling programme with total sulphur (S) analyses to represent expected geochemical variation of coarse rejects and tailings;
- collection of samples by site personnel with advice from EGi;
- sample preparation and laboratory testing of samples; and
- assessment of results and reporting.

The work carried out follows industry best practice, consistent with Australian and international guidelines, of which EGi was a key contributor, including: ARD Test Handbook written by EGi and published by AMIRA in 2002; Preventing Acid and Metalliferous Drainage – Leading Practice Sustainable Development Program for the Mining Industry booklet published by the Australian Government in 2016; and Global Acid Rock Drainage Guide published by INAP in 2009.

2. Background and Geology

2.1 Background

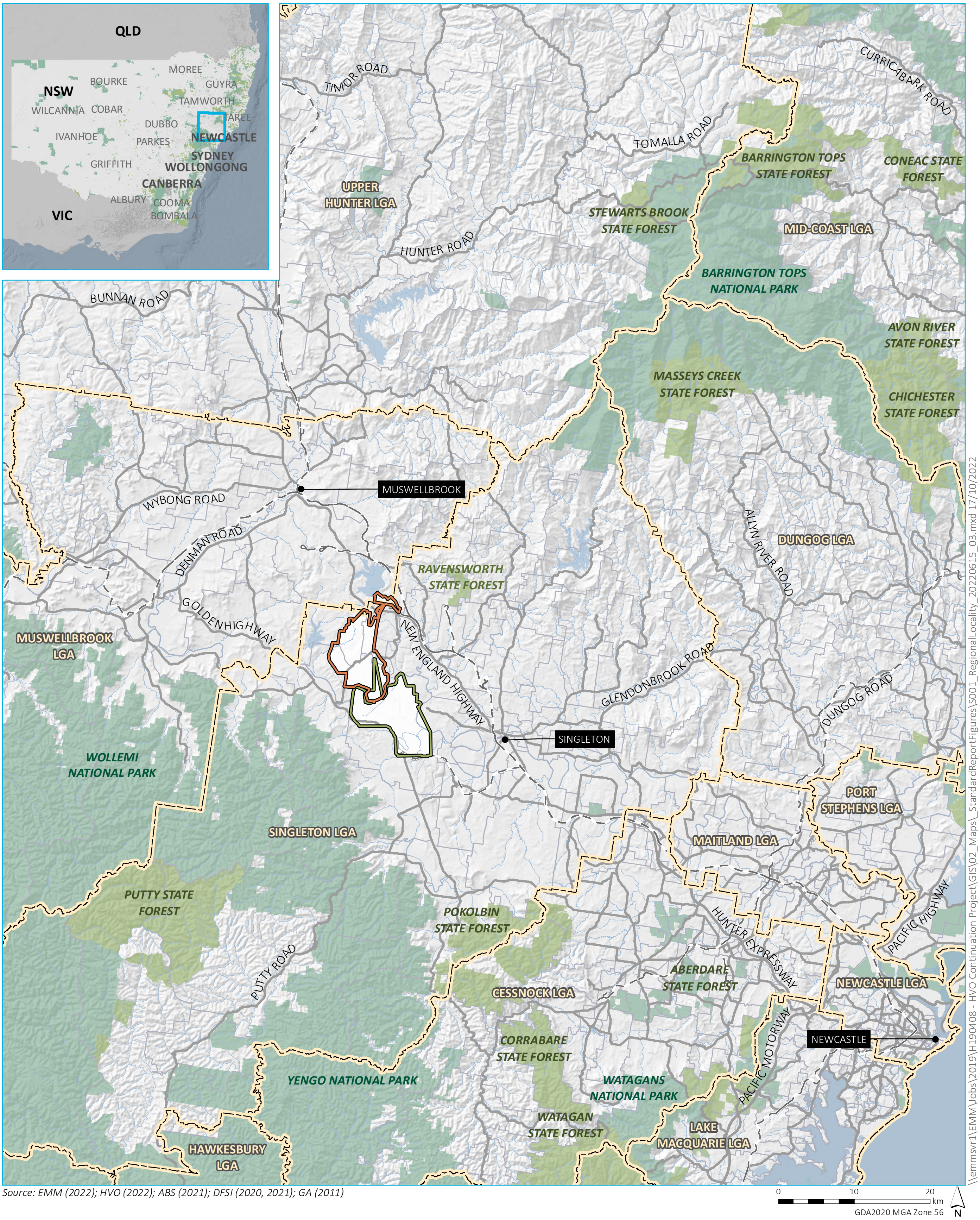
Hunter Valley Operations (HVO) is a multi-pit open cut mining complex approximately 24 kilometres (km) north-west of Singleton in the Hunter Valley of New South Wales (NSW) (Figure 1). HVO comprises two mine sites separated by the Hunter River, HVO North and HVO South. While the two mine sites are approved under separate development consents, they are operated as one complex with fully integrated environmental management systems.

The existing HVO North operation comprises the approved mining areas of West Pit, Mitchell Pit and Carrington Pit, as shown in Figure 2. It operates under development consent DA 450-10-2003 which allows extraction of up to 22 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal until 12 June 2025.

HVO South operates under Project Approval (PA) 06_0261 and comprises the approved mining areas of Riverview Pit and Cheshunt Pit, where mining activities currently take place, and the Riverview South East Extension and South Lemington Pits 1 and 2. PA 06_0261 allows the extraction of up to 20 Mtpa of ROM coal until 24 March 2030.

Mining across HVO is undertaken using dragline and truck and shovel methods. ROM coal from HVO North and South is currently processed at the Hunter Valley (HV) Coal Preparation Plant (CPP) and/or the Howick CPP (both at HVO North), from which product coal is predominantly transported via overland conveyor to the HV load point (HVLP) or Newdell LP and via rail to the Port of Newcastle for export. The Lemington CPP (LCPP) and associated rail loop, which is approved under PA 06_0261 and would process and rail coal from HVO South, is yet to be constructed.

HVO is owned by subsidiary companies of Yancoal and Glencore, as participants in the unincorporated HVO Joint Venture (JV). HV Operations Pty Ltd is the appointed manager of the JV.



Source: EMM (2022); HVO (2022); ABS (2021); DFSI (2020, 2021); GA (2011)

KEY

- Existing HVO North development consent boundary (DA 450-10-2003)
- Existing HVO South project approval boundary (PA 06-0261)
- Rail line
- Major road
- Named watercourse
- Named waterbody
- Suburb boundary
- Local government area
- NPWS reserve
- State forest

Locality plan

Hunter Valley Operations
HVO Continuation Project
Figure 1

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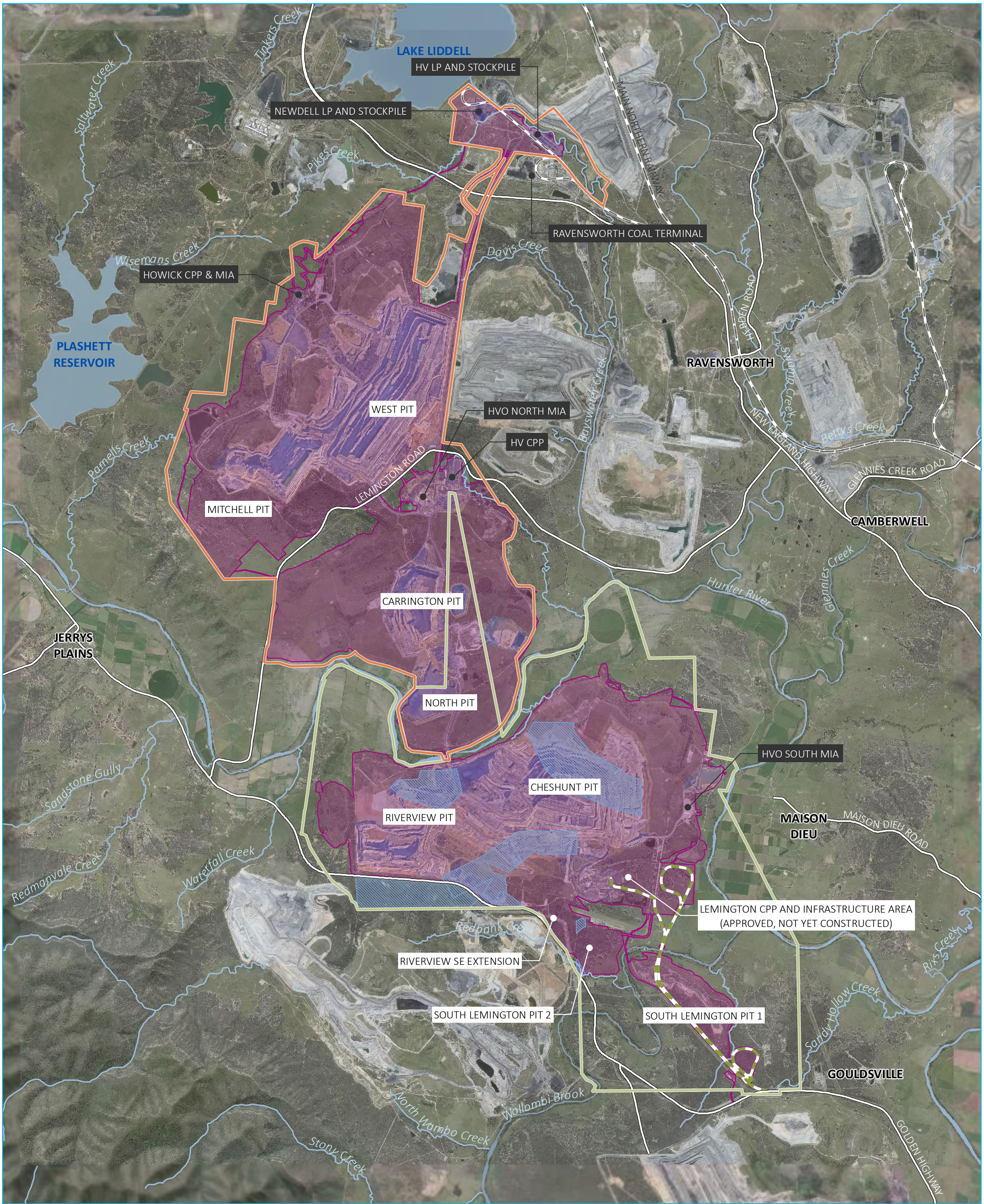

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Source: EMM (2022); HVO (2022); ESRI (2022); DFSI (2017); GA (2011)

0 2.5 5 km

GDA2020 MGA Zone 56

N

KEY

- Existing HVO North development consent boundary (DA 450-10-2003)
- Existing HVO South project approval boundary (PA 06-0261)
- Existing and approved disturbance area
- Approved highwall mining area
- South Lemington Rail Loop and haul route (approved, not yet constructed)

Existing environment

- Rail line
- Major road
- Named watercourse
- Named waterbody

HVO existing environment

Hunter Valley Operations
HVO Continuation Project
Figure 2

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2.2 Project Overview

The HVO Continuation Project (the Project) broadly comprises the continuation of the life of HVO North and HVO South, from the current approved mining completion dates of 2025 and 2030 respectively, to the end of 2050 at HVO North and the end of 2045 at HVO South. The continuation of mining across the HVO Complex will increase resource recovery from the existing operation, predominantly by mining through previously mined areas and to the extent of existing mining tenements and extracting coal from deeper seams at HVO North.

At HVO South an extension to the life of the mine is proposed to facilitate improved mine sequencing outcomes and reduction in mining rate. The Project proposes a reduced mining footprint at HVO South compared to what is approved for extraction, with the previously approved coal extraction in the Riverview South East Extension area and South Lemington Pits 1 and 2 proposed to be removed from the mine plan (and future approvals) for the Project. However, some rehabilitation works will be required to be undertaken in the South Lemington Pit 1 area, as part of the mine closure process. The approved shorter rail loop option associated with the LCPP has also been removed from the Project.

A number of infrastructure upgrades and changes are also required to facilitate the Project (and are included as part of it), including realignment of part of Lemington Road, relocation of transmission and telecommunication lines, an upgrade of the Newdell LP including construction of a new product stockpile and train loading bin, an upgrade of the HVLP product stockpile including an extension to the existing coal stockpile, and improvements to Lake James and Parnells Dam.

To enable the Project to proceed, two new State significant development (SSD) consents are required; one for HVO North and one for HVO South, under Part 4, Division 4.1 of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act). The Project will seek to maintain separate development consents for HVO North and South, as is currently the case. Given that the two mine sites operate as one complex, one Environmental Impact Statement (EIS) has been prepared to support the two development applications required for the Project.

This geochemical assessment forms part of the EIS and provides an assessment of the potential geochemical impacts of the Project. It also assesses the potential incremental impacts of the continuation of HVO North and HVO South given separate development consents are being sought for each operation. It documents the geochemical assessment methods and results, initiatives to avoid and minimise geochemical impacts and additional mitigation and management measures proposed to address residual impacts not able to be avoided.

A full Project description is provided in Chapter 4 of the EIS (EMM 2022). The key components of the Project as they relate to HVO North and HVO South are individually listed below. The proposed conceptual layout of the Project, inclusive of both HVO North and South, is provided in Figure 3.

<u>HVO North</u>

The key changes proposed by the Project to the approved HVO North operations include:

- an extension to the life of the mine until the end of 2050;
- extraction of coal to the base of the Barrett seam across the HVO North mining area. Existing operations are approved to extract coal to the base of the Barrett seam in the West Pit; however, are only approved to the base of the shallower Bayswater seam in Carrington Pit;
- extraction of an additional approximate 400 Million tonnes (Mt) of ROM coal through the extraction of coal from deeper seams and a small increase in the mining extent (between the existing West and Mitchell Pits and Carrington Pit);
- infrastructure upgrades, as listed below:
    - realignment of Lemington Road and construction of a new bridge over the Hunter River. While the proposed realigned corridor is partly within the HVO South development consent boundary, the realignment is required to enable the progression of mining from the Mitchell and West Pits into the Carrington area at HVO North. The works associated with the road realignment therefore form part of the HVO North Project;
    - HVO North site access road relocation off the existing Lemington Road;

    - an increase in the capacity of Parnells Dam from approximately 1 gigalitre (GL) to 4 GL;
    - realignment of transmission and telecommunication lines that are currently within the proposed mining area;
    - mine infrastructure area upgrade;
    - ancillary activities as required to facilitate operations;
    - access roads to facilitate service provider access;
    - use of demountable/temporary buildings in Project compounds as required;
    - upgrade of the existing Newdell LP train loading facility and construction of a new product stockpile; or, extension of the HVLP product coal stockpile, including the closure of a section of Liddell Station Road. While approval for both options is sought, only one will be constructed;
- coal haulage from the HVCPP to the Ravensworth ROM pad, via internal haul roads;
- revision and implementation of the tailings strategy;
- amendments to the approved final landform;
- progressive rehabilitation throughout the mine life; and
- changes to the development consent boundary to incorporate the changes listed above.

Other than as set out above, all activities that are currently approved under the existing HVO North approval are intended to continue. Key aspects and outcomes of the approved development at HVO North that will remain the same under the Project include the following:

- the maximum allowable annual coal extraction and processing rate;
- annual operational workforce numbers and associated traffic generation;
- approved heights of overburden emplacement areas;
- receipt of ROM coal from HVO South via internal haul roads for processing at all CPP facilities approved for HVO North;
- continued avoidance of the Aboriginal heritage site known as Carrington Mine - Colluvial Deposit 1 (CM-CD1); and
- the ridge between Jerrys Plains and HVO North will remain, continuing to provide an effective amenity barrier.

<u>HVO South</u>

The key changes proposed by the Project to the existing approved operations at HVO South include:

- an extension of the life of the mine until the end of 2045;
- a reduction in the approved maximum ROM coal extraction rate from 20 Mtpa to 18 Mtpa;
- changes to the approved mine sequencing (although noting that mining within the two primary open cut pits, Riverview and Cheshunt, will remain generally within the same footprint as approved);
- removal of coal extraction from the mine plan from the Riverview South East Extension, South Lemington Pit 1 and South Lemington Pit 2 mining areas;
- infrastructure upgrades and changes to that currently approved, as listed below:
    - removal of the LCPP short rail loop option;
    - removal of the approved conveyor from HVO South to the HVCPP at HVO North (the conveyor has not been constructed);
    - construction of the Cheshunt and Riverview flood protection levees;
    - realignment of transmission lines;

- enlargement of Lake James from approximately 0.7 GL to approximately 2 GL;
    - additional tailings pipelines and pumps;
    - ancillary activities as required to facilitate operations;
    - access roads to facilitate service provider access;
    - use of demountable/temporary buildings in Project compounds as required;
- revision and implementation of the tailings strategy; and
- amendments to the final landform due to rescheduling and or infrastructure relocations. Progressive rehabilitation will be undertaken throughout the mine life.

Other than as set out above, all activities that are currently approved under the existing HVO South approval are intended to continue. Key aspects of the approved development at HVO South that will remain the same for the Project include:

- the coal seams to be extracted (ie no increase in the depth of mining);
- the extent of approved mining areas within the Riverview and Cheshunt Pits;
- approved heights of overburden emplacement areas;
- construction of the LCPP and associated rail loop (long rail loop option only);
- transfer of coal from HVO South to HVO North for processing; and
- annual operational workforce numbers and associated traffic generation.

Coal from HVO is processed at either the HV CPP or the Howick CPP, and rejects are disposed of as follows:

- Coarse rejects are dumped amongst the overburden/interburden in intermingled end tips, and paddock dumps in blocks as part of dump construction (Plate 23).
- Tailings (fine rejects) are, or have been, spigotted into disused pit voids and tailings storage facilities (TSFs) including Dam 6, Carrington Pit, North Void and Bob's Dump.

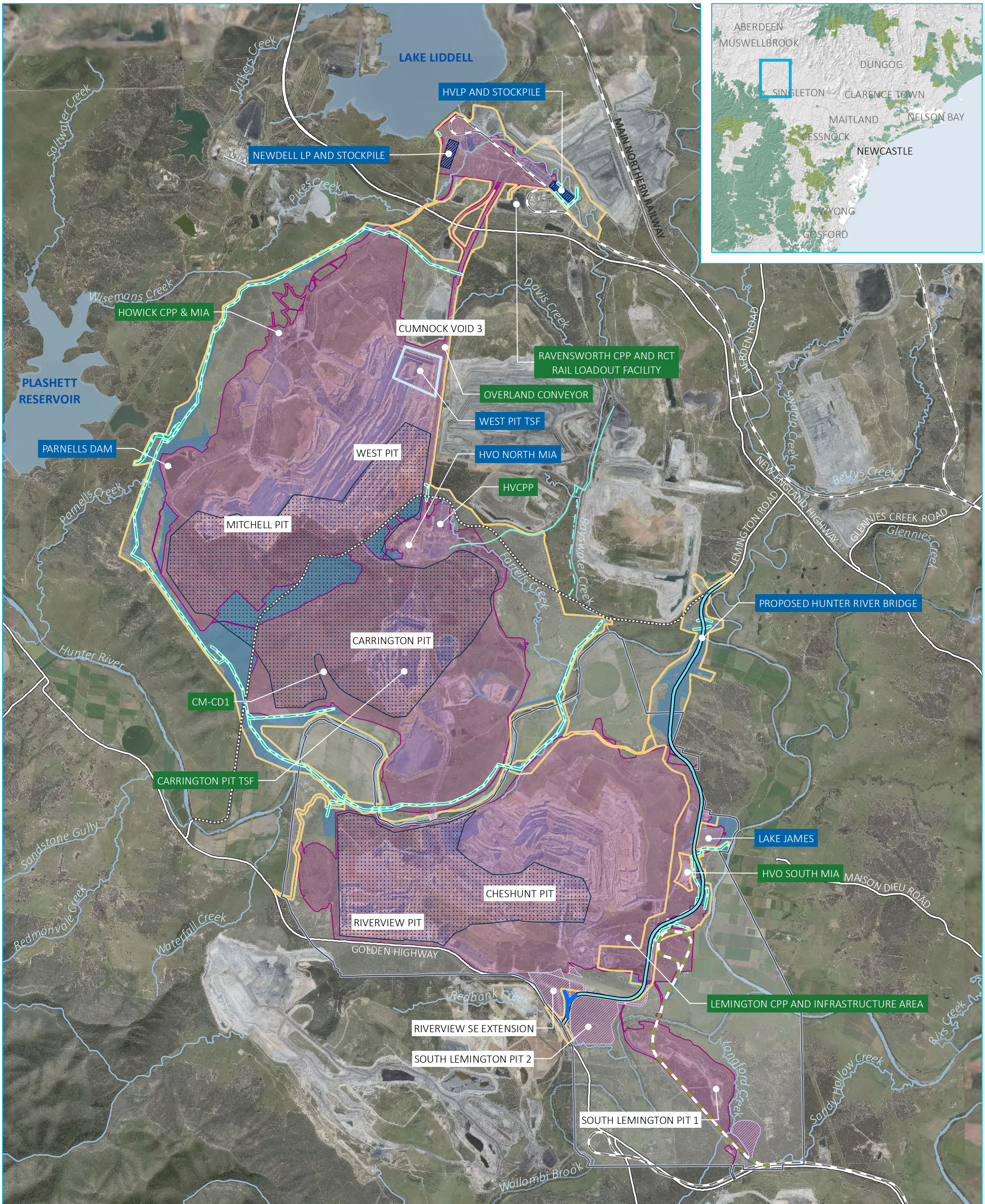
Coarse rejects will continue to be dumped amongst the overburden/interburden.

Tailings will be disposed as follows:

- Establishment of tailings emplacement within the northern extent of West Pit;
- Continuation of tailings emplacement in the Carrington Pit TSF and Cumnock Void 3 TSF during the early stages of the Project;
- Emplacement of tailings in the South Cut void of Liddell Coal Operation (LCO).

The Project will also involve the recovery of tailings from some existing TSFs in areas that will be mined through as part of the Project. Tailings emplaced in the Carrington Pit TSF will be relocated and/or reprocessed to enable the extraction of coal remaining in this area.

Other historic tailings facilities that are proposed to be mined through, such as the Central TSF, will be assessed prior to mining. If recovery via routine mining methods is not possible then an approach similar to the Carrington Pit TSF recovery will be implemented. In addition, decommissioning and rehabilitation of TSFs no longer being used will continue. This may include intermittent deposition of tailings in these TSFs as part of ongoing management towards decommissioning.



Source: *EMM (2022); HVO (2022); DFSI (2017, 2020)*

0 2.5 5 km

GDA2020 MGA Zone 56 N

KEY

- HVO North proposed development consent boundary
- HVO South proposed development consent boundary
- Existing and approved disturbance area
- Previously approved area not retained

Existing HVO elements to be maintained

- South Lemington Rail Loop (approved, not yet constructed)

Proposed HVO Continuation Project elements

- Lemington Road realignment
- Indicative location of public road closure
- Haul route to Ravensworth Operations
- Transmission line relocation
- Alternative Golden Highway intersection
- Proposed mining area
- Product stockpile
- Additional disturbance area
- West Pit TSF

Existing environment

- Rail line
- Major road
- Ravensworth Operations access road
- Named watercourse
- Named waterbody
- NPWS reserve (refer to inset)
- State forest (refer to inset)

Proposed conceptual layout

Hunter Valley Operations
HVO Continuation Project
Figure 3

EMM
creating opportunities

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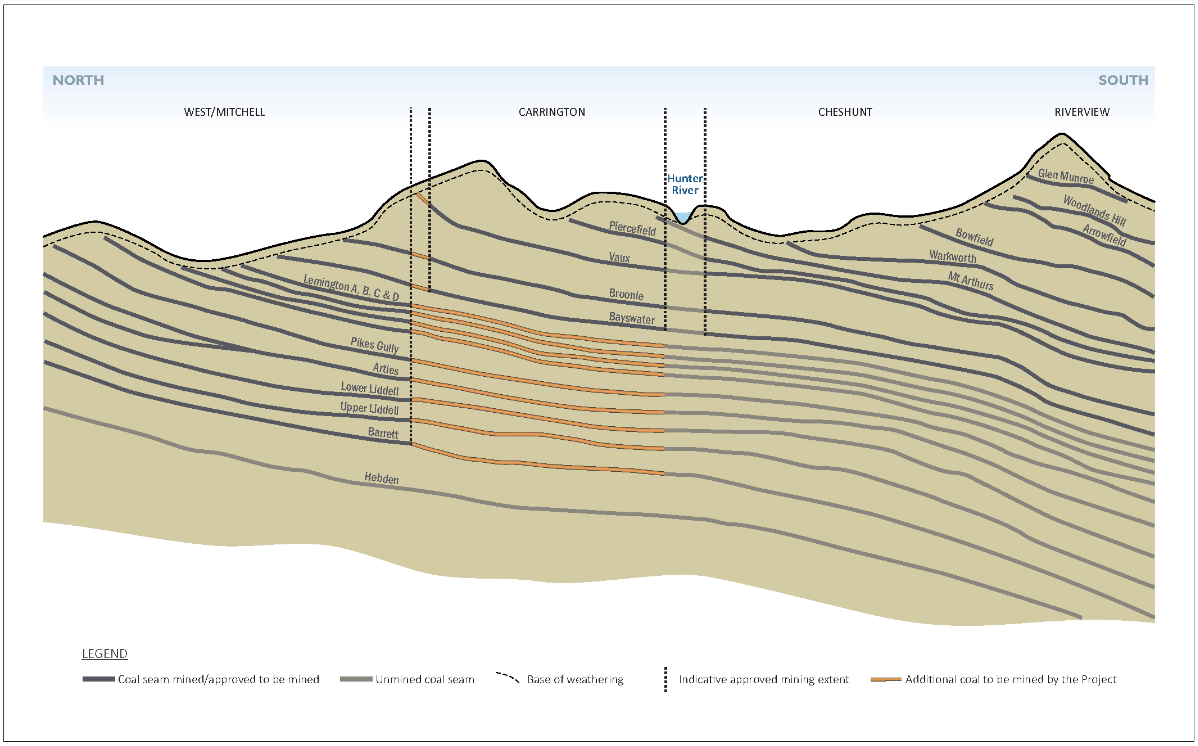
2.3 Geology and Site Observations

The coal deposit is a Permian aged multi-seamed resource hosted within the Wittingham Coal Measures, which is in turn part of the Singleton Super-Group. Figure 4 is a stratigraphic table for the Wittingham Coal Measures which summarises the stratigraphic sequence in the HVO area. This regularly layered sedimentary sequence dips gently to the south-east. The current West Pit and Mitchell Pit operations of HVO North target from the Broonie to the Barrett Seam Groups, while the previously mined Carrington Pit operations of HVO North targeted the partly stratigraphically higher and overlapping Piercefield to Bayswater Seam Groups as shown in Figure 5. The current HVO South operations are focussed on the Cheshunt Pit with stratigraphy from the Bowfield Seam down to the base of the Bayswater Seam mined and the Riverview Pit is currently being mined from the Glen Munro Seam to the base of the Bowfield Seam, however mining to the base of the deeper Bayswater Seam is approved.

The Project would involve continuation of mining the same stratigraphic sequence down to the Barrett Seam in the West Pit and Mitchell Pit areas and, as mining progresses down dip towards the southeast, extending the stratigraphic depth of mining in the previously mined Carrington Pit area also down to the Barrett Seam as shown in Figure 5. The Project would involve no changes to the mine stratigraphic sequence currently approved in the Cheshunt and Riverview Pits.

SINGLETON SUPER GROUP	WITTINGHAM COAL MEASURES	DENMAN FORMATION		
		JERRYS PLAINS SUBGROUP	MOUNT LEONARD FORMATION	WHYBROW SEAM
			ALTHORPE FORMATION	
			MALABAR FORMATION	REDBANK CREEK SEAM
				WAMBO SEAM
				WHYNOT SEAM
				BLAKEFIELD SEAM
			SAXONVALE MBR	
			MOUNT OGILVIE FORMATION	GLEN MUNRO SEAM
				WOODLANDS HILL SEAM
			MILBRODALE FORMATION	
			MOUNT THORLEY FORMATION	ARROWFIELD SEAM
				BOWFIELD SEAM
				WARKWORTH SEAM
			FAIRFORD FORMATION	
			BURNAMWOOD FORMATION	MOUNT ARTHUR SEAM
				PIERCEFIELD SEAM
				VAUX SEAM
				BROONIE SEAM
				BAYSWATER SEAM
		ARCHERFIELD SANDSTONE		
		VANE SUBGROUP	FOYBROOK FORMATION	LEMINGTON
				PIKES GULLY
				ARTIES
				LIDDELL
				BARRETT
				HEBDEN

Figure 4: Wittingham Coal Measures stratigraphic table.



Stratigraphy
HVO Continuation Project
Environmental Impact Statement

*Figure 5: HVO North current and proposed mining stratigraphy for the **Project.***

Key non-coal sedimentary materials which make up the overburden and interburden for the Project are predominantly (in decreasing order of abundance) sandstone, siltstone, mudstone, carbonaceous siltstone / mudstone, conglomerate and tuff.

Six cored holes (4505C, G3, 4095C, GHD23, 4073C and 5028C) were examined during the August 2019 and June 2020 site visits as examples of overburden and interburden through the proposed mine stratigraphy. Holes 4505C, G3, 4095C and 4073C were drilled between 2008 to 2012; hole 5028C was drilled in 2020; with the drilling date of GHD23 unclear. The focus of the core inspection was to identify any pyrite and neutralising carbonate occurrence, and obtain a better understanding of the continuity and variation of the major rock types. The stratigraphy intersected by each of these holes is shown below:

- 4505C – Broonie BR1 to Barrett LBA
- G3 – Mount Arthur MA3J to Lemington LB2
- 4095C – Broonie BR6 to Barrett LBA
- GHD23 – Mount Arthur MA1 to Vaux VA3
- 4073C – Glen Munro GMA to Bayswater BY3
- 5028C – Bowfield BF3 to Bayswater BY3

The drill holes were examined for evidence of pyrite occurrence. As the core had been exposed for a number of years since the time of drilling (with the exception of 5028C), partial oxidation of any pyrite would be expected resulting in readily apparent iron staining and secondary salts, thus highlighting any pyritic zones. Note that with the exception of hole GHD23, coal seam intervals and immediate roof and floor materials had already been removed from the core examined, and thus only limited visual assessment could be made on pyrite occurrence in these materials. Also note that drill hole depths given in the following plates are "uncorrected" as per core mark up and do not directly relate to sample drill hole depths referred to elsewhere in this report which were based on "corrected" drill logs provided to EGi.

The vast majority of the core showed no evidence of pyrite. Pyrite occurrence was generally very minor throughout the stratigraphy, occurring mainly as traces and as thin veneers on bedding surfaces associated with carbonaceous partings (Plate 1 and Plate 2), pyrite containing spheroids (Plate 3 and Plate 4), carbonaceous wisps in sandstone (Plate 5), on fractures and as disseminations within coal (Plate 6), and more rarely as isolated pyritic zones (Plate 7, Plate 8, Plate 10 and Plate 11) and small lenses and bands (Plate 9). Pyrite was also observed as blebs within siderite (Plate 12). The more pyritic zones were generally within one to two metres of coal seams and associated carbonaceous horizons particularly within the Lemington Seam Group. Similar to observations at other neighbouring mine sites, the Archerfield Sandstone (a stratigraphic unit that occurs just above the Lemington Seam Group) included a number of pyritic zones, although most of the Archerfield Sandstone appeared to be benign (Plate 8, Plate 10). A pyritic zone was also observed below the Barrett Seam, with a pervasive yellow tinge apparent in sandstone with pyritic lenses (Plate 13). While the immediate floor of the Barrett did not appear to be highly pyritic, strong pyrite was observed 1m or so below the floor, indicating some ARD potential close to the final pit floor.

Experience from previous EGi work on similar stratigraphy from nearby projects and current observations suggest that those overburden/interburden zones with no visible evidence of pyrite are likely to be NAF.

Plate 1: Iron staining and sulphate salts due to the partial oxidation of a pyrite coating on sandstone bedding plane. Hole 4505C depth 59.35m.

Plate 2: Iron staining and sulphate salts due to the partial oxidation of pyrite on bedding plane of carbonaceous partings within Piercefield Seam Group. Hole GHD23 depth 44.8m

Plate 3: Iron staining and sulphate salts due to the partial oxidation of an isolated pyritic spheroid bleb in sandstone. Hole 4095C depth 57.75m.

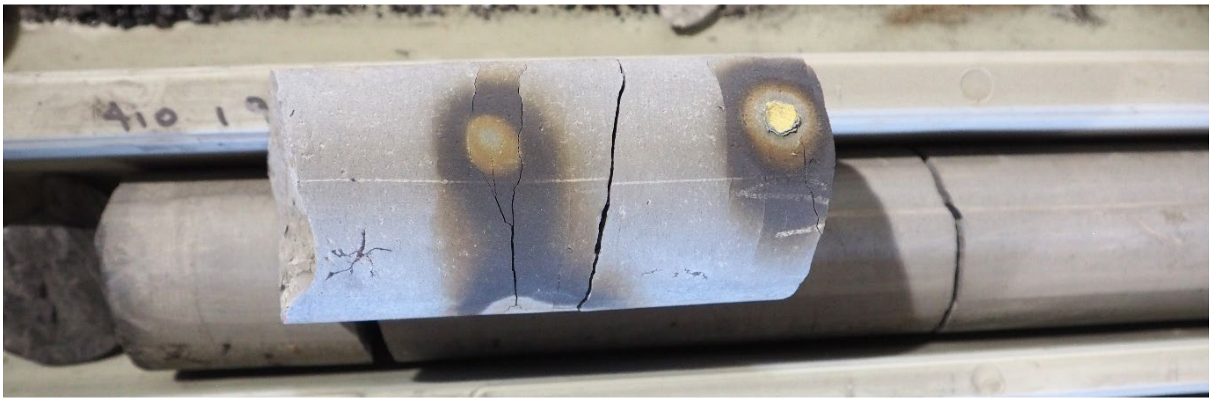


Plate 4: Iron staining and sulphate salts due to the partial oxidation of pyrite containing lensoids. Hole 4095C depth 99.7m.

Plate 5: Iron staining due to the partial oxidation of pyrite associated with carbonaceous wisps in sandstone. Hole G3 depth 77.5m.

Plate 6: Iron staining and sulphate salts due to the partial oxidation of disseminated pyrite in coal associated with Bayswater Seam Group. 4505C depth 92.8m.

Plate 7: Iron staining and sulphate salts due to the partial oxidation of pyritic conglomerate zone above Lemington A seam. Hole 4095C depth 55.6m.

Plate 8: Pyritic zone within Archerfield Sandstone. Hole G3 depth 106m.

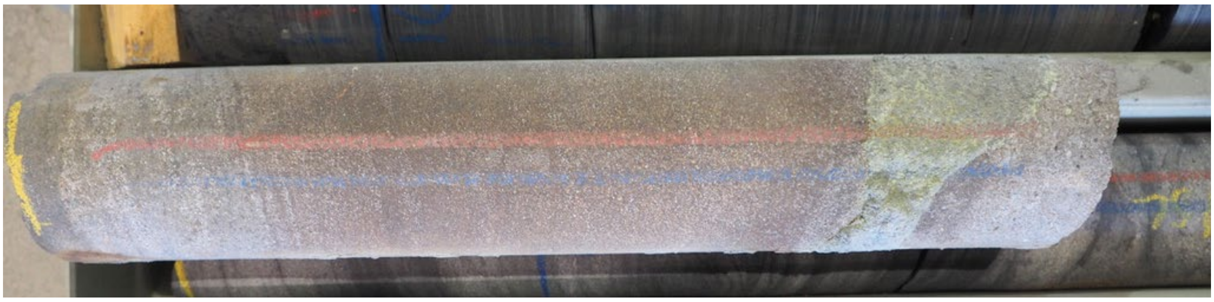


Plate 9: Pyrite lens in sandstone . Hole 4505C depth 89.30m.

Plate 10: Generally benign Archerfield Sandstone but with pyritic zones towards its base close to Lemington A seam (removed), and pyritic zone in siltstone below Lemington A. Hole 4505C depth 99-107m.

Plate 11: Pyritic zone with sulphate salts in siltstone below Lemington A Seam. Hole 4505C depth 105.9m.

Plate 12: Siderite with pyrite blebs and calcite veinlets. Hole 4505C depth 241.8—241.95m.

Plate 13: Pyritic zone with yellow tinged sandstone due to sulphate salts with pyrite lenses below the Barrett Seam. Hole 4505C depth 270.49 to 278.18m.

During inspection of the core, 12% HCl was applied to the core to provide an indication of the presence of reactive carbonate such as calcite and dolomite. Results showed common faint fizzing throughout the core, with intermittent zones of strong fizzing indicating the presence of calcitic carbonate. The calcitic carbonate occurred in the matrix and as veins in sandstone horizons and in some siltstone, as veins and fracture coatings in coal and carbonaceous sediments, and as veinlets and in matrix associated with siderite lenses (Plate 14 and Plate 15). Sideritic zones and sandstones with reactive carbonate were observed throughout the holes inspected, indicating an overall excess of neutralising carbonate in overburden materials.

Plate 14: Common siderite lenses with calcitic veining and matrix. Hole 4095C depth 89-97m.

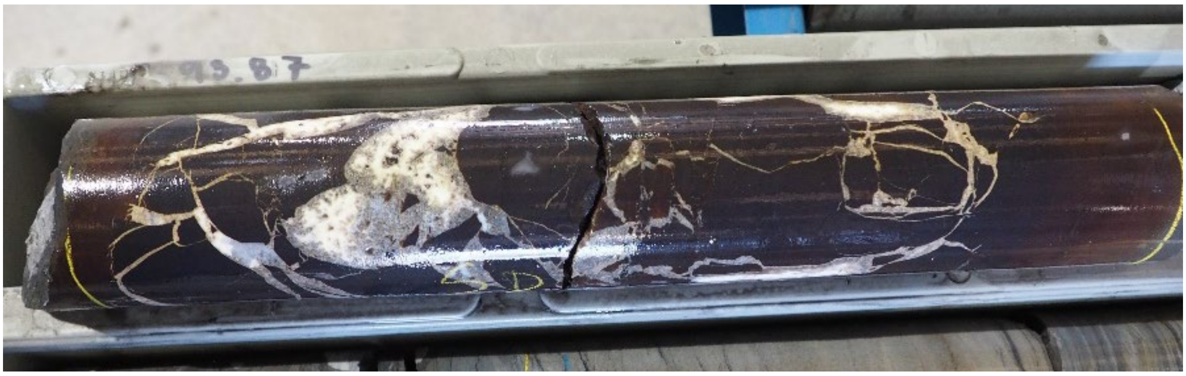


Plate 15: Siderite lens with calcitic veining and matrix. Hole 4095C 94.7m.

The existing pits, overburden/interburden materials and management, and washery waste disposal were inspected during the EGi site visits.

Current HVO North operations are focussed on the West Pit (Plate 16) with stratigraphy from the Bayswater Seam down to the base of the Barret Seam mined. Thin horizons of pyritic materials were observed in the pit walls in a limited number of locations generally associated with the Lemington Seam Group, particularly Lemington A (Plate 17 and Plate 18), and the Archerfield Sandstone formation (Plate 19). These were readily apparent due to development of distinct yellow salts and iron staining after pyrite oxidation. Iron staining was also observed across the floor of the Carrington Pit (Plate 20) which had previously been mined to the base of the Bayswater Seam with the Archerfield Sandstone left exposed as the floor.

Current HVO South operations are focussed on the Cheshunt Pit with stratigraphy from the Bowfield Seam down to the base of the Bayswater Seam mined and Riverview Pit with stratigraphy from the Glen Munro Seam down to the base of the Bowfield Seam mined. Thin horizons of pyritic materials were also observed in the pit walls in a limited number of locations (Plate 21). It is understood that mining at Cheshunt and Riverview Pits will terminate at the base of the Bayswater Seam, which will potentially expose pyritic Archerfield Sandstone in the final pit floor, as in the Carrington Pit (Plate 19).

Overall, pit observations at HVO North and South operations are consistent with core examination, which indicates these pyritic horizons are isolated in nature.

Plate 16: West Pit operations with the majority of the stratigraphy mined exposed down to the base of the Barrett Seam (lower right of photo).

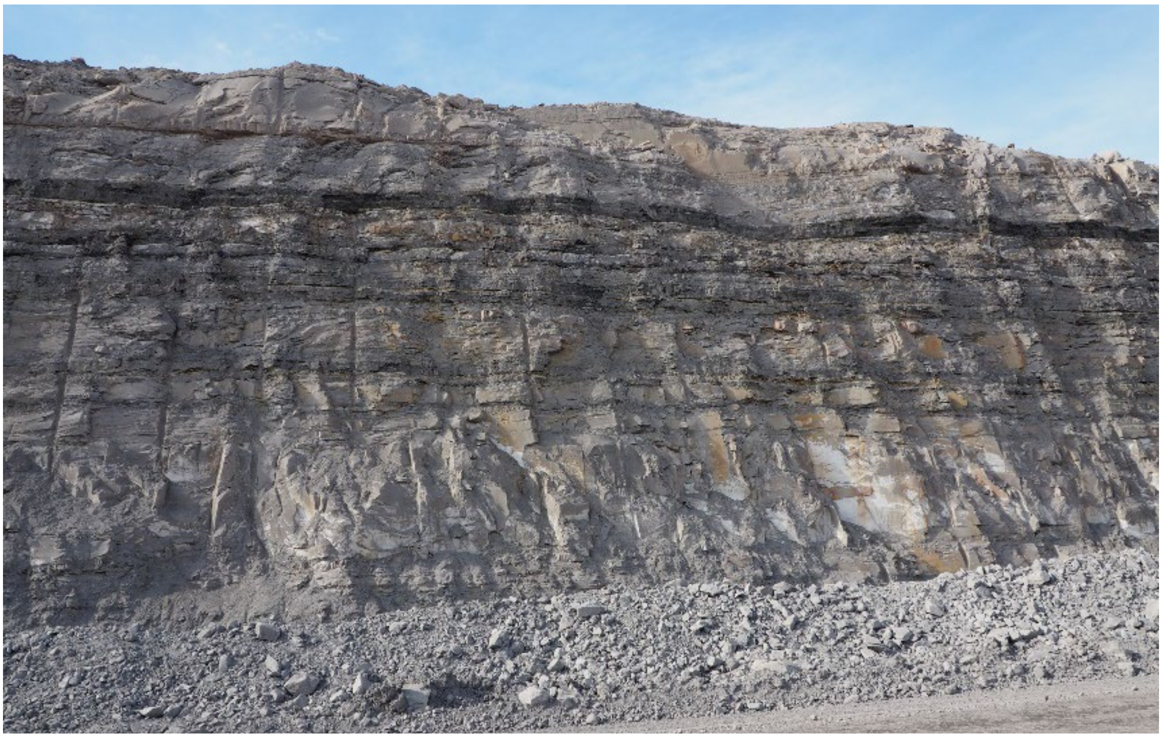


Plate 17: Iron staining and sulphate salts due to the partial oxidation of pyrite associated with the Lemington Seam Group in West Pit.

Plate 18: Iron staining and sulphate salts due to the partial oxidation of pyrite associated with the Lemington Seam Group in West Pit.

Plate 19: Iron staining due to the partial oxidation of pyrite visible in the lower section of the Archerfield Sandstone.

Plate 20: Carrington Pit with iron staining visible on the pit floor due to the partial oxidation of pyrite associated with the Archerfield Sandstone exposed in the floor.

Plate 21: Cheshunt Pit 2 with iron staining and jarosite between the Piercefield and Vaux Seams.

Overburden/interburden materials are placed within in-pit dumps (Plate 22) generally through end tipping in 30 m lifts or more by a combination of truck and dragline. Examination of dumped overburden/interburden indicated a general lack of pyritic materials, consistent with core observations.

Plate 22: End tipped overburden / interburden dumps within the West Pit.

Examination of freshly dumped coarse rejects during the site inspections indicated a general lack of pyritic materials. However, examination of beached tailings within the now disused Bob's Dump TSF indicated that segregation had resulted in pyritic materials being locally concentrated close to spigot points (Plate 24). Abundant white salts were also observed across the surface of the deposited tailings (Plate 25).

Plate 23: Coarse rejects placed within the overburden / interburden dumps within West Pit.

Plate 24: Iron stained pyritic materials concentrated close to spigot points within the disused Bob's Dump TSF.

Plate 25: White salts observed across the surface of deposited tailings within the disused Bob's Dump TSF.

Inspection of core holes 4505C, G3, 4095C, GHD23, 4073C and 5028C and the existing HVO North and South pits and overburden/interburden dumps suggests that the vast majority of overburden/interburden from the Project is likely to be benign, with some higher ARD potential associated with units in the roof and floor of coal seams, some coal seams, Archerfield Sandstone, and a unit below the Barrett Seam. Inspection of deposited tailings shows potential for salt migration from these materials, and localised concentrations of pyritic materials close to spigot points, which will need to be considered in the detailed final rehabilitation design of TSFs and options.

2.4 Previous Work

Direct previous geochemical assessment work at HVO is detailed in an acid rock drainage management plan produced by Coal & Allied (2011). The plan summarises geochemical investigations carried out in 2005 and 2008. Key findings were:

- Acid Rock Drainage (ARD) has a low to moderate risk at Hunter Valley Operations but care needs to be taken to ensure that problem materials are well managed.
- The main ARD issues at HVO are the disposal of interburden and washery reject materials which have acid producing potential.
- At the current assessment status, this is limited to the Archerfield Sandstone at West Pit, which constitutes some 2% of the total overburden and interburden moved.
- Some 15% of the coarse and fine washery reject material has been identified as needing assessment for ARD.
- An independent review in 2005 recognised that acid drainage risk is most likely low, since acid drainage issues have failed to develop after 30-40 years of mining in the Hunter Valley in the absence of any active ARD management. The review concluded that a sampling program should be implemented to geochemically characterise the mineral wastes at HVO and confirm the effectiveness of the current mineral waste management strategy.

- A sampling campaign was initiated in 2008 to better quantify net acid generation potential in HVO seams and interburdens. This was incorporated in exploration, to identify areas well in advance of mining. A sampling program for coarse rejects and tailings was also initiated. Ongoing sampling will continue to be required as a precautionary measure.
- For mining activities in units of ARD potential, procedural systems will ensure dumping of potentially acidic material in correct locations.
- Training systems are important to the success of these procedures and for awareness of the HVO site risk.
- The risk analysis of these issues shows that the reduction of hazards to a low risk status is practicable.

Overall, the geochemical data in the HVO 2011 management plan indicated a small but manageable ARD risk, with the need for ongoing testing of overburden and washery wastes to confirm and demonstrate the validity of assumed ARD distributions. No results for any subsequent sampling and testing were available.

Similar stratigraphy is encountered at adjacent Ravensworth and nearby Liddell, United Wambo, Mt Owen, Glendell and Bulga Mines. A review of the available geochemical testing information in Environmental Impact Assessments (EIS), Environmental Assessments (EA) and Mine Operations Plans (MOP) from these sites showed the following:

Many of the EIS and EA for these sites includes anecdotal references to low ARD risks, or broad conclusions drawn on geochemical processes based on inadequate data, with small numbers of samples and a lack of comprehensive geochemical testing:

- Ravensworth 2010 EIS (Umwelt, 2010) has no geochemical test results;
- Ravensworth 2021 MOP (Glencore, 2021) refers to testing of exploration samples and an assertion there are no ARD issues identified, but there is no supporting test data provided;
- United Wambo EIS (Umwelt, 2016) includes testing of only 87 samples, which is insufficient to cover variability or provide any correlation with HVO materials. The rehabilitation management plan (Glencore, 2020) does not provide any additional data;
- Liddell EA (SLR, 2013) does not include any geochemical test data, and refers anecdotally to a low ARD potential based on broad groundwater quality.

More comprehensive geochemical investigations were carried out by EGi at Mt Owen, Glendell and Bulga Mines (EGi, 2012, 2013, 2014a, 2014b and 2018), but the HVO geologists were not able to directly match seams from HVO with those at the other sites to compare detailed trends. However, some general findings are likely to be applicable to HVO:

- the Archerfield Sandstone is a common stratigraphic unit at all sites with significant ARD potential;
- Units above the Archerfield Sandstone tend to have low ARD potential;
- Units below the Archerfield Sandstone show some marine influence during deposition and greater ARD potential, though potentially discontinuous;
- The vast majority of overburden/interburden, coal and washery wastes at these nearby operations are expected to be NAF with excess ANC and are not expected to require special handling to prevent ARD, although there may be potential for some local effects on rehabilitation success through upward migration of acid and salinity into the growth horizon; and
- Tailings beaches showed pyrite segregation and concentration effects, similar to those observed at HVO.

Overall, the previous geochemical investigations indicate a small but manageable ARD risk at HVO, with the need for ongoing testing of overburden and washery wastes to confirm and demonstrate the validity of assumed ARD distributions.

3. Sample Selection

The original depositional environment largely controls the distribution and abundance of pyrite in coal bearing sedimentary sequences, with influences such as seawater incursions and presence of organic matter key to pyrite formation. As a result of these controls, pyrite is usually preferentially distributed in particular lithologies (such as carbonaceous mudstones) and stratigraphic horizons. Coal sequences usually have high lithological variation in the vertical sense, but tend to show lateral continuity, and hence sampling for ARD assessment needs to take this into account by obtaining detailed continuous samples in individual holes spaced at wide intervals. This was the approach taken for this geochemical assessment, with the aim of screening the entire HVO North and South mine stratigraphy for acid potential to identify horizons of concern, and rely on geological controls to help predict the distribution of potentially acid forming (PAF) and non-acid forming (NAF) rock types across the Project. This approach results in a better representation of mine materials in coal deposits than purely lithological based sampling.

A total of 401 overburden/interburden and, where available, coal core samples were selected for assessment from five drill holes that intersected the target stratigraphy to be developed as part of the Project, comprising 4095C, 4505C, G3, GHD23 and 4073C.

Three of these holes (4505C, G3 and 4073C) were continuously sampled from above to below the stratigraphy indicated and as shown in Figure 6, together representing the full overburden/interburden sequence to be mined in the Project:

- 4505C – Broonie BR1 to Barrett LBA
- G3 – Mount Arthur MA3J to Lemington LB2
- 4073C – Glen Munro GMA to Piercefield PF4

For the other two holes (4095C and GHD23), sampling was generally restricted to intervals where pyrite occurrence was observed, the Archerfield Sandstone, carbonaceous materials, intervals either side of coal seams and, where available, coal seams. The remaining overburden/interburden intervals could be reliably assumed to be NAF based on observation and correlation with the continuously sampled holes, which cover a similar stratigraphy, and comparison with geochemical assessment work on similar stratigraphy as part of the Bulga Complex Optimisation Project (EGi, 2012 and 2014). Holes 4095C and GHD23 covered from above to below the stratigraphy indicated:

- 4095C – Broonie BR6 to Barrett LBA
- GHD23 – Mount Arthur MA1 to Vaux VA3C

Sample intervals were selected by EGi generally to correspond to logged geological boundaries, with intervals ranging from less than 0.2 m to 5 m. Drill logs were generally only available in “corrected” depth format, so care was necessary to ensure the corrected sample intervals as selected were accurately matched with the uncorrected core markings. Site geologists were responsible for sample collection, bagging and numbering.

It is noted that for holes 4505C, G3, 4095C and 4073C the majority of coal seams, along with their immediate roof and floor materials, were not available for geochemical sampling as they had previously been removed for coal quality testing. Results of coal quality testing for these holes, including total S analyses, were provided to EGi by HVO personnel.

Locations of drill holes inspected as described in Section 2 and sampled for geochemical testing are shown in Figure 7.

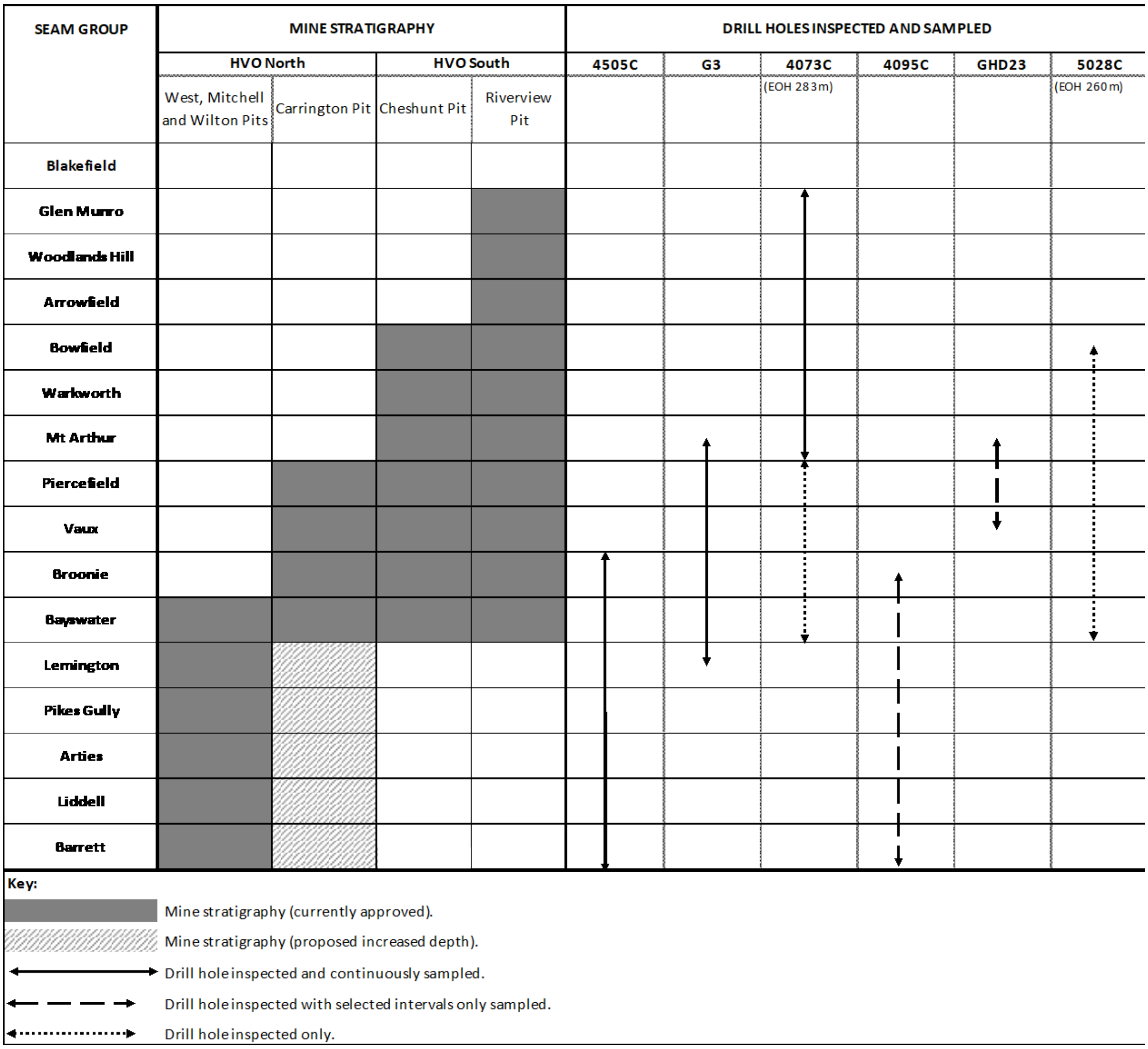
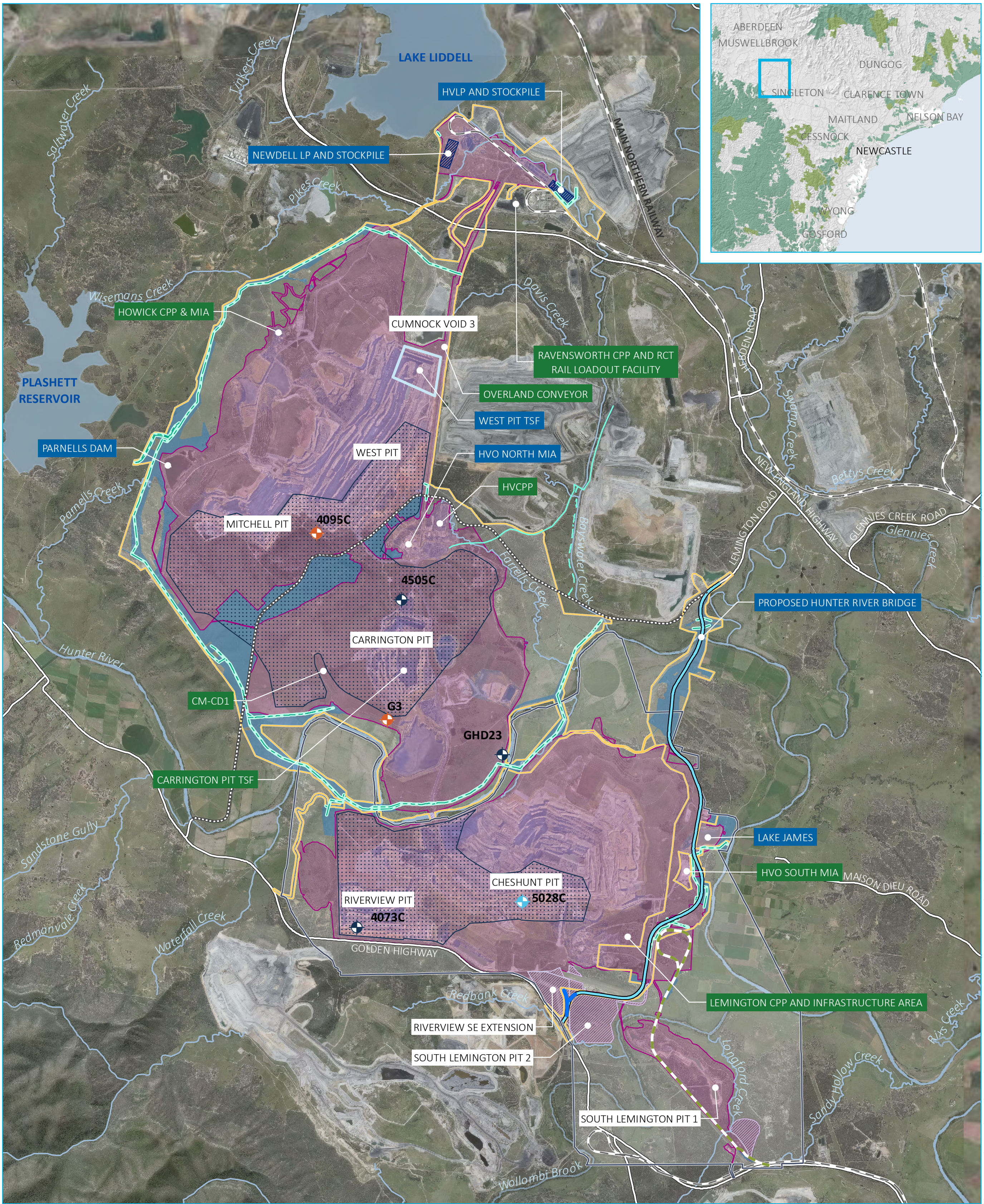


Figure 6: Mine stratigraphy by pit, along with drill holes inspected and sampled.



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Source: EMM (2022); HVO (2022); DFSI (2017, 2020)

0 2.5 5 km

GDA2020 MGA Zone 56

N

KEY

- HVO North proposed development consent boundary
- HVO South proposed development consent boundary
- Existing and approved disturbance area
- Previously approved area not retained
- Drill hole inspected and continuously sampled
- Drill hole inspected only
- Drill hole inspected with selected intervals only sampled

Existing HVO elements to be maintained

- South Lemington Rail Loop (approved, not yet constructed)

Proposed HVO Continuation Project elements

- Lemington Road realignment
- Indicative location of public road closure
- Haul route to Ravensworth Operations
- Transmission line relocation
- Alternative Golden Highway intersection
- Proposed mining area
- Product stockpile
- Additional disturbance area
- West Pit TSF

Existing environment

- Rail line
- Major road
- Ravensworth Operations access road
- Named watercourse
- Named waterbody
- NPWS reserve (refer to inset)
- State forest (refer to inset)

Location of drill holes inspected and sampled for geochemical testing

Hunter Valley Operations
HVO Continuation Project
Figure 7

EMM
creating opportunities

In addition, site undertook sampling of coal washery wastes from the HV CPP on an approximately weekly basis over a 12-month period from 29 November 2019 to 18 November 2020, with samples analysed for total S. The aim of the sampling was to provide a screening sample set which captured wastes being generated from as many different coal seams as possible along with variability over time.

Three waste streams were sampled:

- Rejects, sampled from the outflow of the rejects D&R screen, comprising both coarse rejects and fine rejects combined and representing the washery waste stream which reports to the overburden dumps;
- Fine Rejects, collected from the inlet stream to the rejects D&R screen prior to dewatering, representing the fine fraction (0.125mm to 1.4mm) of the (combined) rejects; and
- Tailings, collected from the desliming cyclone overflow, comprising the ultra fine rejects and representing the washery waste stream which reports to the TSFs.

For sampling events up until 9 May 2020, samples were collected separately from multiple of the CPP's six modules to gain an idea of material variability from module to module at any one time. As such, up to six rejects, six fine rejects and six tailings samples were collected and analysed per sampling event. After 9 May 2020 composite samples only were collected (with grab samples from each of the six modules contributing equally to each composite sample) such that one sample of each stream (rejects, fine rejects and tailings) was collected and analysed per sampling event.

Generally, rejects and tailings samples from each sampling event were retained and stored (reserved) to enable more detailed geochemical testing, if required, following completion of the screening programme. Where individual CPP modules had been sampled (ie up until 9 May 2020) these were composited per sampling event prior to reserving. Samples prior to 17 January 2020, all fine rejects samples and a number of individual samples were not reserved. In total, at the time of this assessment 34 rejects samples and 25 tailings samples were reserved and available for further testing.

The screening total S dataset indicated considerable variation in rejects materials.

All 59 washery wastes samples (34 rejects samples and 25 tailings samples) available at the time of this assessment were subjected to more detailed testing and assessment by EGi. The number of samples tested from each seam group are shown in Figure 8. The figure shows that most seam groups from the mine target stratigraphy have at least some representation within the selected samples, either as samples taken when feed from individual seam groups was being processed or samples taken when feed from multiple seam groups was being processed. However, there is no representation in the samples from the Glen Munro, Woodlands Hill and Lemington Seam Groups which were not being processed at the HV CPP during the sampling period, and no tailings samples with representation from the Piercefield Seam Group were available. It is also noted that while most seam groups are represented in the samples, not all seams and plies within each of those seam group are represented. However, the range of samples tested is sufficient for an initial assessment of the likely variation in washery waste geochemical properties.

SEAM GROUP	MINE STRATIGRAPHY				REJECTS SAMPLES		TAILINGS SAMPLES	
	HVO North		HVO South					
	West, Mitchell and Wilton Pits	Carrington Pit	Cheshunt pit	Riverview pit	No. of Samples representing Individual Seam Group Only	No. of Samples # representing Multiple Seam Groups	No. of Samples representing Individual Seam Group Only	No. of Samples # representing Multiple Seam Groups
Blakefield								
Glen Munro								
Woodlands Hill								
Arrowfield					2		2	
Bowfield					2	6	2	6
Warkworth					1		1	
Mt Arthur					2		2	
Piercefield						1		
Vaux						1		1
Broonie					2	4	2	2
Bayswater					2	6		5
Lemington								
Pikes Gully					2	1		1
Arties					2	10	1	7
Liddell					3		3	
Barrett						3		3

Key:

Mine Stratigraphy (currently approved).

Mine Stratigraphy (proposed increased depth).

Where a sample represents multiple seam groups, the one sample is counted multiple times (ie under each relevant seam group).

Figure 8: Representation of seam groups from the mine target stratigraphy within the rejects and tailings sample set selected for detailed testing and assessment.

4. Methodology

Existing total S results for coal quality samples from drill holes 4505C, G3, 4095C and 4073C were provided by HVO personnel. These samples, which included coal seams and their immediate non-coal roof, floor and partings, were not available for any additional testing as part of this programme.

A total of 401 overburden/interburden and coal samples relevant to the Project were sampled by HVO personnel with advice from EGi. Sample preparation was arranged by EGi and carried out by Indicium Laboratories (Brisbane). Preparation involved drying (as required), crushing to a nominal -4 mm, splitting, pulverising a 500 g split to -212 µm, and dispatch of 500 g of -212µm pulverised samples and 500 g of -4 mm crushed samples to EGi.

Screening washery wastes samples (rejects, fine rejects and tailings) were sampled by HVO personnel, with sample preparation and total S analysis organised by HVO and carried out by SGS (Muswellbrook), and the screening results provided to EGi. A total of 59 washery wastes samples were selected for detailed testing by EGi as part of this programme. Existing stored crushed and pulverised sample material was utilised where available, otherwise further sample preparation was carried out by SGS involving crushing, splitting and / or pulverising. The following were dispatched to EGi: 500 g crushed and 200 g pulverised sample splits for rejects, and 500 g pulverised sample splits for tailings.

The following standard geochemical characterisation testing was carried out on all 401 selected overburden/interburden and coal samples, and all 59 rejects and tailings samples:

- Leco total S;
- acid neutralising capacity (ANC); and
- net acid producing potential (NAPP) – calculated from total S and ANC.

The following standard geochemical characterisation testing was carried out on a representative subset of the overburden/interburden and coal samples, and all rejects and tailings samples:

- pH and electrical conductivity (EC) of deionised water extracts at a ratio of 1 part solid to 2 parts water ($pH_{1:2}$ and $EC_{1:2}$) – 267 overburden and coal samples, and 59 rejects and tailings samples;
- single addition net acid generation (NAG) test – 267 overburden and coal samples, and 59 rejects and tailings samples.

Additional specialised testing was carried out on selected samples to further characterise ARD geochemistry and to help resolve uncertainties in the above test results:

- extended boil and calculated NAG testing to account for high organic carbon contents – 14 overburden and coal samples, and 20 rejects and tailings samples;
- kinetic NAG testing of higher S samples to check pyrite reactivity and to indicate lag times – 11 overburden and coal samples;
- sulphur speciation to obtain a guide to the proportion of pyritic S – 24 overburden and coal samples, and 19 rejects and tailings samples; and
- acid buffering characteristic curve (ABCC) testing to define the relative availability of the ANC measured – 29 overburden and coal samples, and 15 rejects and tailings samples.

Selected samples were also assayed for the following to identify elements subject to significant enrichment as well as provide a preliminary indication of leaching behaviour:

- multi-element testing of solids to assess elemental enrichment – 36 overburden and coal samples, and 13 rejects and tailings samples;
- pH, EC, acidity/alkalinity and multi-element scans of single stage deionised water batch extracts at a ratio of 1 part solid to 2 parts water to provide an indication of leachate water quality as a result of initial contact with an unbuffered water source – 36 overburden and coal samples, and 13 rejects and tailings samples; and
- Multi-element testing of single addition NAG leach extracts to provide a preliminary indication of leachate water quality as a result of the oxidation of the sulphide content of the material – 25 overburden and coal samples and 6 rejects and tailings samples.

A general description of ARD test methods and calculations used is provided in Appendix A.

Water extractions for $pH_{1:2}$ and $EC_{1:2}$ and multi-element testing were carried out on -4 mm crushed samples for overburden, coal and rejects samples, and on pulverised samples for tailings. Pulverised samples were used for all other tests.

The sulphur speciation procedure involved Leco total S, chromium reducible sulphur (CRS) and KCl digestion to help differentiate pyritic S, acid forming sulphate, non-acid forming sulphate and other S forms (including organic S, jarosite S and elemental S).

Elements that may be mobilised as a consequence of sulphide oxidation were determined by reacting a 2.5 g sub-sample of pulverised material with 250 mL of 15% hydrogen peroxide, as per the single-stage NAG test procedure. After completion of the oxidation reaction, the NAG liquor was re-adjusted to 250 mL with deionised water. A 100 mL sub-sample was then taken for determination of NAG pH, and a second 100 mL sub-sample was filtered through a 0.45 micron membrane filter, preserved with a few drops of high purity HNO_3 acid, and sent to ALS for multi-element analysis.

Total S assays and multi-element analyses of sample solids were carried out by Indicium Laboratories (Brisbane). CRS was carried out by ALS Laboratory Group (Brisbane). Multi-element analyses of water extracts were carried out by ALS Laboratory Group (Sydney). Analysis of NAG solutions and S analysis of KCl digest solutions were carried out by Levay & Co. Environmental Services (Adelaide). All other analyses were carried out by EGi.

5. Geochemical Characterisation of Overburden / Interburden and Coal

Acid forming characteristics of the 401 selected overburden/interburden and coal samples are presented in Appendix B, Table B1, comprising pH and EC of water extracts, total S, maximum potential acidity (MPA), ANC, NAPP, ANC/MPA ratio and single addition NAG. Results are discussed in the following subsections. Table B1 also includes coal quality total S data supplied by HVO personnel for 414 samples, which did not undergo any further testing, but provided an expanded S dataset to assess trends in coal plies, partings, and immediate roof and floor.

5.1 pH and EC

The $pH_{1:2}$ and $EC_{1:2}$ results were determined by equilibrating the sample in deionised water for approximately 16 hours at a solid to water ratio of 1:2 (w/w). This gives an indication of the inherent acidity and salinity of the waste material when initially exposed in a waste emplacement area. A total of 267 samples were tested for $pH_{1:2}$ and $EC_{1:2}$, covering a subset representing the geological and geochemical variation of the samples collected from HVO North and South.

The $pH_{1:2}$ values ranged from 2.4 to 9.4, with the majority (over 85%) of samples having a pH greater than 6 and showing no inherent acidity. Sixteen of the samples tested had a slightly acidic pH of between 4.5 and 6.0. Eighteen of the samples tested had an acidic pH of less than 4.5, of which 13 samples were non coal lithologies and 5 were coal samples.

$EC_{1:2}$ values ranged from 0.11 to 6.87 dS/m, with the majority (approximately 80%) falling within the non-saline to slightly range with an EC of 0.8 dS/m or less. Thirty-two samples were moderately saline at 0.8 to 1.6 dS/m. Twenty-six samples were saline with EC greater than 1.6 dS/cm. Twenty-one of these samples were non coal lithologies and 4 were coal samples.

Figure 9 is a plot of $pH_{1:2}$ and $EC_{1:2}$ versus total S for all samples tested. The plot shows that slightly acidic to acidic $pH_{1:2}$ values (< pH 6) and moderately saline to saline $EC_{1:2}$ values (>0.8 dS/m) are generally associated with higher S (approximately >0.20 %S) samples. This indicates that lower $pH_{1:2}$ and higher $EC_{1:2}$ values are primarily the result of partial pyrite oxidation occurring between the time of drilling, sample collection and sample testing. The five drill holes sampled and tested were drilled between 8 to 12 years ago.

Results suggest low leachable acidity and salinity in overburden/interburden materials represented by these samples except where pyrite is present and it has partially oxidised.

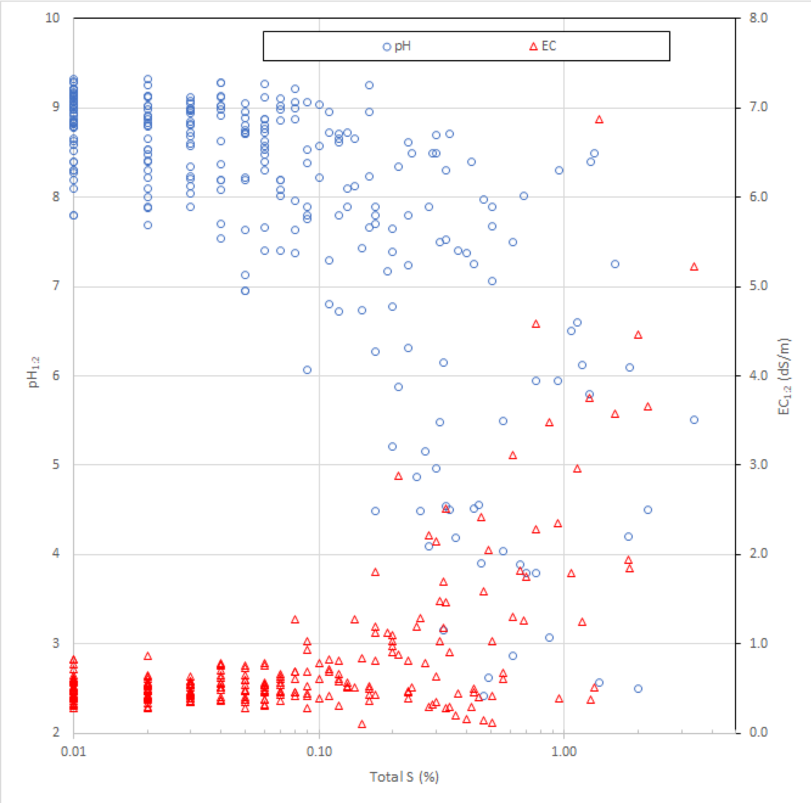

Figure 9: Plot showing $pH_{1:2}$ and $EC_{1:2}$ versus total S for overburden/interburden and coal samples.

5.2 Acid Base (NAPP) Results

Leco total S was tested on 401 overburden / interburden and coal samples sourced from lithologies occurring within the stratigraphy to be targeted by the Project. Total S values ranged from below detection to 3.39 %S, with the majority of samples (75%) having low S values of less than 0.1 %S. In addition, S data were available for 414 coal quality samples from four of the five drill holes used for sample selection. Total S values for coal quality samples, which generally represented coal seam, roof and floor materials, ranged from below detection to 4.93 %S with the majority of samples (70%) having S values greater than 0.25 %S.

Figure 10 is a box plot of the distribution of S, split by lithology for the samples tested by EGi and for coal quality samples excluding those from that portion of hole 4073C which was inspected but not sampled by EGi. Roof and floor samples that are likely to be mined and processed with the coal, rather than report to overburden waste dumps, have been grouped together as Roof/Floor despite the fact that these samples include a range of lithologies. The plot shows that conglomerates (of which there was only a limited number of samples tested), sandstones, siltstones and mudstones generally have low S with medians ranging from 0.01%S to 0.04%S. Carbonaceous siltstones, carbonaceous mudstones and the roof and floor materials generally have higher S with medians around 0.2%S, and coal samples have the highest S with median S of 0.55%. For each of the carbonaceous siltstone, carbonaceous mudstone, roof / floor and coal lithologies, approximately 10% to 15% of samples have S concentrations greater than 1%S.

ANC was tested on 401 overburden / interburden and coal samples sourced from lithologies occurring within the stratigraphy to be targeted by the Project. The ANC was generally low to moderate but ranging up to 455 kg H_2SO_4/t, and with a median ANC of 30 kg H_2SO_4/t. ANC data were not available for the coal quality samples. Figure 11 is a box plot of the distribution of ANC, split by lithology. Conglomerate samples have a high median ANC value of 85 kg H_2SO_4/t, however as previously noted only a limited number of conglomerate samples were tested. Sandstone and siltstone materials have moderate median ANC values between 25 to 40 kg H_2SO_4/t. The median ANC values of mudstone, carbonaceous mudstone and carbonaceous siltstone materials are low ranging from 10 to 20 kg H_2SO_4/t. The median ANC of the coal samples that were tested is also low at less than 5 kg H_2SO_4/t, however it is also noted that only a limited number of coal seams were available to be sampled and tested for ANC. Roof and floor materials were generally not available for testing.

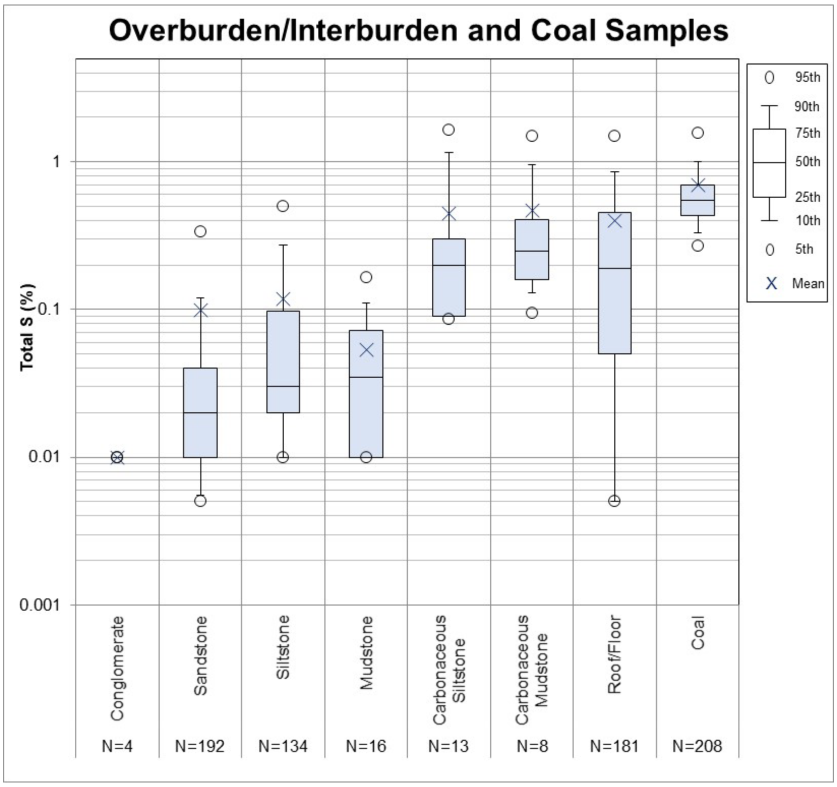

Figure 10: Box plot showing the distribution of S split by lithology for overburden/interburden and coal samples. Box plots show 5th, 10th, 25th, 50th (median), 75th, 90th and 95th percentiles and means.

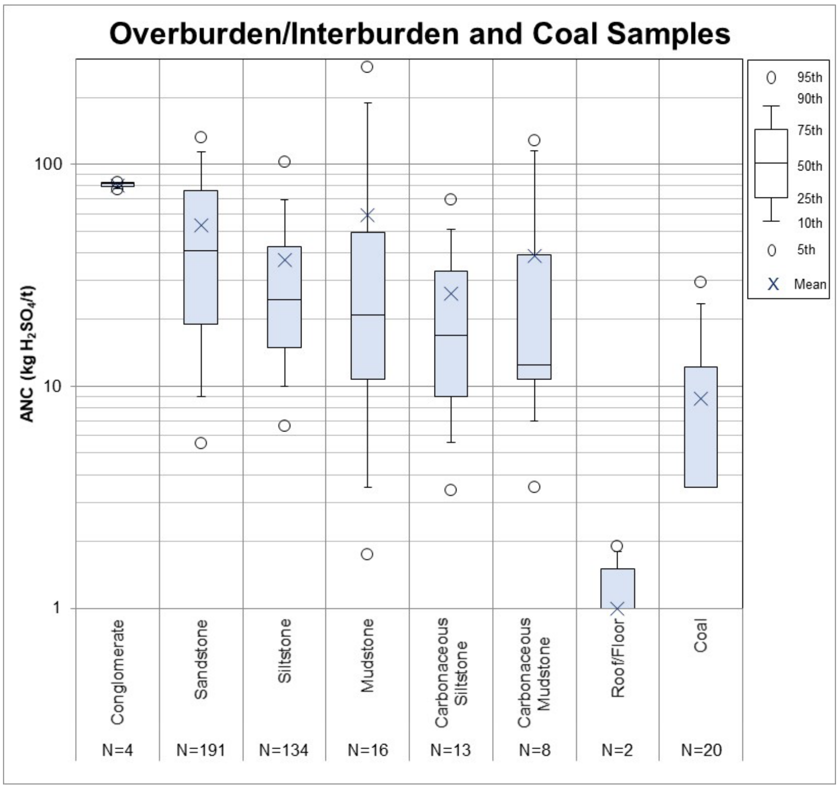

Figure 11: Box plot showing the distribution of ANC split by lithology for overburden/interburden and coal samples. Box plots show 5th, 10th, 25th, 50th (median), 75th, 90th and 95th percentiles and means.

The NAPP value is an acid-base account calculation using measured total S and ANC values. It represents the balance between the MPA and ANC. A negative NAPP value indicates that the sample may have sufficient ANC to prevent acid generation. Conversely, a positive NAPP value indicates that the material may be acid generating.

Figure 12 is an acid-base account plot of ANC versus total S, with results split by material type. Figure 13 is the same as Figure 12, but re-scaled to better represent S below 2%S and ANC values below 100 kg H_2SO_4/t. The NAPP zero line is shown which defines the NAPP positive and NAPP negative domains, and the line representing an ANC/MPA value of 2 is also plotted. Note that the NAPP = 0 line is equivalent to an ANC/MPA of 1. The ANC/MPA value is used as an indication of the relative factor of safety within the NAPP negative domain. Usually a ratio of 2 or more signifies a high probability that the material will remain circum-neutral in pH and thereby should not be problematic with respect to ARD.

NAPP values were calculated for 401 samples. The results show that 89% of samples tested plot in the NAPP negative domain, with 85% also having ANC/MPA ratios of 2 or more, indicating a high factor of safety. 11% of all samples plot in the NAPP positive domain, including 16 of the 20 coal samples tested.

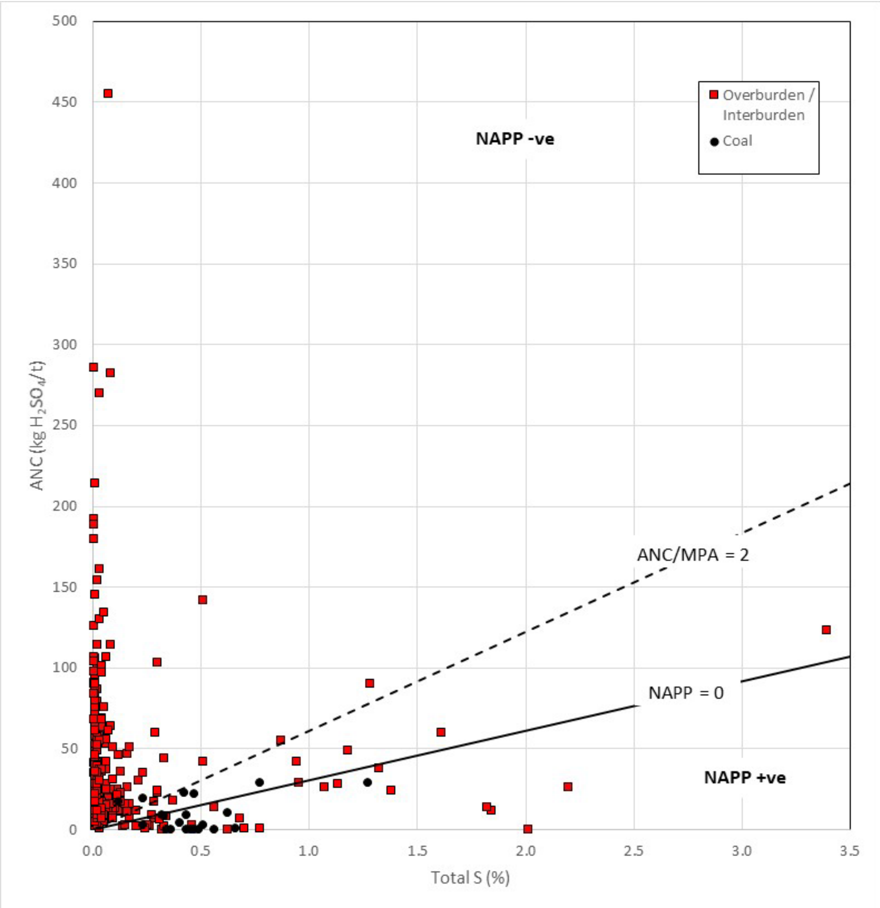

Figure 12: Acid base account (ABA) plot showing ANC versus total S split by overburden/interburden and coal samples.

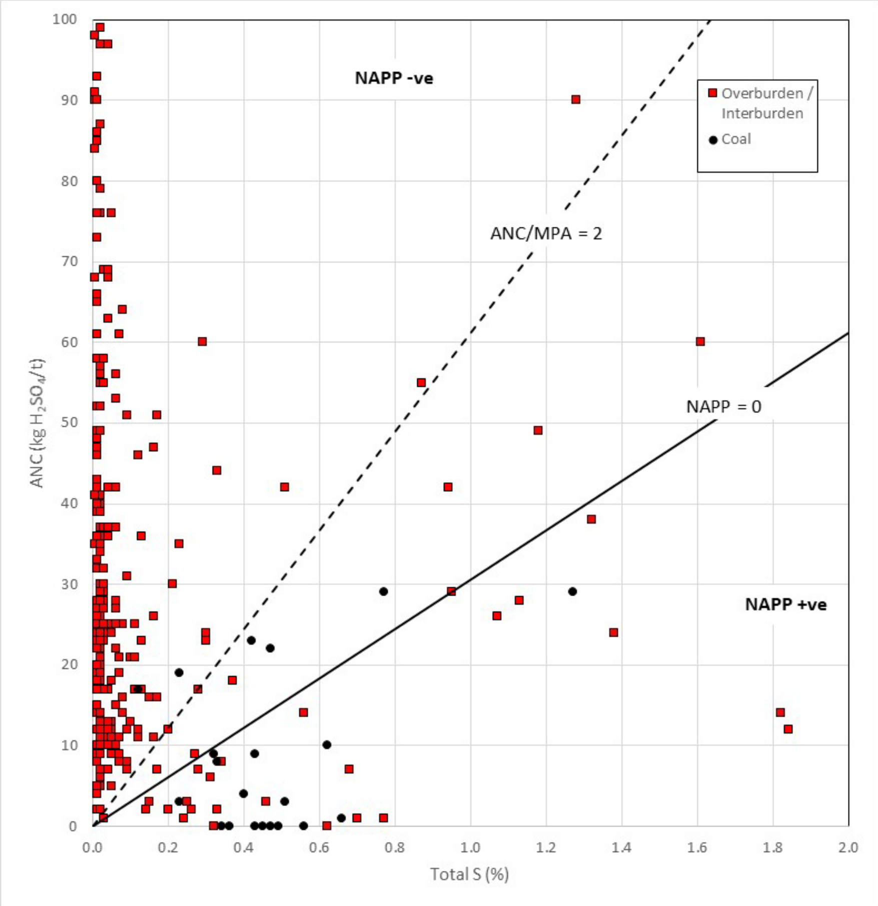

Figure 13: As for Figure 12 with an expanded scale.

5.3 Single Addition NAG Results

Generally a NAGpH value less than 4.5 indicates a sample may be acid forming. However, samples with high organic carbon contents (such as coal and carbonaceous sedimentary materials) can cause interference with standard NAG tests due to partial oxidation of carbonaceous materials. This can lead to low NAGpH values and high acidities in standard single addition NAG tests unrelated to acid generation from sulphides.

NAG testing was conducted on the same representative subset of 267 samples tested for pH and EC, which also ensured that all samples with S greater than 0.05%S were tested. Samples with 0.05%S or less are considered to have negligible potential to produce significant acid. Of these 267 samples, 86% had NAGpH values of 4.5 and greater, indicating they are likely to be NAF. The remaining 14% had NAGpH values less than 4.5, but many of these were associated with carbonaceous horizons and coal seams, and results are inconclusive in isolation due to potential organic acid effects that may contribute acidity to the sample liquor in addition to that released from sulphide oxidation.

NAG test results are used in conjunction with NAPP values to classify samples according to acid forming potential. Figure 14 is an ARD classification plot showing NAGpH versus NAPP value, with results split by material type. Figure 15 is the same as Figure 14, but with an expanded NAPP axis to better represent the range -100 to 100 kg H_2SO_4/t. PAF, NAF and uncertain (UC) classification domains are indicated. A sample is classified PAF when it has a positive NAPP and NAGpH < 4.5, and NAF when it has a negative NAPP and NAGpH ≥ 4.5. Samples are classified uncertain when there is an apparent conflict between the NAPP and NAG results, i.e. when the NAPP is positive and NAGpH ≥ 4.5, or when the NAPP is negative and NAGpH < 4.5.

The plot shows that most samples (more than 80%) plot in the NAF domain, with 33 samples plotting in the PAF domain, 4 samples plotting in the lower left uncertain domain and 10 samples plotting in the upper right uncertain domain.

A total of 220 samples plot in the NAF domain, with 212 (or 96%) of those samples having a relatively low total S of 0.5%S or less. Samples 17821, 17851, 17854, 17859, 17860, 17979, 17988 and 17805 had higher total S values of 0.51%S to 3.39%S and moderate to high ANC values of 37 to 142 kg H_2SO_4/t, and further testing was carried out to confirm that buffering was sufficient to account for acid generated from these samples.

Of the 33 samples plotting in the PAF domain, approximately 60% are coal or carbonaceous sediments. Of these, 12 samples showed organic acid effects in the NAG test indicated by a large difference between the $NAG_{(pH4.5)}$ and $NAG_{(pH7.0)}$ values, and/or $NAG_{(pH4.5)}$ values very close to or exceeding that of MPA. In these samples the NAG results overestimate the acid potential. Samples showing organic acid effects are shown in red text in Table B1 (Appendix B). The remaining 21 samples are expected to be PAF, with 14 samples likely to have a low acid generating capacity of less than 5 kg H_2SO_4/t. Specialised testing was carried out to help define the geochemical properties of the PAF samples and resolve uncertainties in the classification.

Two of the four samples plotting in the lower left uncertain domain showed organic acid effects in the NAG test, with one sample a carbonaceous siltstone and the other a siltstone but with some carbonaceous sediments included in the sample interval. Follow up tests to check for organic acid effects and availability and nature of the acid neutralising capacity were carried out to resolve the classification of these samples.

Six of the nine samples plotting in the upper right uncertain domain have low to moderate total S of 0.14 to 0.68%S, low ANC values of 1 to 8 kg H_2SO_4/t, and NAGpH values greater than 4.5. The NAG test would normally account for most of the pyritic S in these samples and they are expected to be NAF. ABCC and S speciation testing was carried out to confirm the NAF classification. The remaining four samples plotting in the upper right uncertain domain have high total S of 0.95 to 1.32%S, moderate ANC values of 26 to 38 kg H_2SO_4/t, and NAGpH values greater than 4.5. ABCC and S speciation testing was carried out to help resolve uncertainties.

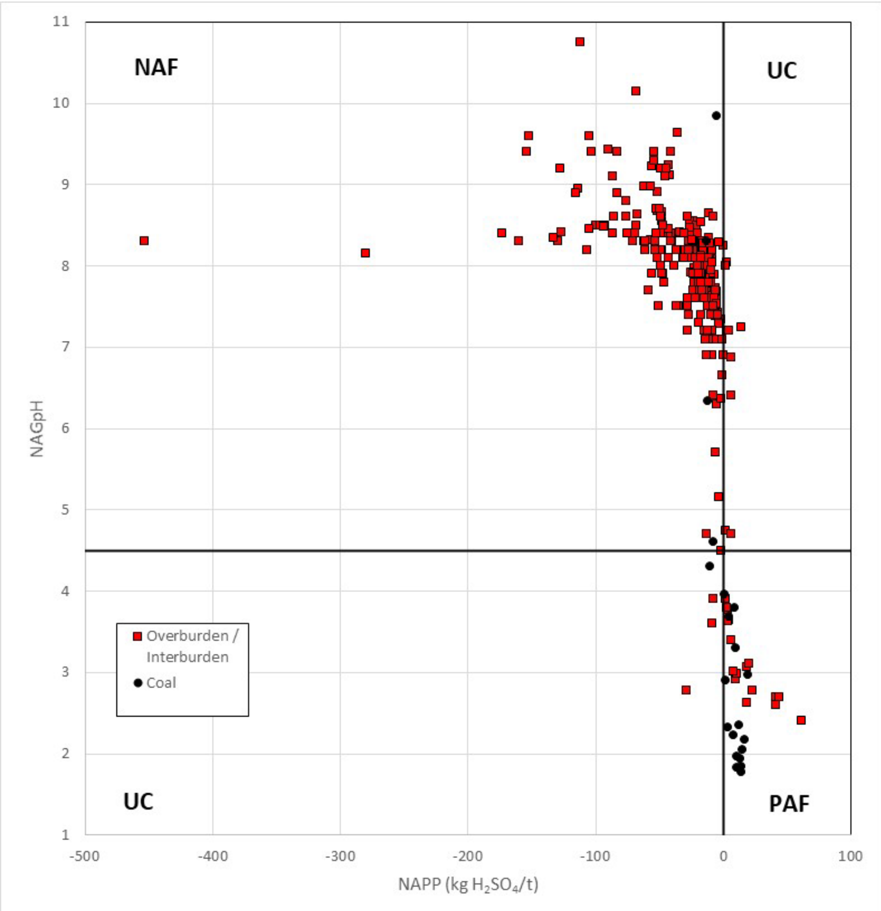

Figure 14: ARD classification plot showing NAGpH versus NAPP split by material type (i.e. overburden/interburden, coal) of samples, with potentially acid forming (PAF), non-acid forming (NAF) and uncertain (UC) ARD classification domains included for reference.

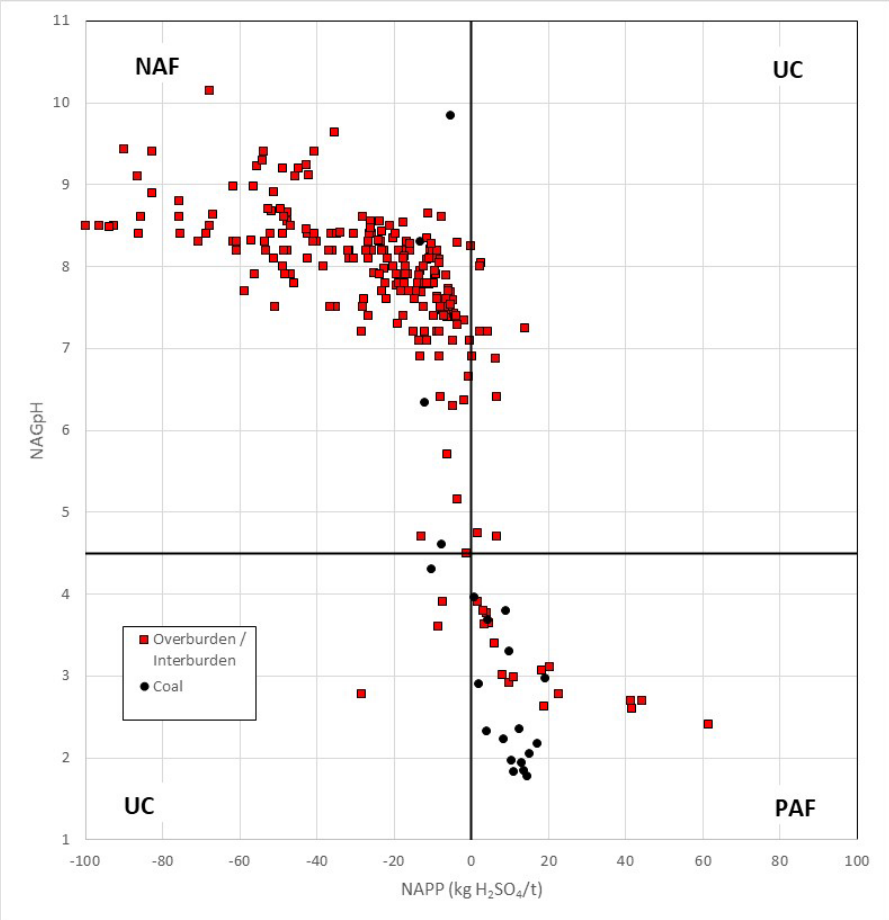

Figure 15: As for Figure 14 with an expanded scale.

5.4 Extended Boil and Calculated NAG Results

Extended boil and calculated NAG testing were carried out on 14 selected samples to help resolve uncertainties in ARD classification based on standard NAG test results, as discussed in the previous section. Results are shown in Table B2, Appendix B.

Results show that the NAGpH value for most samples increases 2 to 4 pH units after the extended boiling step. The increase in NAGpH confirms the effects of organic acids. The extended boil NAGpH of seven samples (17855, 17724, 17733, 17734, 17736, 17738 and 17750) remained less than 4.5, indicating these samples are likely to be acid producing.

Note that the extended boil NAGpH value can be used to confirm samples are PAF, but an extended boil NAGpH value greater than 4.5 does not necessarily mean that samples are NAF, due to some loss of free acid during the extended boiling procedure. To address this issue, a calculated NAG value is determined from assays of anions and cations released to the NAG solution. A calculated NAG value of less than or equal to 0 kg H_2SO_4/t indicates the sample is likely to be NAF, and a value of more than 0 kg H_2SO_4/t indicates the sample may be PAF.

The calculated NAG values for two of the samples (18004 and 18054) were negative or equal to zero, indicating that all acid generated in the standard NAG test for these samples was organic, and that materials represented by these samples are unlikely to be acid producing under field conditions.

The remaining 12 samples had positive calculated NAG values, indicating these samples are likely to be acid producing. Of those, samples 17853, 18007 and 17752 had acid potentials of 5 kg H_2SO_4/t or less, and are classified as PAF with a low capacity (PAF-LC).

Most coal materials tested (92%, with S ranging from 0.23 to 0.66%S) were characterised as PAF or PAF-LC by the calculated NAG test, suggesting that although organic acids affected the NAG results, a significant portion of the acidity was still associated with sulphide oxidation.

5.5 Acid Buffering Characteristic Curve (ABCC) Testing

ABCC testing was carried out on 29 selected samples to evaluate the availability of the ANC measured. The ABCC test involves slow titration of a sample with acid while measuring the solution pH. The acid buffering of a sample to pH 4 can be used as an estimate of the proportion of readily available ANC. Results are presented in Figures C1 to C14, Appendix C, with calcite, dolomite, ferroan dolomite and siderite standard curves as reference. Calcite and dolomite readily dissolve in acid and exhibit strongly buffered pH curves in the ABCC test, rapidly dropping once the ANC value is reached. The siderite standard provides very poor acid buffering, exhibiting a very steep pH curve in the ABCC test. Ferroan dolomite is between siderite and dolomite in acid buffering availability.

Seven of the samples 17833 (Figure C1), 17838 (Figure C4), 17839 (Figure C9), 17842 (Figure C1), 17849 (Figure C10), 18054 (Figure C4), and 20148 (Figure C6) have profiles that plot similar to the siderite standard curves indicating slow reactivity and with only 0% to 25% of the total ANC likely to be effective.

Nine of the samples 17785 (Figure C1), 18004 (Figure C3), 18022 (Figure C2), 20122 (Figure C7), 20123 (Figure C1), 20132 (Figure C9), 20168 (Figure C11), 20171 (Figure C8) and 20195 (Figure C11) have profiles that plot between the siderite and ferroan dolomite standard curves also indicating slow reactivity but generally with 25% to 65% of the total ANC likely to be effective (although two samples were higher with effective ANC above 90%).

Samples 17821 (Figure C13), 17975 (Figure C7), 18007 (Figure C1), 20139 (Figure C14) and 20150 (Figure C2) have profiles that plot close to the ferroan dolomite standard curves. Results indicate slow reactivity but with an effective ANC of around 50% to 90% of the total ANC.

Four samples, 17860 (Figure C10), 17999 (Figure C4), 18020 (Figure C5) and 20209 (Figure C10), have profiles that plot between the dolomite and ferroan dolomite standard curves. The readily available ANC portion for these samples was generally 90% to 100% of the total ANC (although one sample was lower at around 55%), with reaction rates likely to be slower than dolomite.

The ABCC profiles for the remaining four samples 17854 (Figure C7), 17805 (Figure C12), 17806 (Figure C1) and 17807 (Figure C1) show strong buffering, with profiles plotting close to or between those of calcite and dolomite standard curves. For these samples the proportion of readily available ANC is elevated, ranging from 90% to 100% of the ANC.

Overall, ABCC results suggest that the ANC measured for sandstone materials represented by the samples tested is likely to be moderate to fast reacting and effective. However, results for other lithology types are more variable, with the ANC measured mostly likely to be slow reacting and largely ineffective due to the likely inclusion of a high proportion of iron carbonate.

5.6 Kinetic NAG Testing

Kinetic NAG tests provide an indication of the kinetics of sulphide oxidation and acid generation for a sample. Kinetic NAG testing was carried out on 11 selected samples. Results are presented in Figures C15 to C25, Appendix C.

Typically, there will be a distinct temperature peak of 50°C or more in the kinetic NAG profile for samples with pyritic S greater than 0.7%S and low ANC. The kinetic NAG temperature profiles for samples 17838 (Figure C18), 17861 (Figure C20), 17996 (Figure C21), 17999 (Figure C22), 18022 (Figure C24) and 18066 (Figure C25) showed distinct temperature peaks, typical of pyritic samples. The remaining samples had lower S of 0.66%S or less, and did not have distinct temperature peaks as expected from lower pyritic S contents.

The time to pH 4 in the kinetic NAG test can be used to estimate the lag time before acid conditions develop in a sample under atmospheric oxidation conditions. All of the samples show relatively fast reaction rates, dropping below pH 4 in 8 minutes or less, despite varying ANC, indicating lag times of one month or less. Note that these samples had had opportunity to oxidise prior to testing, and longer lags could be expected from fresher materials. The results do confirm the poor reactivity of the ANC measured in these samples, which were mainly non-sandstone lithologies, consistent with ABCC test results.

5.7 Sulphur Speciation

Sulphur speciation testing was carried out on 24 selected samples representative of overburden/interburden and coal materials. Results are shown in Table B3, Appendix B, and the relative proportions of sulphur forms for the samples tested are indicated in Figure 16. Note that the pyritic S value should only be treated as a guide to the pyrite content in the sample due to issues with repeatability in the chromium reducible sulphur (CRS) method (EGi et al., 2008).

Eight of the samples tested were coal samples. Results suggest that all coal samples tested except two (17854 and 17855) have low pyritic S values, with the acid generating proportion of S (including some contribution from oxidised pyrite forms) generally accounting for only 30% or less of the total S, indicating most of the S is in non-pyritic forms and most likely occurs as organic S. NAPP estimates based on total S may overestimate the acid forming potential of these samples. Coal samples 17854 and 17855 have a higher proportion of pyritic S, but still only accounting for 50% to 60% of the total S.

Sixteen of the samples tested were non-coal lithologies. For all of these samples except three (17839, 20208 and 20209) results indicate that they have comparatively high pyritic S values, with the acid generating proportion of S greater than 50% (generally greater than 60%) and ranging up to 92%, suggesting that total S values are a reasonable guide to the acid generating S content of non-coal samples. Samples 17839, 20208 and 20209 have a lower proportion of pyritic S, with the acid generating proportion of S accounting for 44%, 30% and 19% of the total S, respectively.

ABCC testwork conducted on 15 of the 16 non-coal samples indicates in nine samples the ANC is associated with a range of carbonate forms (ferroan dolomite, dolomite and calcite) with high availability of at least 50% and generally greater than 90%. In six samples (17833, 17839, 20122, 20123, 20132 and 20148) siderite was the main carbonate present with low availability of 33% or less.

Samples 17833, 17975, 17806, 17807, 18020 and 20208 had positive NAPP values but NAGpH values greater than 4.5, thus plotting in the upper right hand uncertain classification domain. However, their NAPP values are negative (with the exception of sample 17807) when estimated based on pyritic S (from S speciation testing) and effective ANC (from ABCC testwork), which is consistent with the NAGpH results. The recalculated NAPP estimate for sample 17807 suggests this sample may be PAF-LC.

Results suggest that the total S in non-coal samples is likely to be mainly pyritic, and that coal samples are likely to include a higher proportion of non-pyritic S forms. Assessment of sulphur speciation results in conjunction with ABCC testing suggests that most non-coal samples plotting in the upper right hand uncertain domain (refer Figure 14 and Figure 15 in Section 5.3) are likely to be NAF.

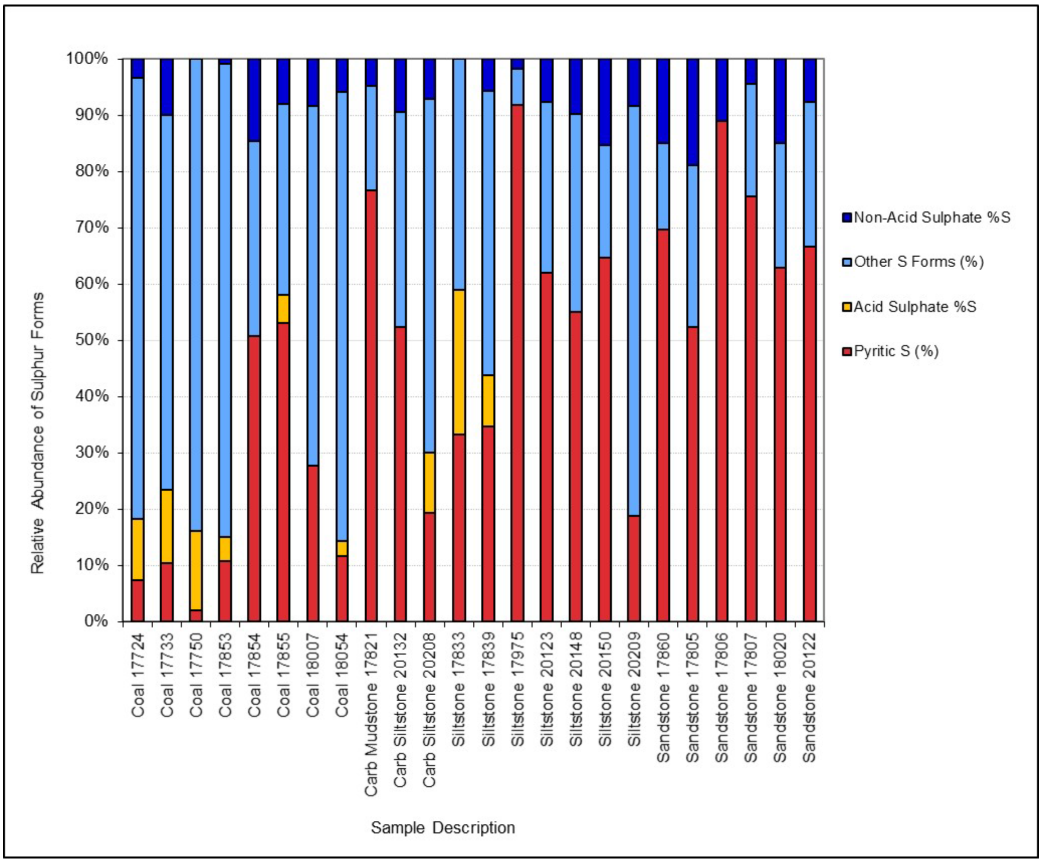

Figure 16: Relative proportions of S forms for selected samples as indicated by sulphur speciation testing.

5.8 Multi-Element Analysis of Solids, Water Extracts and Peroxide Extracts

Multi-element testing was biased towards samples with higher S contents to obtain information on elemental enrichment and mobility of materials with higher ARD potential.

Results of multi-element scans of solids from 36 selected samples were compared to the median soil abundance (from Bowen, 1979) to highlight enriched elements. The extent of enrichment is reported as the Geochemical Abundance Index (GAI), which relates the actual concentration with an average or median abundance on a log 2 scale. The GAI is expressed in integer increments where a GAI of 0 indicates the element is present at a concentration similar to, or less than, median soil abundance; and a GAI of 6 indicates approximately a 100-fold enrichment above median soil abundance. As a general rule, a GAI of 3 or greater signifies enrichment that warrants further examination.

Results of multi-element analysis of solids are presented in Tables B4 and B5, Appendix B, and the corresponding GAI values are presented in Tables B6 and B7.

Most of the samples are slightly enriched in beryllium (Be) relative to median soils, samples 17750 (coal), 17852 (siltstone), 18021 (carbonaceous mudstone) and 18033 (carbonaceous siltstone) more significantly so, but they are within normal ranges for sedimentary rock. Many samples, particularly 17852 (siltstone), 18054 (Coal), 20139 (sandstone), 20168 (conglomerate) and 20195 sandstone) are also enriched in tungsten (W). Most samples also showed slight enrichment, some significant, in thallium (Tl). A number of the samples are slightly enriched in arsenic (As), samples 17838 (siltstone), 18021 (carbonaceous mudstone) and 18033 (carbonaceous siltstone) more significantly so and these are also enriched in S. The As enrichment is likely to be due to small amounts of arsenopyrite associated with pyrite or oxidation products containing arsenic. A number of samples also showed enrichment in S, which was already discussed in relation to acid forming potential. There are a few samples enriched in germanium (Ge). Samples 17837 (siltstone) and 17999 (carbonaceous siltstone) are strongly enriched in nickel (Ni), and sample 20139 (sandstone) is also significantly enriched in silver (Ag), copper (Cu) and tin (Sn).

The same sample solids were subjected to water extraction at a solids:liquor ratio of 1:2. The samples were rotated for 3 hours and allowed to sit overnight and filtered at -0.45µm. Water extracts were analysed for pH, EC, acidity/alkalinity and multi-elements. Results are shown in Table B8, Appendix B, with lithology, total S of the solid samples and their expected ARD classification provided for reference. The results provide an indication of solutes that might be released from freshly exposed NAF and PAF materials immediately following exposure to atmospheric conditions. As such, the water extractions provide an indication of the quality of drainage that might ensue a rainfall event immediately following exposure by mining.

The pH of extracts was acidic to alkaline ranging from 2.4 to 9.3. ECs were variable, ranging from non-saline to saline (0.204 dS/m to 5.9 dS/m). In general, samples expected to be PAF/PAF-LC have the highest salinities.

Twelve samples (17724, 17750, 17752, 17759, 17838, 17839, 17856, 17861, 17999, 18021, 18033 and 18066) were classified PAF/PAF-LC with total S in solids ranging from 0.20%S to 2.2%S. Ten of these samples had acidic pH extracts below 4.5 and were moderately saline to saline with EC values generally ranging from 1.3 dS/m to 5.9 dS/m. The acidic pH of these samples is associated with elevated aluminium (Al), cobalt (Co), Cu, iron (Fe), manganese (Mn), Ni, sulphate (SO_4), strontium (Sr) and zinc (Zn), and slightly elevated cadmium (Cd). Samples 17838 and 18021 also had elevated As. PAF / PAF-LC samples 17752 and 17759 (S ranging from 0.2%S to 0.4%S) had slightly acidic (pH 5.1) to alkaline (pH 7.6) pH extracts, were non-saline (EC 0.204dS/m) to slightly saline (EC 0.8dS/m), with sample 17759 showing slightly elevated SO_4, and did not show elevated concentrations of metals / metalloids.

The remaining 24 samples were classified as non-acid forming. Six of these samples (17805, 17847, 17851, 17852, 17886 and 20208) had slightly acidic pH extracts (pH 4.7 to pH 5.95), were moderately saline to saline (EC 1.144dS/m to 3.74dS/m) and showed elevated Fe, SO_4 and Sr concentrations. Sandstone sample 17805 with a high S of 3.39%S also showed elevated concentrations of Co, Mn, Ni, Sr and Zn. The remaining 18 non-acid forming samples (17745, 17785, 17787, 17806, 17821, 17837, 17979, 18004, 18054, 20122, 20123, 20132, 20139, 20148, 20150, 20168, 20195 and 20209) had circum-neutral to alkaline pH extracts, varied from non-saline to moderately saline and generally showed a lack of elevated metals/metalloids concentrations.

Peroxide extraction tests were carried out on a total of 25 samples, with 15 samples representing sandstone/siltstone overburden, six samples representing carbonaceous material, and four coal samples. The peroxide extractions were based on the single addition NAG test, which involves reaction of a sample with hydrogen peroxide to rapidly oxidise any sulphides that are present. Normally only the pH and acidity of the NAG solution are measured following the oxidation stage, but with these tests a sub-sample of the NAG solution was filtered at 0.45µm and then assayed for multi-elements to determine the extent of elemental release from overburden and coal rock when exposed to oxidising conditions. As such, the peroxide extractions provide an indication of the quality of drainage that might be produced from rock with prolonged exposure conducive to sulphide oxidation.

The peroxide extraction procedure is particularly relevant to mine rock with higher sulphide content, which can undergo significant geochemical change over time when exposed to atmospheric conditions. For PAF samples, the oxidation of sulphide can result in acidification and mobilisation of environmentally important metals that typically become soluble under low pH conditions, however peroxide extraction is also applicable to sulphidic NAF materials as it provides an indication of the potential for mobilisation of elements such as metalloids that are commonly more soluble under circum-neutral and alkaline conditions.

The compositions of the peroxide extracts are given in Appendix B, Table B9. When assessing the results, it should be noted that the actual concentrations of elements in a peroxide extract are directly related to the volume of peroxide used per unit weight of sample. The method involves a leach ratio of 100 mL/g which is high in comparison to leach rates typically encountered under field conditions, as well as rates typically used in column leach tests. For example, the column leach tests routinely run by EGi typically average around 75 mL/kg/week, which over a five year period (for example) equates to a leach ratio of around 20 mL/g. As such, it can be expected that the peroxide extracts represent a diluted condition in comparison to the “average” leachate quality that might be expected from the same samples under standard column leach test conditions.

Therefore, to make the results more meaningful for the field situation, EGi typically apply a scaling factor to concentrations reported for peroxide extracts. From past experience, EGi has determined that concentrations in peroxide extractions carried out at a liquor to solid ratio of 100 mL/g are typically between 5 to 10 times lower than average concentrations typically recorded for leachates from the same materials in standard column leach tests. Therefore, peroxide extract concentrations typically need to be increased in the order of 5 to 10-times to provide a reasonable guide to what might be expected from column leach tests. As no kinetic leach column data are currently available for HVO overburden and coal samples, a scaling factor of 10 was arbitrarily applied to the peroxide extract results. Figure 17 shows a statistical summary of the peroxide extract results with the scaling factor applied.

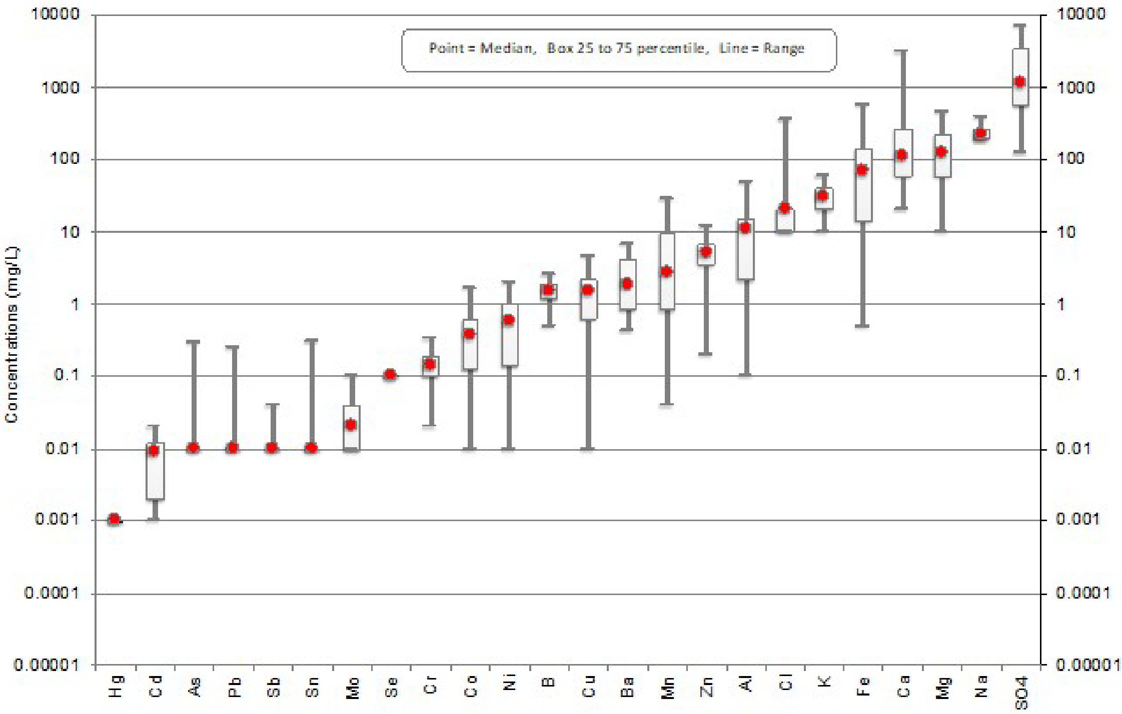

Figure 17. Box plot of elemental concentrations in peroxide extracts scaled 10-times

The majority of the samples selected for extraction using peroxide were classified as PAF or PAF-LC, and when reacted they acidified to less than pH 4.5. There were also three NAF samples with higher sulphur contents. The concentrations of SO_4 in the peroxide extracts varied widely consistent with the wide-ranging sulphur contents of the samples tested. The scaled SO_4 concentrations ranged from only 120 mg/L for sample representing low sulphur coal, up to 7,140 mg/L for a sample representing PAF sandstone that contained 3.4 %S. The median SO_4 concentration for all samples tested was 1,120 mg/L. There was also significant release of Fe (typically around 100 mg/L), which is directly related to pyrite oxidation, as well significant releases of calcium (Ca) and magnesium (Mg) from most of the samples, with median concentrations in the extracts of 110 and 120 mg/L, respectively. It can be expected that much of the Ca and Mg would have been released as a consequence of the acid generated by sulphide oxidation reacting with carbonate bearing minerals responsible for sample ANC.

There were elevated concentrations of Al, Zn, Mn and Cu with scaled concentrations typically in the 1 to 10 mg/L range, slightly elevated concentrations of Ni, chromium (Cr) and Co with scaled concentrations typically in the 0.1 to 1 mg/L range.

There were trace concentrations of As and Cd in the peroxide extracts of coal samples, but for most other samples the concentrations were less than detection. Similarly, for most samples the concentrations of Sb, mercury (Hg), lead (Pb), selenium (Se) and Sn were typically less than the limits of analytical detection.

Overall, the results of the water and peroxide batch leach tests indicate that significant metal/metalloid release from materials represented by the samples tested would only be associated with generation of ARD. The solubility of metals/metalloids will largely be determined by pH and therefore prevention of acid generation will effectively control metal/metalloid leaching.

Extracts from low S NAF materials indicated that circum-neutral leachates from these materials are unlikely to contain significant metal/metalloid concentrations, but elevated SO_4 may occur from NAF materials with significant pyrite.

Extracts show that metal/metalloid release associated with any ARD generated from pyritic materials would include Al, Cd, Co, Cr, Cu, Fe, Mn, Ni, Sr and Zn, and possibly As at low pH (less than 3).

5.9 Sample Classification and Distribution of ARD Rock Types

The results and discussions presented above were used to classify samples as NAF, NAF high sulphur (NAF-HS), PAF, PAF-LC or UC in Table B1 (Appendix B). NAF-HS samples are defined as NAF samples having a total S content greater than 1%, with potential to leach salinity and elevated metals. PAF-LC samples are defined as PAF samples having an acid capacity of 5 kg H_2SO_4/t or less. All samples with S values of less than or equal to 0.05%S were classified NAF due to the negligible risk of acid formation.

The dataset of 401 overburden, interburden and coal samples with full geochemical testing was used to determine whether total S alone could be used as an indicator of ARD potential. Figure 18 is a box plot showing the S distribution for all samples classified as PAF, PAF-LC or NAF (including NAF-HS), split into overburden/interburden and coal groupings. The figure shows that for overburden/interburden materials, a total S cut-off of 0.2%S discriminates well between NAF and PAF-LC / PAF samples, with over 90% of NAF samples having less than 0.2%S, and approximately 90% of PAF-LC and all PAF samples having over 0.2%S. However, total S is a poor discriminator for coal materials due to the presence of organic S, and NAF and PAF-LC / PAF classes show considerable overlap in S values.

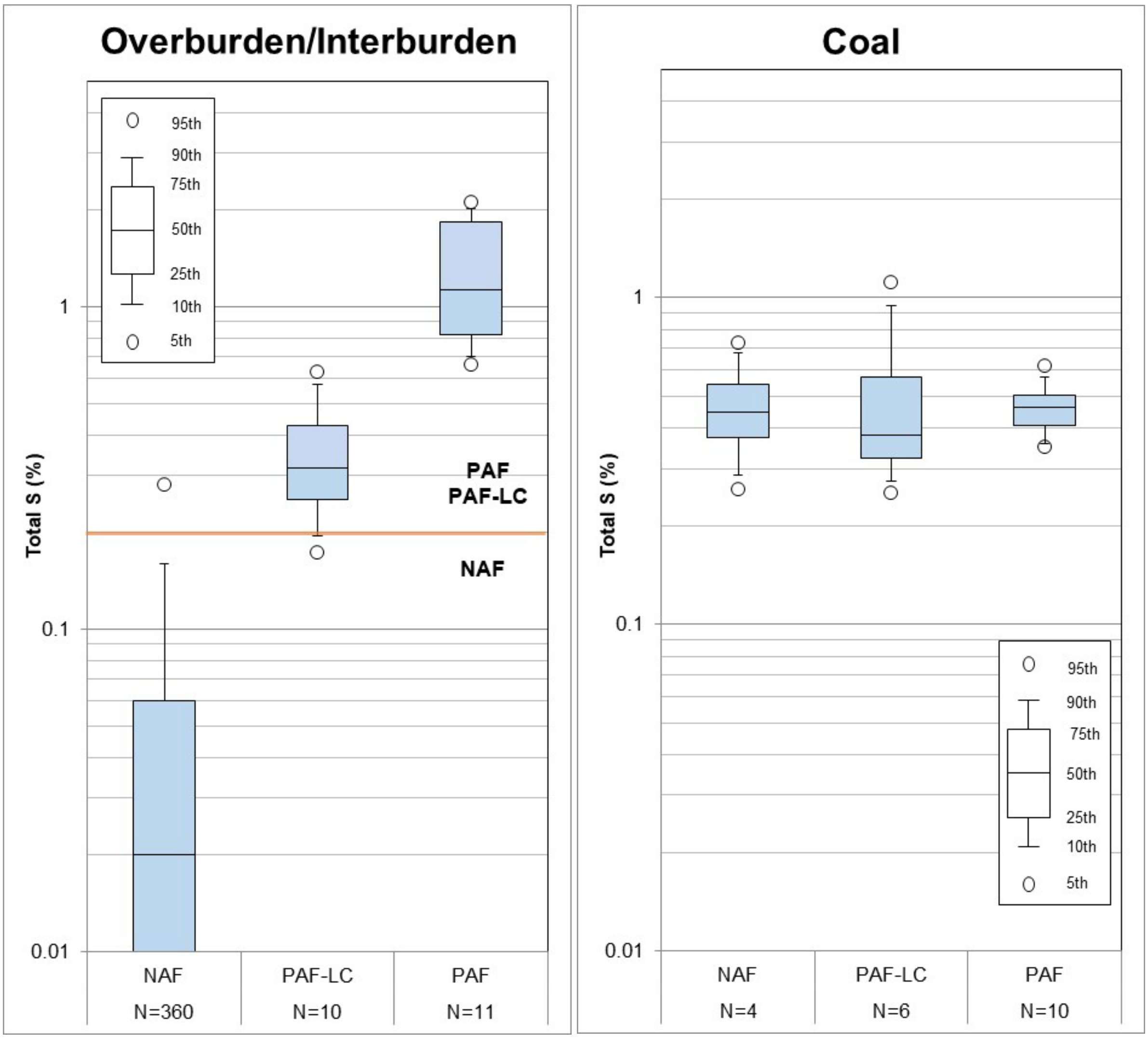

Figure 18: Box plot showing the distribution of S for overburden/interburden and coal materials as a function of ARD classification. Box plots show 5th, 10th, 25th, 50th (median), 75th, 90th and 95th percentiles.

Final sample classifications were based on the full geochemical testing where available. For non-coal samples with S testing only (being roof and floor samples from coal quality testing data), the S cut off indicated in Figure 18 was applied, so that those samples with S values of less than or equal to 0.2 %S were classified NAF and those with S greater than 0.2 %S were classified PAF. Coal samples were only classified where full geochemical testing was available.

Table 1 shows the approximate breakdown of geochemical rock types for the Project target stratigraphy overall and for HVO North and HVO South target stratigraphies separately based on the sample intervals tested to date (not taking spatial distribution or mining blocks into account) for overburden/interburden and the immediate non-coal roof, floor and partings of seams. Note that results from HVO North holes were used for HVO South where they covered the relevant stratigraphy, and vice versa.

Table 1: Geochemical breakdown for overburden/interburden and roof/floor materials for samples tested.

Mine (with included stratigraphy indicated)	Material Type	ARD Classification	
		NAF Incl. NAF-HS, UC(NAF) and UC(NAF-HS)	PAF / PAF-LC Incl. UC(PAF) and UC(PAF-LC)
HVO North (Stratigraphy from below Barrett to above Piercefield Seam Groups)	Overburden / Interburden	97%	3%
	Roof / Floor / Partings	49%	51%
HVO South (Stratigraphy from below Bayswater to above Glen Munro Seam Groups)	Overburden / Interburden	99%	1%
	Roof / Floor / Partings	59%	41%
HVO North and South (Stratigraphy from below Barrett to above Glen Munro Seam Groups)	Overburden / Interburden	97%	3%
	Roof / Floor / Partings	52%	48%

Overall, the estimated proportions of ARD classes indicate that the vast majority of overburden / interburden is likely to be NAF, with PAF/PAF-LC materials estimated to be less than 5%. In contrast, approximately half of seam roof, floor and partings materials is likely to be PAF/PAF-LC, with NAF materials estimated to be approximately 50%. Seam roof, floor and partings are generally thin (less than 0.3 m) and are expected to report to raw coal rather than to the overburden / interburden waste dumps.

The majority of coal samples tested were PAF/PAF-LC, however only a limited number of coal intervals were available for sampling and testing as most had previously been removed for coal quality testwork, and the coal intervals that were available were from a limited number of seams and not representative of all the seam groups to be extracted at HVO.

Table 1 also shows that NAF materials make up a slightly higher proportion of the overburden / interburden for the stratigraphy to be mined at HVO South (99%) compared to that to be mined at HVO North (97%). Similarly, NAF materials make up a slightly higher proportion of the seam roof, floor and partings materials for the stratigraphy to be mined at HVO South (59%) compared to that to be mined at HVO North (49%).

Figure 19 to Figure 23 show down hole profiles of total S, ANC and NAPP values for each of the holes tested, with the stratigraphic position of coal seams plotted for reference. The plots also show sample ARD classifications for each parameter, with NAF (including UC(NAF) and NAF-HS) samples represented as blue symbols, PAF-LC (including UC(PAF-LC)) samples as orange symbols, and PAF (including UC(PAF)) samples as red symbols. Note that many of the coal quality samples were not tested and classified by EGi, but total S results were available, providing a guide to the presence of pyritic horizons. These samples are shown as black symbols on the total S profiles. Also note that drill holes 4505C and G3 were sampled continuously for their entire length and drill hole 4073C was also sampled continuously but only from the Piercefield Seam Group and above; whereas for drill holes 4095C and GHD23 only selected intervals were sampled.

The profiles emphasise the preferential distribution of higher total S and PAF/PAF LC samples in distinct zones associated with coal seams, coal seam partings, and immediate roof and floor. The vast majority of overburden/interburden is NAF with low S (more than 75% have less than 0.1%S) and with a median ANC of

30 kg H_2SO_4/t. The PAF/PAF-LC intervals of seam roof, partings and floor are generally thin, and dilution and mixing during mining is expected to be sufficient to negate any serious ARD risk from these materials if they were to report to overburden. Results to date indicate that the key pyritic zones outside of the coal to be mined are associated with the following stratigraphy:

- Roof with 1m of Broonie 3 Seam top
- Interburden between Broonie 4A and 5A Seams
- Archerfield Sandstone, particularly within 5m of the Lemington A Seam roof
- Roof within 1 to 2m of Lemington A Seam top (overlapping with the Archerfield Sandstone)
- Floor within 0.5m of Lemington A Seam base
- >6m thick unit approximately 1m below the base of the Barrett Seam

Overall, results of geochemical testing together with visual inspection of holes 4505C, G3, 4095C, GHD23 and 4073C as part of this study indicate that overburden/interburden will be mainly NAF, with excess acid buffering. The main pyritic zone in overburden/interburden is the interburden between the lower seam of the Bayswater Seam Group and the upper seam of the Lemington Seam Group, including parts of the Archerfield Sandstone and Lemington A Seam roof.

The Project will involve development to the base of the Barrett Seam at HVO North. As discussed in Section 2, results to date suggest that the immediate floor of the Barrett is not highly pyritic, however, strong pyrite was observed 1m or so below the floor, indicating ARD potential close to the final pit floor, and possibly at the base of the Barrett Seam in part. The overall ARD potential of the final floor of the HVO North pit would require further assessment during operations. The findings also would have implications if development was extended to below the Barrett Seam.

Given the expected high proportions of NAF (over 97% in the sample set tested) relative to PAF (less than 3%), operational blending of NAF and PAF overburden/interburden together with the excess alkaline leachate from NAF materials is expected to be a generally robust approach to controlling ARD from PAF materials. However, there are pyritic units in the stratigraphy that should be actively excluded from near final surface placement to avoid development of pyritic hot spots and potential local impacts on rehabilitation success.

Low ARD risk (NAF) materials should be specifically targeted for placement on the upper 5 metres or more of overburden dumps and any cover systems for tailings facilities. Low ARD risk materials could include, but would not be limited to:

- overburden/interburden generally from the upper stratigraphic sequence from 1m above the Mt Arthur Seam and upwards which appears to be almost all NAF with a very low potential for ARD with a freshwater dominated depositional environment; and
- other reasonably thick (>10m) interburden units lower in the stratigraphic sequence that appear to have low ARD potential include, but are not limited to:
    - Interburden between the Vaux and Broonie Seam Groups excluding 1m from Vaux Seam Group floor and 1m from Broonie Seam Group roof
    - Interburden between the Lemington and Pikes Gully Seam Groups excluding 2m from Lemington Seam Group floor and 1m from Pikes Gully Seam Group roof
    - Interburden between the Pikes Gully and Arties Seam Groups excluding 1m from Pikes Gully Seam Group floor and 1m from Arties Seam Group roof
    - Interburden between the Liddell and Barrett Seam Groups excluding 1m from Liddell Seam Group floor and 1m from Barrett Seam Group roof
- materials outside of the above zones if it can be demonstrated that operational blending is sufficient to control ARD from any contained PAF zones.

By contrast, the interburden between the base of the Bayswater Seam Group and the Lemington Seam A, which includes the Archerfield Sandstone, have had some marine influence during deposition and greater ARD potential, and should be placed within the bulk fill zone of the dump. In addition, limited testing to date suggests coal seams and/or immediate roof and floor contain some proportion of PAF, and it should be assumed that where coal plies, and immediate roof and floor are treated as waste rock, that they also be placed in the bulk fill zone

The stratigraphic trends in ARD potential indicated in results to date are limited to individual holes and have not been correlated across the site. These trends should be confirmed with visual inspection of stored core and/or new core supported with S testing as required.

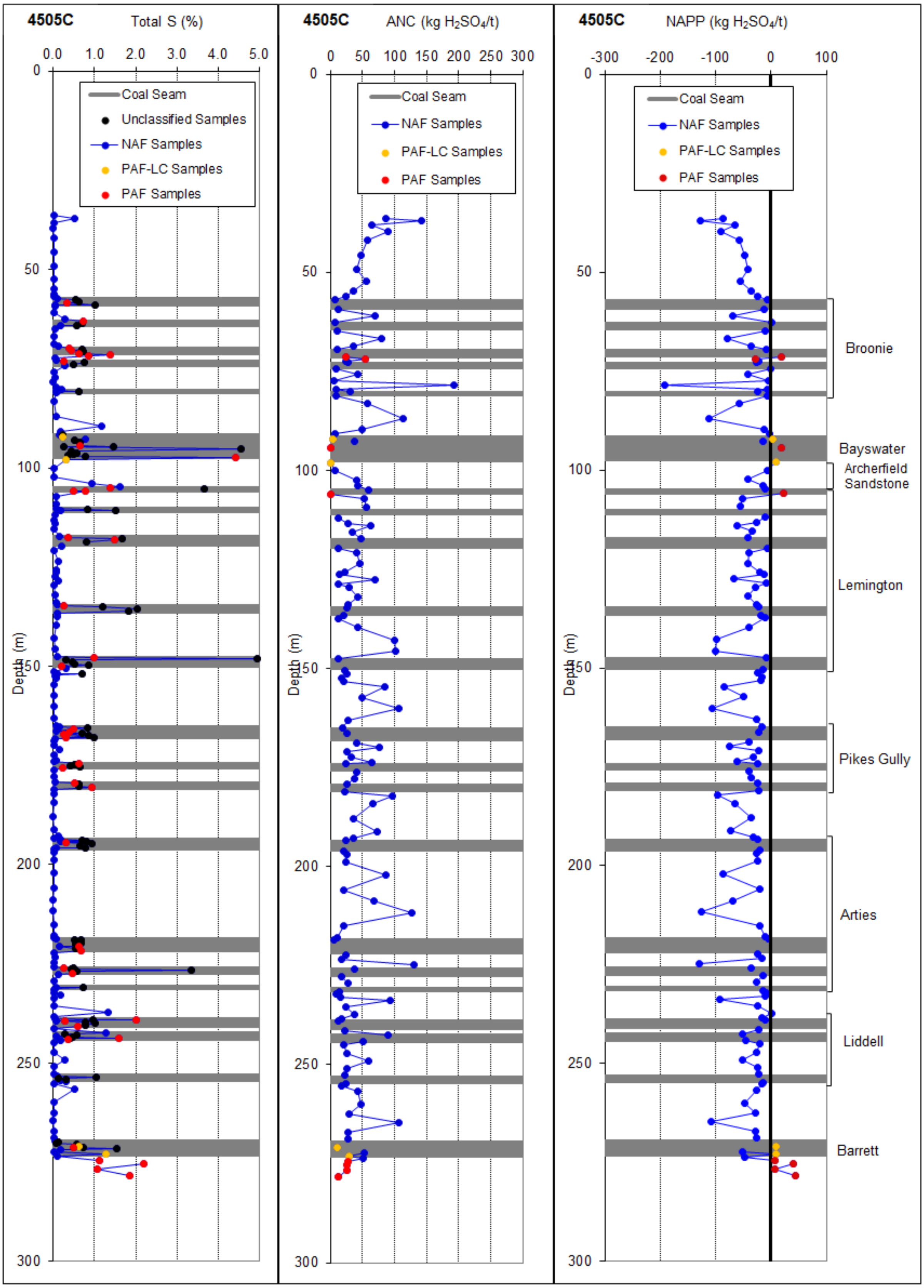

Figure 19: Total S, ANC and NAPP profiles for hole 4505C.

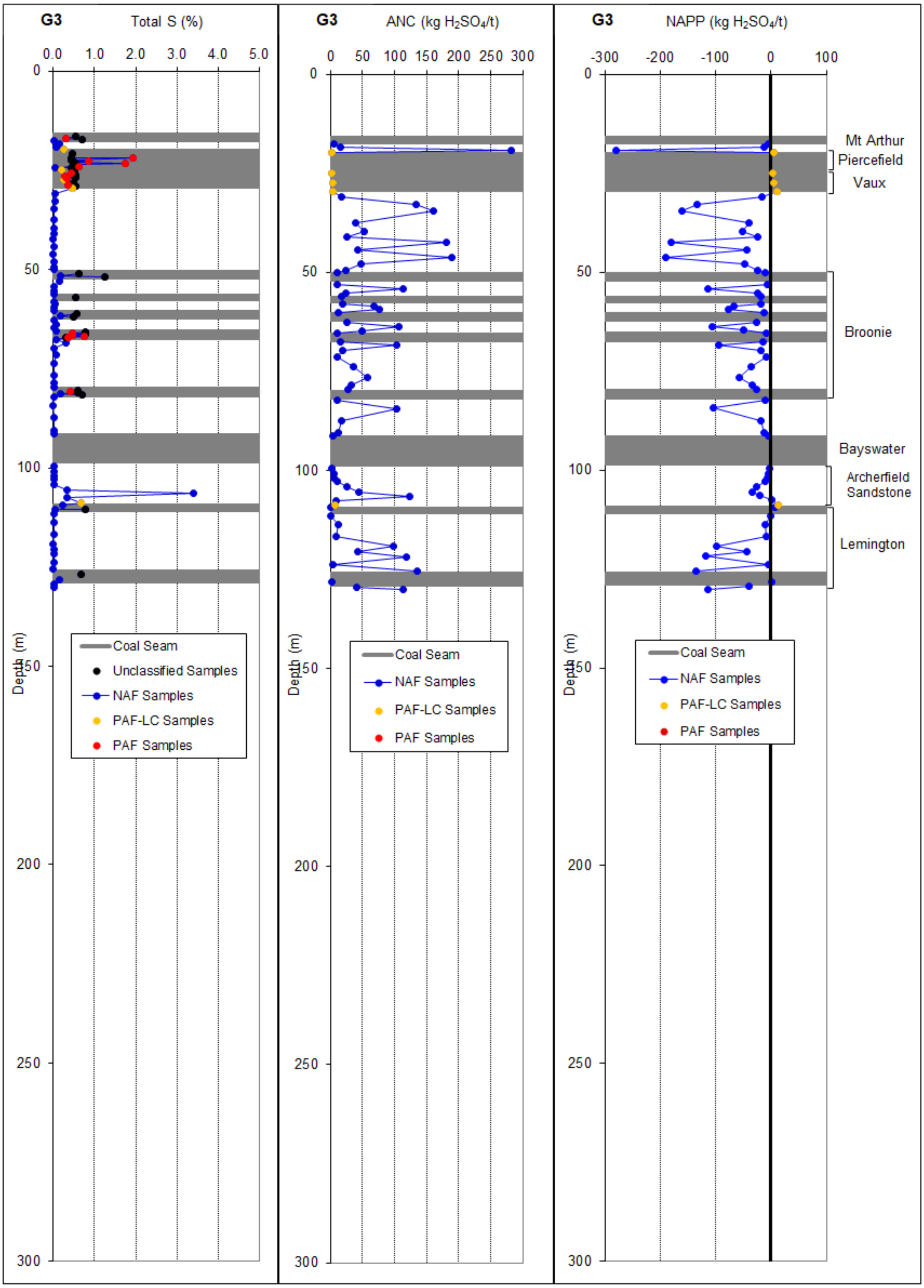

Figure 20: Total S, ANC and NAPP profiles for hole G3.

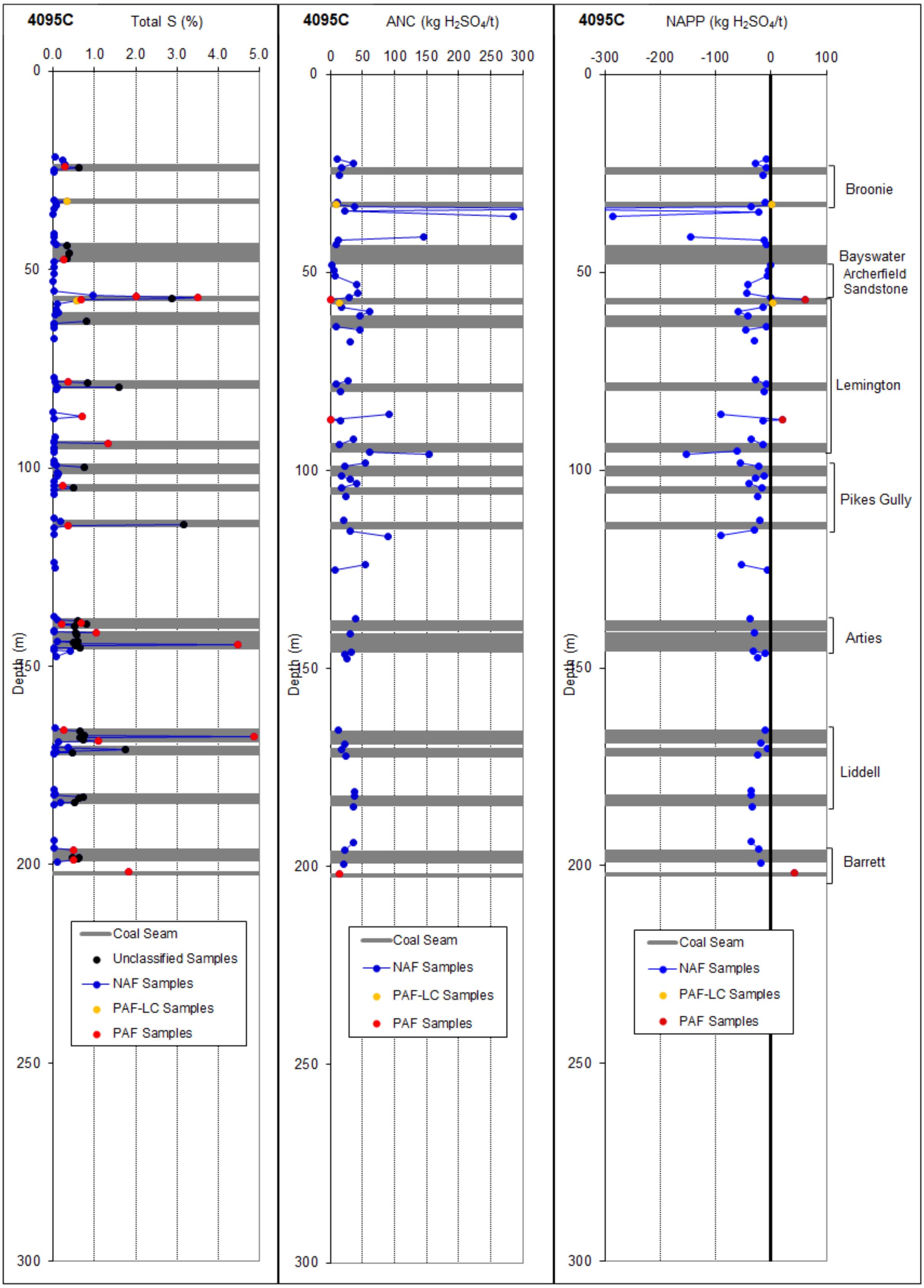

Figure 21: Total S, ANC and NAPP profiles for hole 4095C.

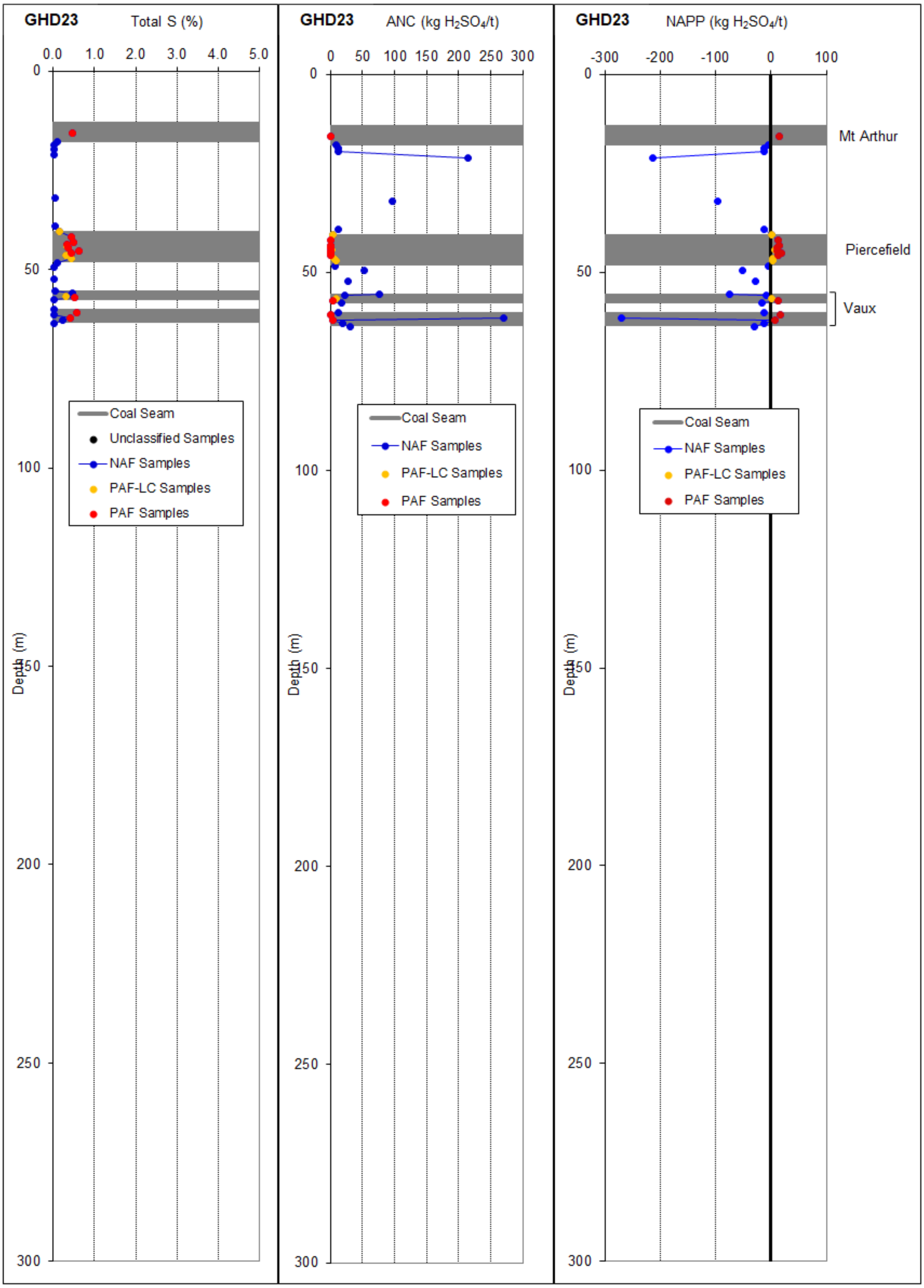

Figure 22: Total S, ANC and NAPP profiles for hole GHD23.

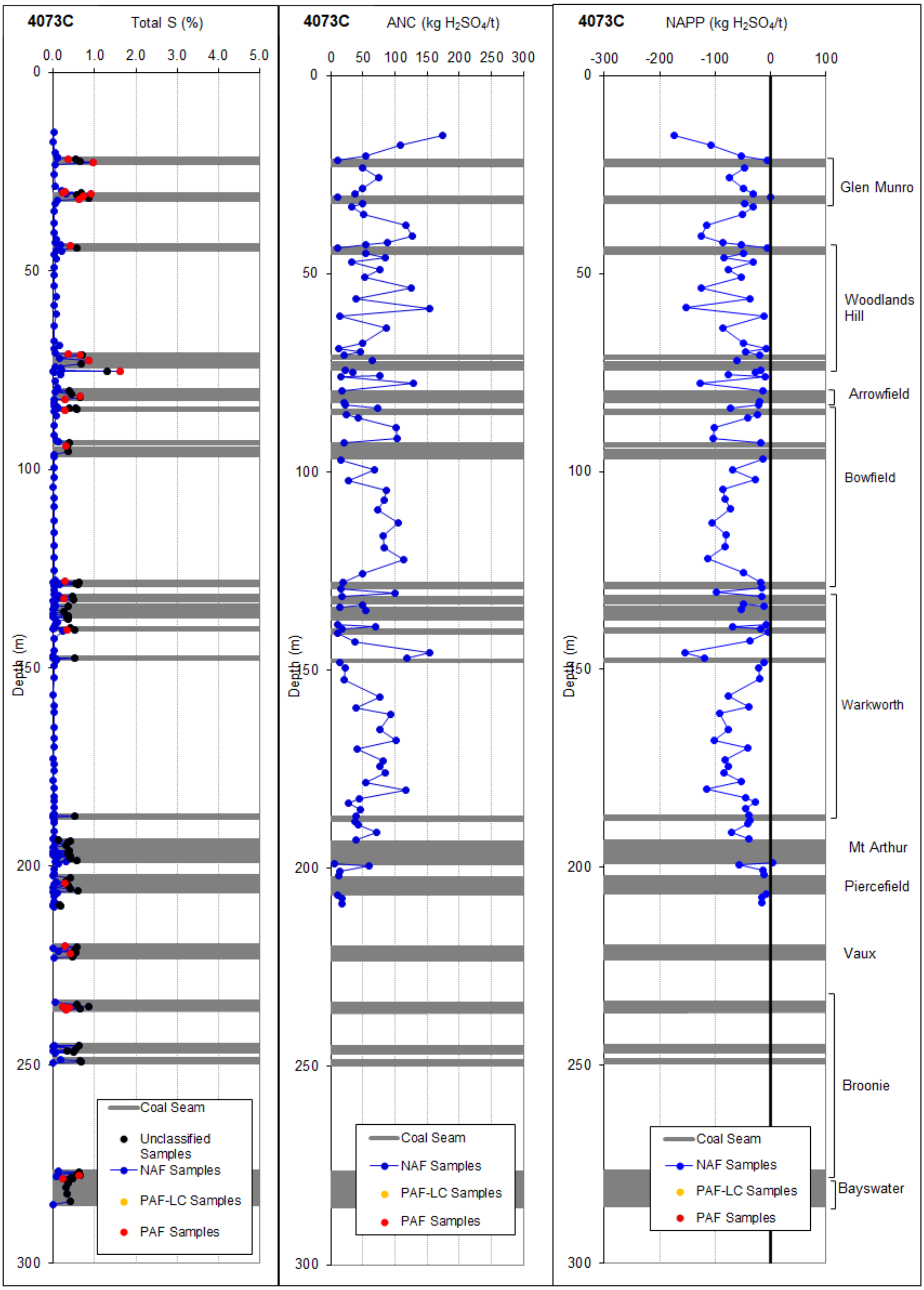

Figure 23: Total S, ANC and NAPP profiles for hole 4073C.

6. Geochemical Characterisation of Washery Wastes

Acid forming characteristics of the 59 selected rejects and tailings samples are presented in Appendix B, Table B10, comprising pH and EC of water extracts, total S, maximum potential acidity (MPA), ANC, NAPP, ANC/MPA ratio and single addition NAG. Results are discussed in the following subsections.

6.1 pH and EC

A total of 58 samples were tested for $pH_{1:2}$ and $EC_{1:2}$. The $pH_{1:2}$ values ranged from 4.4 to 8.7, with all except three of the samples having a pH of 6.8 or greater and showing no inherent acidity. The three exceptions had slightly acidic pH of between 4.4 and 5.3, and were all higher S (>0.9%S) rejects samples. $EC_{1:2}$ values ranged from 0.24 to 4.27 dS/m, with the majority (approximately 85%) of tailings samples falling within the saline to strongly saline range with Ecs of 1.6 dS/m or greater, but with the majority (approximately 75%) of rejects samples falling within the non-saline to slightly saline range with Ecs of 0.8 dS/m or less. Eight rejects samples (all with moderate to high total S above 0.5%S) had moderately saline to saline Ecs above 0.8 dS/m.

Results suggest high leachable salinity in tailings materials likely derived from CPP process waters, but low leachable acidity and salinity in rejects materials represented by these samples except where pyrite is present and it has partially oxidised.

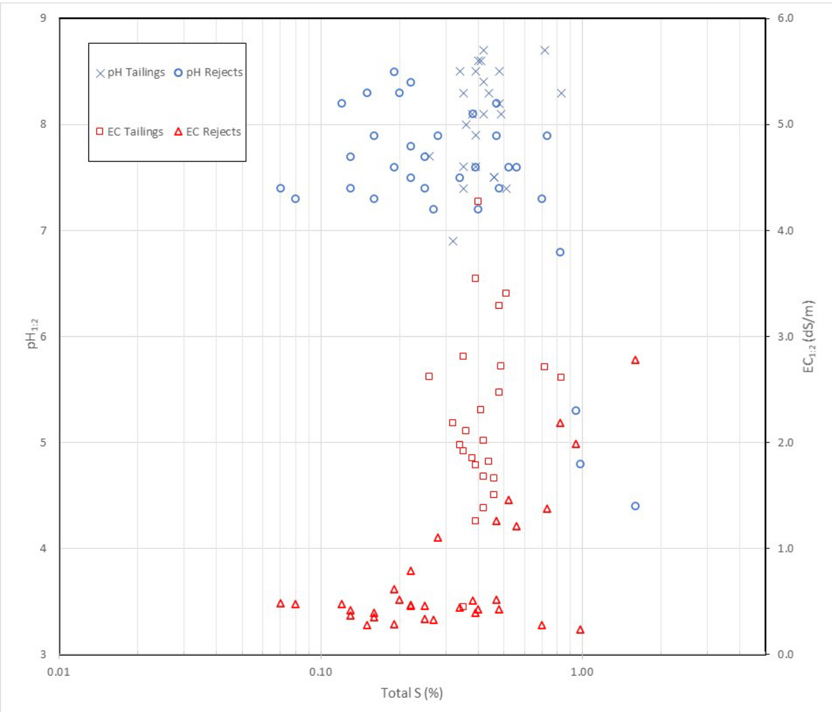

Figure 24: Plot showing $pH_{1:2}$ and $EC_{1:2}$ versus total S for rejects and tailings samples.

6.2 Acid Base NAPP Results

Leco total S was tested on the 59 selected rejects and tailings samples and ranged from 0.07 %S to 1.59 %S. Figure 25 is a box plot of the distribution of S, split by waste stream for the samples tested. The plot shows that there is considerable variation in the total S of rejects with values overall ranging from 0.07 %S to 1.59%S, and with a low median S of 0.26%S. The total S of tailings shows significantly less variability overall ranging from 0.26 %S to 0.83 %S but with 80% of samples (from 10th to 90th percentiles) in the narrow range 0.35 %S to 0.5 %S. The median total S for tailings is higher than that of rejects, but is still low at 0.41%S.

In addition to total S of rejects and tailings, site testing of the slightly larger screening set of washery waste samples also included total S of the fine fraction (<1.25mm) of rejects. Total S of the coarse fraction (>1.25mm) of rejects was then calculated on a proportional basis given that rejects overall are nominally made up of approximately 85% coarse rejects and 15% fine rejects. Site total S results are presented in Table B11 Appendix B and Figure 26 is a box plot of the distribution of S, split by waste stream and reject fraction. Results show that S preferentially reports to fine rejects stream with a median of 0.67%S compared to medians of 0.15%S for the coarse reject stream and 0.26%S for rejects overall.

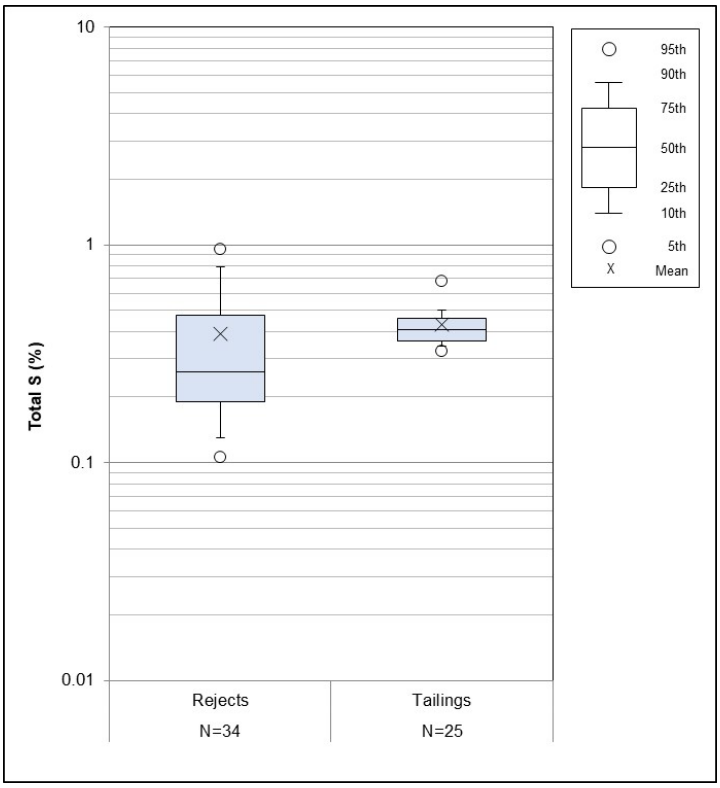

Figure 25: Box plot showing the distribution of S (as tested by EGi) split by rejects and tailings samples. Box plots show 5th, 10th, 25th, 50th (median), 75th, 90th and 95th percentiles and means.

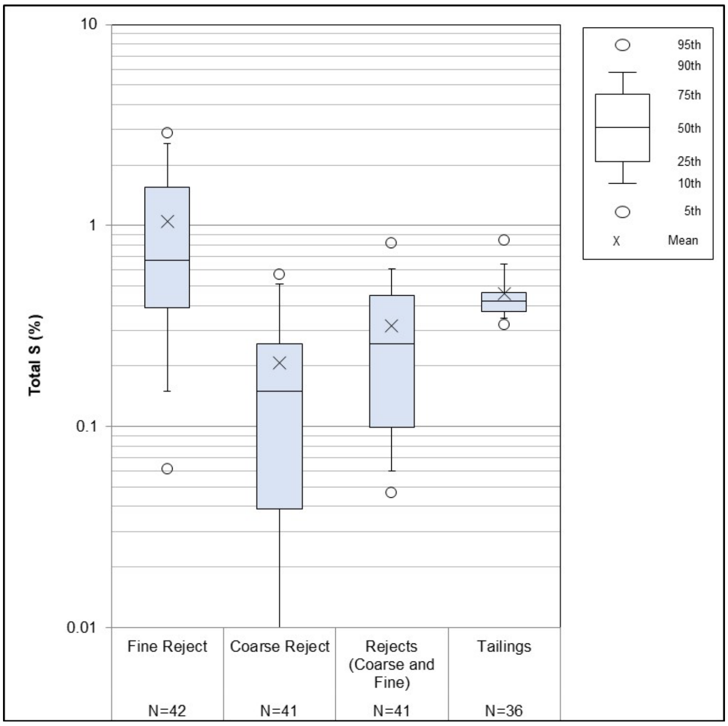

Figure 26: Box plot showing the distribution of S (as tested by site) split by waste stream. Box plots show 5th, 10th, 25th, 50th (median), 75th, 90th and 95th percentiles and means.

ANC was tested on the 59 selected rejects and tailings samples. The ANC was generally low to moderate but ranging up to 72 kg H_2SO_4/t. Figure 27 is a box plot of the distribution of ANC, split by waste stream. Rejects samples have a moderate median ANC value of 21 kg H_2SO_4/t, with the ANC of most samples (approximately 80%) in the range 15 to 30 kg H_2SO_4/t. Tailings samples have a low median ANC value of 7 kg H_2SO_4/t, with the ANC of most samples (approximately 80%) in the range 5 to 15 kg H_2SO_4/t.

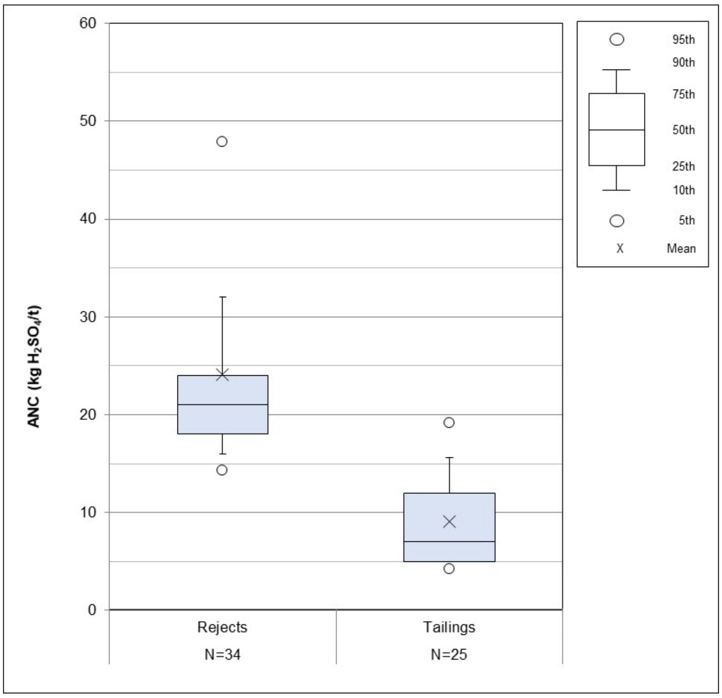

Figure 27: Box plot showing the distribution of ANC split by rejects and tailings samples. Box plots show 5th, 10th, 25th, 50th (median), 75th, 90th and 95th percentiles and means.

Figure 28 is an acid-base account plot of ANC versus total S, with results split by waste stream. NAPP values were calculated for the 59 samples. The results show that approximately 80% of rejects samples tested plot in the NAPP negative domain, with 75% of those also having ANC/MPA ratios of 2 or more, indicating a high factor of safety. Six rejects samples plot in the NAPP positive domain. In contrast, approximately 75% of tailings samples tested plot in the NAPP positive domain. Only six tailings samples plot in the NAPP negative domain, with just one of those also having an ANC/MPA ratio of 2 or more. The plot highlights the higher S and lower ANC in the tailings relative to the rejects, as described above.

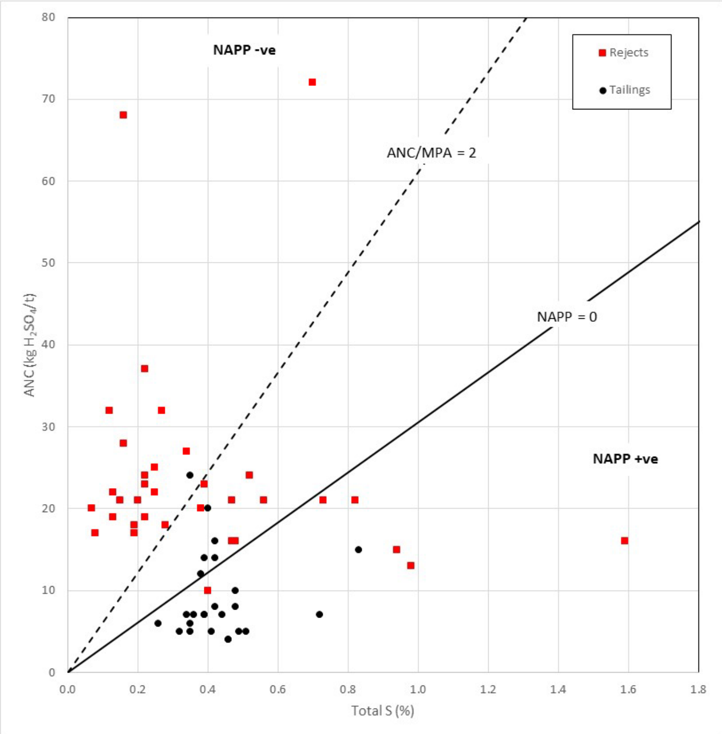

Figure 28: Acid base account (ABA) plot showing ANC versus total S split by rejects and tailings samples.

6.3 Single Addition NAG Results

NAG testing was conducted on the 59 selected samples. Of these, 39 samples (65%) had NAGpH values of 4.5 and greater, indicating they are likely to be non-acid forming (NAF). The remaining 20 samples, including most (almost 70%) of the tailings samples, had NAGpH values less than 4.5, but due to the carbonaceous nature of these materials the results are inconclusive in isolation due to potential organic acid effects that may contribute acidity to the sample liquor in addition to that released from sulphide oxidation.

Figure 29 is an ARD classification plot showing NAGpH versus NAPP value, with results split by waste stream. The plot shows that 33 samples (just over half of all samples) plot in the NAF domain (of which 85% are rejects), with 19 samples plotting in the PAF domain (of which 90% are tailings), 1 sample plotting in the lower left uncertain domain and 5 samples plotting in the upper right uncertain domain.

Thirty of the 33 samples that plot in the NAF domain have a relatively low total S of 0.5%S or less. Samples 20573 and 20583 had higher total S values of 0.52%S to 0.56%S respectively and ANC/MPA ratios less than 2, and S speciation and ABCC testing was carried out to confirm that buffering was sufficient to account for acid generated from these samples.

All of the 19 samples that plot in the PAF domain showed organic acid effects in the NAG test and thus NAG results are likely to overestimate their acid potential. The one sample plotting in the lower left uncertain domain, tailings sample 20611, also showed organic acid effects in the NAG test. Samples showing organic acid effects are shown in red text in Table B10 (Appendix B). Extended boil and calculated NAG testing was carried out on all of these samples, and S speciation and ABCC testing on a subset, to help define the geochemical properties of these samples and resolve uncertainties in their classification.

Three of the six samples plotting in the upper right uncertain domain have low total S of 0.36 to 0.48%S, low ANC values of 7 to 10 kg H_2SO_4/t, and NAGpH values greater than 4.5. The NAG test would normally account for most of the pyritic S in these samples and they are expected to be NAF. ABCC and S speciation testing was carried out on these samples to confirm their NAF classification, and on the remaining three samples plotting in the upper right uncertain domain to help resolve uncertainties.

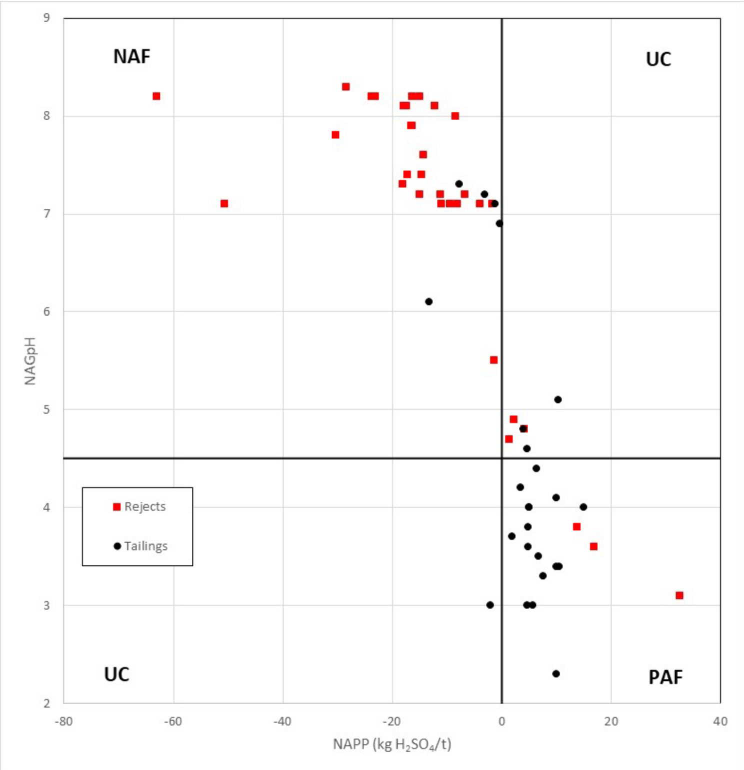

Figure 29: ARD classification plot showing NAGpH versus NAPP split by rejects and tailings samples, with ARD classification domains PAF, NAF and UC included for reference.

6.4 Extended Boil and Calculated NAG Results

Extended boil and calculated NAG testing were carried out on 17 selected tailings and 3 selected rejects samples to help resolve uncertainties in ARD classification based on standard NAG test results, as discussed above. Results are shown in Table B12, Appendix B.

Results show that the NAGpH value for all samples increases after the extended boiling step, mostly by 1 or more pH units, thus confirming the effects of organic acids. The extended boil NAGpH of two samples (20559 and 20593) remained less than 4.5, indicating these samples are likely to be acid producing. Although the extended boil NAGpH value can be used to confirm samples are PAF, where the extended boil NAGpH value is greater than 4.5 the calculated NAG value is required to confirm ARD classification.

The calculated NAG values for ten of the samples were positive, indicating these samples are likely to be acid producing. Of those, samples 20598, 20601, 20602, 20604 and 20615 had acid potentials of 5 kg H_2SO_4/t or less, and are classified PAF-LC. Samples 20559, 20561, 20593, 20606 and 20619 had acid potentials greater than 5 kg H_2SO_4/t and are classified PAF.

The calculated NAG values for the remaining ten samples were negative or equal to zero, indicating that all acid generated in the standard NAG test for these samples was organic, and that materials represented by these samples are unlikely to be acid producing under field conditions, and the samples were classified NAF.

6.5 ABCC Testing

ABCC testing was carried out on 15 selected rejects and tailings samples to evaluate the availability of the ANC measured. Results are presented in Figures C26 to C31, Appendix C, with calcite, dolomite, ferroan dolomite and siderite standard curves as reference.

Three of the samples, 20607 (Figure C26), 20620 (Figure C29) and 20599 (Figure C28) show strong buffering, with profiles plotting close to or between those of calcite and dolomite standard curves. For these samples the proportion of readily available ANC is elevated, ranging from 90% to 100% of the ANC.

Six samples, 20561 (Figure C28), 20573 (Figure C30), 20590 (Figure C31), 20593 (Figure C28), 20596 (Figure C28) and 20621 (Figure C27), have profiles that plot between the dolomite and ferroan dolomite standard curves. The readily available ANC portion for these samples was also generally high ranging from 70% to 100% of the total ANC, with reaction rates likely to be slower than dolomite.

Samples 20563 (Figure C29), 20565 (Figure C27), 20583 (Figure C29), 20584 (Figure C29) and 20602 (Figure C26), have profiles that plot close to the ferroan dolomite standard curves. Results indicate slow reactivity with an effective ANC of around 55% to 75% of the total ANC.

The ABCC profile for the remaining sample 20611 (Figure C28) plots between the ferroan dolomite and siderite standard curves also indicating slow reactivity but with only around 50% of the total ANC likely to be effective.

Overall, ABCC results suggest that for most washery waste materials represented by the samples tested a moderate to high proportion of the total ANC measured is likely to be readily available but with variable reactivity.

6.6 Sulphur Speciation

Sulphur speciation testing was carried out on 19 selected rejects and tailings samples. Results are shown in Table B13, Appendix B, and the relative proportions of sulphur forms for the samples tested are indicated in Figure 30.

Ten of the samples tested were rejects. For all of these samples, results indicate that they have moderately high pyritic S values, with the acid generating proportion of S ranging from 70% to 85% suggesting that total S values are a reasonable guide to the acid generating S content of reject samples.

Nine of the samples tested were tailings samples. Results suggest that all tailings samples tested have comparatively low pyritic S values, with the acid generating proportion of S accounting for between 10% to 50% of the total S, indicating most of the S is in non-pyritic forms and most likely occurs as organic S. NAPP estimates based on total S may overestimate the acid forming potential of tailings samples.

Assessment of sulphur speciation results alone, and in conjunction with ABCC testing, was used to help resolve uncertainties in classification.

Samples 20573 and 20583 had negative NAPP values consistent with their NAGpH greater than 4.5, but with total S greater than 0.5%S and low factors of safety indicated by ANC/MPA ratios < 2 there was uncertainty with their classification. S speciation results for both of these samples indicated pyritic S contents less than 0.5%S and the NAG test would normally account for most of the pyritic S in these samples and they are expected to be NAF.

Six samples had positive NAPP values but NAGpH values greater than 4.5, thus plotting in the upper right hand uncertain classification domain. However, for two of these samples, 20607 and 20621, their NAPP values are negative when estimated based on pyritic S (from S speciation testing) and effective ANC (from ABCC testwork), which is consistent with the NAGpH results and these samples were classified NAF. For samples 20565 and 20596 their recalculated NAPP estimate remained marginally positive, however their pyritic S content was less than 0.5%S and the NAG test would normally account for most of the pyritic S in these samples and they are expected to be NAF. The remaining two samples, 20563 and 20584, have pyritic S greater than 0.5%S and the NAG test may not have accounted for all of the pyritic S. The recalculated NAPP estimates for these two samples were positive and greater than 5 kg H_2SO_4, and they are expected to be PAF.

Sample 20611 had a negative NAPP value but NAGpH value less than 4.5, thus plotting in the lower left hand uncertain classification domain. The recalculated NAPP estimate for this sample remained negative, which supports extended boil and calculated NAG results for this sample which indicated it is likely to be NAF.

In addition, extended boil and calculated NAG results for samples 20561 and 20593 indicated they are likely to be PAF, and 20602 likely to be PAF-LC. The recalculated NAPP estimates for these samples supported the classifications indicated by the extended boil / calculated NAG results.

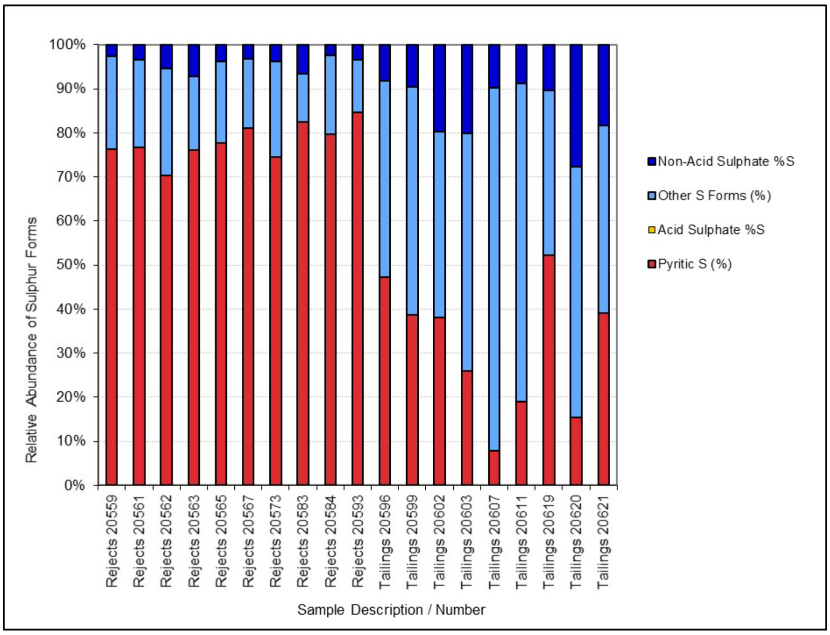

Figure 30: Relative proportions of S forms for selected samples as indicated by sulphur speciation testing.

6.7 Multi-element Testing of Solids, Water Extracts and Peroxide Extracts

Multi-element scans were carried out on solids from 6 selected rejects samples and 7 selected tailings samples. The selected samples were biased towards those with higher S contents to obtain information on elemental enrichment and mobility of materials with higher ARD potential. Results of multi-element analysis of solids are presented in Table B14 (Appendix B) and the corresponding GAI values in Table B15.

Most of the rejects samples show minor enrichment (with GAI's of 1 or 2) in Ag, As, Be, bismuth (Bi), Hg, molybdenum (Mo), S, Se, Tl and W relative to median soils, with the enrichment in As, S, Se and Tl being significant (GAI of 3 or more) in samples 20559 and 20563 (Upper Liddell and Lower Arties Seam Groups respectively). Most of the tailings samples show minor enrichment in Be, Bi, Ge, Se, S and Tl, with enrichment in S being significant in some samples.

The same rejects and tailings samples were subjected to water extraction at a solids:liquor ratio of 1:2. Results are shown in Table B16, Appendix B, with seam group, total S of the solid samples and their expected ARD classification provided for reference. The results provide an indication of solutes that might be released from freshly exposed NAF and PAF materials immediately following exposure to atmospheric conditions. As such, the water extractions provide an indication of the quality of drainage that might ensue a rainfall event immediately following exposure by mining.

The water extracts of two of the rejects samples (20559 and 20593) were slightly acidic with pH values of 4.3 and 5.5 respectively. These samples were classified PAF with total S in solids of 1.59%S and 0.94%S, and both samples were saline with EC values of 2.79 dS/m to 1.96 dS/m, respectively. The slightly acidic pHs of these samples were associated with elevated Mn (5.52 and 1.32 mg/L), SO_4 (1,810 and 1,110 mg/L) and Sr (3.65 and

1.06 mg/L). For sample 20599, Zn was also elevated (2 mg/L) and Al, Co Cu Fe Ni were slightly elevated (0.3 to 0.8 mg/L).

The extracts of the remaining 11 rejects and tailings samples were circum neutral to alkaline with pH values ranging from 6.7 to 8.8. These samples included three NAF and one PAF rejects; and five NAF, one PAF-LC and one PAF tailings samples. The EC of the rejects samples ranged from 0.876 to 2.18 dS/m, indicating rejects overall are generally moderately saline; and for tailings ranged from 1.37 to 4.29 dS/m, indicating tailings overall are generally saline. Most of these samples showed some elevation in SO_4 (ranging from 240 to 1,190 mg/L) and Sr (ranging from 0.192 to 2.95 mg/L) but otherwise there was a lack of elevated metals/metalloids concentrations.

Peroxide extraction tests were carried out on two rejects and four tailings samples. Four of the samples were classified as PAF or PAF-LC. The other two samples were classified NAF but had moderate sulphur contents. The compositions of the peroxide extracts are given in Appendix B, Table B17. As discussed in Section 5.8, peroxide extract concentrations typically need to be increased by a factor of 5 to 10-times to make the results more meaningful relative to the field situation. For the overburden samples (Section 5.8) a factor of 10 was applied, however for the six washery waste samples, there was clear evidence of organic acids being produced by the reaction of the peroxide with carbonaceous matter, which is a common artefact of the method when testing coal washery wastes which is unrelated to sulphide oxidation and the generation of ARD (refer Section 6.4). The additional acidity associated with organic acids typically results in a lower pH than would otherwise be expected from sulphide oxidation alone, and the lower pH can unduly effect the solubilities of some elements, in particular metals. Furthermore, dissolved organic acids have the capacity to form highly stable complexes with Fe, which further enhances the solubility of Fe above what would normally be expected for non-carbonaceous samples. To offset the effects of organic acids, which are largely an artefact of test methodology on carbonaceous materials, a lower scaling factor of 5 was applied to the peroxide extract concentrations of the washery wastes samples.

The pHs of the six peroxide extracts ranged from 3.1 to 4.8. Extracts contained high concentrations of SO_4 (with the scaled SO_4 concentrations ranging from 420 mg/L up to 2,345 mg/L) and iron (with the scaled Fe concentrations ranging from 122 mg/L to 196 mg/L) which are the main products of pyrite oxidation. There were also elevated concentrations of aluminium (with the scaled Al concentrations ranging from 8.1 mg/L to 24.7 mg/L) consistent with dissolution of alumino-silicate minerals under acid conditions. Calcium and magnesium were elevated, likely as a consequence of acid neutralisation reactions with carbonate bearing minerals.

There were also elevated concentrations of Cu, Mn, Sr, Zn and Ba with scaled concentrations typically in the 1 to 10 mg/L range, and slightly elevated concentrations of boron (B), Co, Cr and Ni with scaled concentrations typically in the 0.1 to 1 mg/L range.

Elements that were not released to any significant extent included As, Hg, Cd, Pb, Mo, Sb, Se and Sn.

Notwithstanding issues with reaction of carbonaceous matter, the results of the peroxide extractions indicate the potential for significant metal/metalloid release from PAF rejects and washery tailings as represented by the samples tested. However, as the solubilities of most metals/metalloids are pH-dependent the successful management of these materials in relation to control of acid generation should also effectively limit the potential for metal/metalloid leaching.

6.8 Sample Classification

The results and discussions presented above were used to classify rejects and tailings samples as NAF, PAF, PAF-LC or UC in Table B10 (Appendix B). Figure 31 shows the relative proportions of ARD classes for washery wastes generated from the Project target stratigraphy based on the rejects and tailings samples tested to date.

The majority (85%) of rejects samples were classified NAF, generally with low S and low to moderate ANC. Five rejects samples were classified PAF, all with higher S greater than 0.7%S and sourced from the Upper Liddell, Lower Arties, Bowfield and Barratt seam groups. The acid potentials of these PAF rejects samples were between 6 and 22 kg H_2SO_4 based on calculated NAG and / or recalculated NAPP estimates.

Most (70%) tailings samples were also classified NAF, generally with low S but also low ANC, however a significant portion (approximately 30%) of tailings samples were classified PAF or PAF-LC. Two tailings samples were classified PAF, and five were classified PAF-LC, and sourced from the Upper Liddell, Lower Arties, Bowfield and Barratt seam groups. The acid potentials of the PAF and PAF-LC tailings samples were all low less than 6 kg H_2SO_4.

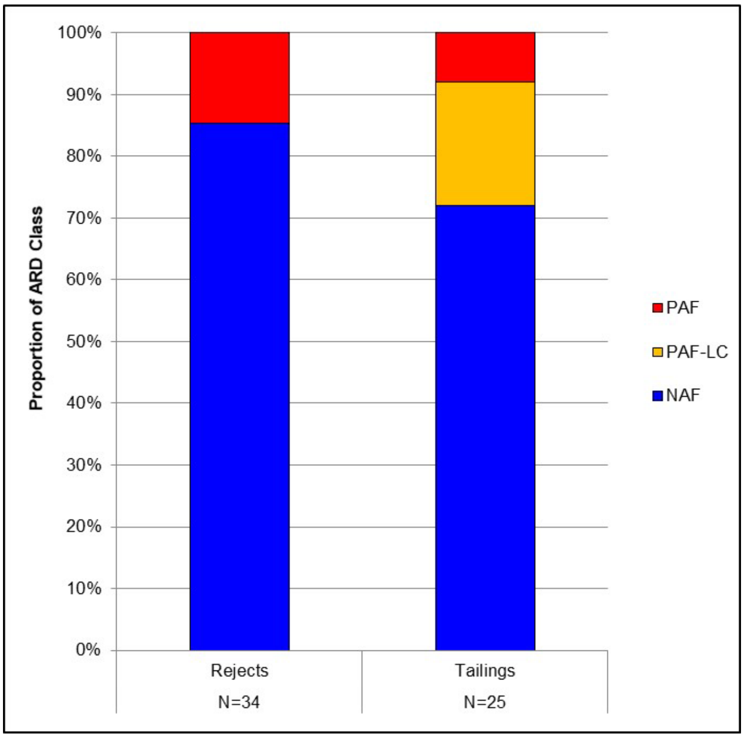

Figure 31: Stacked bar chart showing proportions (by sample count) of ARD classes split by waste stream.

The results to date suggest that the majority of rejects generated by the project are likely to be NAF, however it is noted that although most seam groups were represented within the sample set tested, only a small number of the individual seams and plies within each seam group were tested. Further testing especially of higher S seam groups would be required to confirm this. Rejects are disposed within in-pit waste dumps. Although 15% of the rejects samples tested were PAF, the thorough intermingling of rejects and overburden observed on site (refer Section 2), and the excess ANC in the overburden, suggests that these bulk fill zones are unlikely to result in any significant ARD issues or effects on rehabilitation.

Results also indicate that although most tailings generated by the project are likely to be NAF, approximately 30% may be acid forming but with a low acid potential. Tailings have historically been, and are currently being, disposed of within various tailings storage facilities. Tailings have low ANC are not mixed with neutralising overburden materials, and spigotting tailings can result in preferential deposition and concentration of pyritic materials (as was observed at Bobs Dump TSF refer Section 2), potentially resulting in PAF zones. Risks associated with the upward movement of acid and salinity from PAF material can be effectively managed through selected addition of neutralising materials (such as limestone) and use of an appropriately designed capping system that controls upward water flux.

Understanding the overall ARD hazard of tailings materials would require ongoing testing, with focus on tailings from seams identified as having higher acid forming and salinity potential (such as Upper Liddell, Lower Arties and Barratt Seam Groups), along with seams not yet tested (such as Lemington, Woodlands Hill and Glen Munro Seam Groups), and would need to include sampling of deposited materials to ascertain the extent of any segregation and concentration of pyritic materials.

7. Mine Water Management and Quality

The vast majority of overburden / interburden is expected to be NAF (Section 5.9) but inherently saline to some degree when initially exposed in a waste emplacement area. The EC results for NAF overburden / interburden samples tested in this study ranged from 0.11 to 2.89 dS/m, but the majority were below 0.8 dS/m indicating samples were slightly saline. Water extracts from selected samples were also analysed for multi-elements as discussed in Section 5.8. Nineteen of these were overburden / interburden samples classified NAF and with total S of solids less than 1%. Results indicated that drainage from these materials is unlikely to contain significant metal/metalloid concentrations, but elevated SO_4 may occur from NAF materials with significant pyrite.

A surface water quality monitoring database from 2010 to 2020 was provided by site for review by EGi. Monthly sampling of West Pit has been undertaken from May 2019 onwards. The West Pit monitoring point, as part of the approved operations, receives drainage from in-pit overburden dumps, in-pit deposited coarse rejects, exposed pit walls and operational areas of the West Pit. As such, it provides a guide to expected water quality from the proposed continuation of HVO North. Water quality monitoring results are summarised in Table 2. Results show slightly alkaline pH of over 8.1, strongly saline EC of 4.4 to 9.5 dS/m, high alkalinity, and low concentrations of dissolved metals/metalloids. The high alkalinity in these water samples suggests that any ARD generated by the small amounts of PAF materials in overburden/interburden, coarse rejects, and pit walls (mainly residual coal seams) is relatively minor in comparison to alkaline drainages from natural groundwater influx and runoff from NAF overburden/interburden and other sources. Furthermore, any minor sources of ARD are unlikely to result in elevated metal/metalloid concentrations in the accumulated drainage. The EC is dominated by chloride (Cl) and SO_4 salts, and show similar major ion chemistry as groundwater from interburden and coal (AGE, 2022), suggesting that groundwater is currently the main source of salinity in West Pit.

Parnells Dam (Dam 9W) and Dam 9N are key mine water management storages for the approved operations of HVO North. Parnells Dam receives water from a number of sites including West and Mitchell Pits as well as TSFs Dam 6W (current) and Dam 20W Bob's Dump (disused). Dam 9N also receives water from a number of sites including Carrington Pit and TSF Dam 29N. Intermittent data from 2010, including monthly sampling from May 2019 onwards, were available for Parnells Dam. For Dam 9N, data were available from 2010 to 2013 as well as monthly sampling from May 2019 onwards. Water quality monitoring results in Table 2 indicate saline water quality comparable to the West Pit monitoring site, with salinity due to Cl and SO_4 salts. These data suggest there should be no significant salinity effect from ARD generated by PAF materials beyond what is already being managed on site.

Riverview Void and Lake James (Dam 15S) are the key mine water management storages for the approved operations of HVO South. Together they receive water from the various HVO South pits and mining areas. Water quality monitoring data were available for Lake James from 2010 until present, with results summarised in Table 2. Results show alkaline pH (8.2 to 9.4), variable salinity (EC 0.9 to 7.8 dS/m) but on average strongly saline (mean of 4.8 dS/m), high alkalinity, and low concentrations of dissolved metals/metalloids.

Overall, the proportion of PAF overburden/interburden, coarse washery wastes and pit wall materials is expected to be relatively minor and should not have a significant impact on pit water quality, or require modification of the current saline water management. The pit water qualities in the HVO North and South mines during the Continuation Project are expected to be similar to current pit water qualities. Detailed assessment of existing surface and groundwater quality and water quality prediction modelling has been undertaken by Engeny (2022) and EGi (2022) as part of the EIS studies.

Table 2: Summary of water quality monitoring for selected sites from the approved operations.

Sample Site	W3 Parnells Creek Dam (9W)				New Dam (9N)				West Pit				Lake James (Dam 15S)			
	N	Min	Max	Mean	N	Min	Max	Mean	N	Min	Max	Mean	N	Min	Max	Mean
Field pH (pH unit)	127	8.4	9.9	9.1	37	8.4	9.2	8.7	16	8.1	8.7	8.4	106	8.2	9.4	9.1
Field Electrical Conductivity (dS/m)	126	0.49	9.43	4.48	36	1.76	8.74	4.03	16	4.35	9.53	7.22	102	0.914	7.84	4.80
Total Dissolved Solids (mg/L)	46	584	6610	3011	21	956	5000	1981	16	2690	6080	4739	34	497	4690	2159
Total Alkalinity as CaCO3 (mg/L)	44	226	859	478	22	262	788	450	17	367	1110	797	35	231	1294	674
Bicarbonate Alkalinity as CaCO3 (mg/L)	33	222	741	415	19	245	639	376	17	345	1010	716	21	199	648	284
Sulfate as SO4 (mg/L)	44	110	2300	949	22	248	1170	490	17	854	2010	1413	34	50	1000	350
Dissolved Chloride (mg/L)	33	140	1797	871	19	186	696	423	17	662	1700	1152	21	120	781	300
Total Hardness as CaCO3 (mg/L)	4	290	465	393	21	219	765	333	17	575	1100	837	23	139	465	222
Carbonate Alkalinity as CaCO3 (mg/L)	34	<1	286	91	19	<1	149	46	17	6	248	80	21	<1	158	61
Total Calcium (mg/L)	37	0	44	22	21	0	63	32	16	28	98	56	25	0	33	16
Total Magnesium (mg/L)	41	27	200	99	21	34	161	61	16	105	211	169	33	24	120	53
Total Sodium (mg/L)	40	138	2200	907	21	242	1500	588	16	715	1840	1387	33	116	1500	707
Total Potassium (mg/L)	41	5	48	22	21	8	38	16	16	12	34	17	33	5	54	18
Total Phosphorus as P (mg/L)	13	<0.01	32.4	2.51	22	<0.01	0.19	0.03	17	0.005	0.11	0.02	28	<0.01	0.14	0.03
Dissolved Zinc (mg/L)	3	0.006	0.009	0.007	7	<0.005	<0.005	<0.005	7	<0.005	0.005	0.003	7	<0.005	0.009	0.003
Dissolved Selenium (mg/L)	3	0.010	0.012	0.011	7	<0.010	0.010	0.008	7	<0.010	0.030	0.009	7	<0.010	<0.010	<0.010
Dissolved Nickel (mg/L)	3	0.007	0.010	0.009	7	0.002	0.008	0.004	7	0.004	0.028	0.010	7	0.001	0.002	0.002
Dissolved Mercury (mg/L)					7	<0.0001	<0.0001	<0.0001	7	<0.0001	<0.0001	<0.0001	7	<0.0001	<0.0001	<0.0001
Dissolved Manganese (mg/L)					7	<0.001	0.023	0.005	7	0.007	0.250	0.076	7	<0.001	0.002	0.001
Dissolved Lead (mg/L)	3	<0.001	<0.001	<0.001	7	<0.001	<0.001	<0.001	7	<0.001	<0.001	<0.001	7	<0.001	<0.001	<0.001
Dissolved Iron (mg/L)	1	<0.050	<0.050	<0.050	7	<0.050	<0.050	<0.050	7	<0.050	<0.050	<0.050	6	<0.050	<0.050	<0.050
Dissolved Copper (mg/L)	1	0.002	0.002	0.002	7	<0.001	0.002	0.001	7	<0.001	0.002	0.001	7	<0.001	<0.001	<0.001
Dissolved Cobalt (mg/L)					7	<0.001	0.004	0.001	7	<0.001	0.013	0.004	7	<0.001	<0.001	<0.001
Dissolved Cadmium (mg/L)	2	0.0002	0.0002	0.0002	7	<0.0001	<0.0001	<0.0001	7	<0.0001	<0.0001	<0.0001	7	<0.0001	<0.0001	<0.0001
Dissolved Boron (mg/L)	3	0.190	0.190	0.190	7	<0.050	0.070	0.031	7	0.100	0.210	0.157	7	<0.050	0.070	0.035
Dissolved Barium (mg/L)					7	0.026	0.047	0.036	7	0.048	0.153	0.082	7	0.017	0.030	0.025
Dissolved Arsenic (mg/L)	3	0.010	0.019	0.014	7	<0.0001	0.009	0.003	7	0.003	0.029	0.010	7	0.003	0.005	0.004
Dissolved Aluminium (mg/L)	3	0.012	0.079	0.041	7	<0.010	0.030	0.014	7	<0.010	<0.010	<0.010	7	0.02	0.04	0.03

Notes:
Where some samples tested below the detection limit, the mean has been calculated using half the detection limit.

8. Conclusions and Recommendations

Results indicate that the vast majority of overburden / interburden materials represented by the samples tested is likely to be NAF, with low S (more than 75% less than 0.1%S), an excess of acid neutralising capacity and low leachable salinity. PAF/PAF-LC materials are estimated to comprise only 3% of overburden / interburden. Thin pyritic zones of elevated S were identified generally close to coal seams, but dilution and mixing during mining should be sufficient to mitigate any ARD generation. This is supported by water quality monitoring data for West Pit from the period 2019 to 2020, which shows slightly alkaline pH, with pit water quality primarily controlled by groundwater, and no evidence of ARD impacts.

Key pyritic zones outside of the coal to be mined are associated with the following stratigraphy:

- Roof within 1m of Broonie 3 Seam top
- Interburden between Broonie 4A and 5A Seams
- Archerfield Sandstone, particularly within 5m of the Lemington A Seam roof
- Roof within 1 to 2m of Lemington A Seam top (overlapping with the Archerfield Sandstone)
- Floor within 0.5m of Lemington A Seam base
- >6m thick unit approximately 1m below the base of the Barrett Seam

Overburden / interburden samples tested had a median ANC of 30 kg H_2SO_4/t, providing a potential source of buffering to help mitigate any ARD from PAF materials. Sandstone and siltstone tended to have higher ANC than other lithologies, having medians of 30 and 25 kg H_2SO_4/t respectively, and are also the most common lithologies. Given the expected high proportions of NAF (approximately 97% of overburden / interburden intervals tested were classified NAF) relative to PAF (approximately 3%), operational blending of NAF and PAF overburden/interburden together with the excess alkaline leachate from NAF materials is expected to be a robust approach to controlling ARD from PAF materials.

The majority of coal samples tested were PAF/PAF-LC, however only a limited number of coal intervals were available for sampling and testing, and these were from a limited number of seams not representative of all the seam groups to be extracted at HVO. Approximately half of immediate seam roof, floor and partings materials is also likely to be PAF/PAF-LC, with NAF materials estimated to be 52%. These materials are generally thin (less than 0.3 m) and are expected to report to the raw coal process stream, however if they were to report to overburden / interburden then dilution and mixing during mining is expected to be sufficient to negate any serious ARD risk from these materials.

The majority of rejects generated by the project are likely to be NAF, however it is noted that although most seam groups were represented within the sample set tested, only a small number of the individual seams and plies within each seam group were tested. Rejects are disposed within in-pit waste dumps. Although 15% of the rejects samples tested were PAF, the thorough intermingling of rejects and overburden observed on site, and the excess ANC in the overburden, suggests that these bulk fill zones are unlikely to result in any significant ARD issues or effects on rehabilitation.

Although most tailings generated by the project are also likely to be NAF, approximately 30% may be acid forming but with a low acid potential. Tailings have historically been, and are currently being, disposed of within various tailings storage facilities. Tailings have low ANC and are not mixed with neutralising overburden materials, and spigotting tailings can result in preferential deposition and concentration of pyritic materials, potentially resulting in PAF zones.

ABCC results suggest that the ANC measured for sandstone materials represented by the samples tested is likely to be moderate to fast reacting and effective. However, results for other lithology types are more variable, with the ANC measured mostly likely to be slow reacting and largely ineffective due to the likely inclusion of a high proportion of iron carbonate. Results for washery waste samples suggest a moderate to high proportion of the total ANC measured for most rejects and tailings is likely to be readily available but with variable reactivity.

Kinetic NAG testing indicated that the PAF samples tested were relatively fast reacting and, despite varying ANC, lag times of one month or less were indicated. However, it is noted that these samples had opportunity to oxidise prior to testing, and longer lags could be expected from fresher materials before ARD would be generated.

Sulphur Speciation testing suggests that the total S in non-coal overburden / interburden samples and in rejects samples is likely to be mainly pyritic, and that coal samples and tailings samples are likely to include a higher proportion of non-pyritic S forms.

Calibration of full geochemical test results against total S shows that for overburden/interburden materials, a total S cut-off of 0.2%S discriminates well between NAF and PAF-LC / PAF samples. However, total S is a poor discriminator for coal and carbonaceous materials due to the presence of organic S.

The results of water and peroxide extraction tests indicate that significant metal/metalloid release from materials represented by the samples tested would only be associated with generation of ARD. The solubility of metals/metalloids will largely be determined by pH and therefore prevention of acid generation will effectively control metal/metalloid leaching.

Extracts from low S NAF materials indicated that generally drainage from these materials is likely to be slightly saline to moderately saline and is unlikely to contain significant metal/metalloid concentrations, but elevated SO_4 may occur from NAF materials with significant pyrite.

Extracts show that metal/metalloid release associated with any ARD generated from pyritic overburden materials would include Al, Cd, Co, Cr, Cu, Fe, Mn, Ni, Sr and Zn, and possibly As at low pH (less than 3), and from pyritic washery waste materials would include Al, Ba, Cu, Fe, Mn, Sr and Zn and to a lesser extent B, Co, Cr and Ni.

Results have the following implications for mine materials management:

- Operational blending of NAF and PAF overburden/interburden together with the excess alkaline leachate from NAF materials is expected to be a robust approach to controlling ARD and water quality impacts from PAF materials for the bulk of the waste rock dumps.
- Although the PAF mine materials do not appear to represent a concern in terms of water quality impacts, if PAF materials were placed close to final surfaces this could cause local effects on rehabilitation success through upward migration of acid and salinity into the growth horizon. The existing HVO Rehabilitation Management Plan (ERR Australia, 2022) includes completion criteria that are expected to minimise surface placement of PAF.
- Low ARD risk (NAF) materials should be specifically targeted for placement on the upper 5 metres or more of overburden dumps and any cover systems for tailings facilities. Low ARD risk materials could include, but would not be limited to:
    - overburden/interburden generally from the upper stratigraphic sequence from 1m above the Mt Arthur Seam Group and upwards which appears to be almost all NAF with a very low potential for ARD with a freshwater dominated depositional environment; and
    - other reasonably thick (>10m) interburden units lower in the stratigraphic sequence that appear to have low ARD potential, which include, but would not be limited to:
        - Interburden between Vaux and Broonie Seam Groups excluding 1m from Vaux Seam Group floor and 1m from Broonie Seam Group roof;
        - Interburden between Lemington and Pikes Gully Seam Groups excluding 2m from Lemington Seam Group floor and 1m from Pikes Gully Seam Group roof;
        - Interburden between Pikes Gully and Arties Seam Groups excluding 1m from Pikes Gully Seam Group floor and 1m Arties Seam Group roof;
        - Interburden between Liddell and Barrett Seam Groups excluding 1m from Liddell Seam Group floor and 1m from Barrett Seam Group roof.
    - materials outside of the above zones if it can be demonstrated that operational blending is sufficient to control ARD from any contained PAF zones.
- By contrast, the interburden between the base of the Bayswater Seam Group and the Lemington Seam A , which includes the Archerfield Sandstone, have had some marine influence during deposition

and greater ARD potential, and should be placed within the bulk fill zone of the dump. In addition, limited testing to date suggests coal seams and/or immediate roof and floor contain some proportion of PAF, and it should be assumed that where coal plies, and immediate roof and floor are treated as waste rock, that they also be placed in the bulk fill zone.

- The stratigraphic trends in ARD potential indicated in results to date are limited to individual holes and have not been correlated across the site. These trends should be confirmed with visual inspection of stored core and/or new core supported with S testing as required.
- HVO North will be developed to the base of the Barrett Seam. Results to date suggest that the immediate floor of the Barrett is not highly pyritic, however, strong pyrite was observed 1m or so below the floor, indicating ARD potential close to the final pit floor, and possibly at the base of the Barrett Seam in part. The overall ARD potential of the final floor of the HVO North pit would require further assessment during operations. The findings would also have implications if development was extended to below the Barrett Seam.
- The final pit floors for the Cheshunt and Riverview Pits are expected to terminate at the base of the Bayswater Seam, which will potentially expose pyritic Archerfield Sandstone, as in the current Carrington Pit (Plate 19). The implications of this on pit water quality was assessed in more with water quality modelling (EGi, 2022), and overall is expected to have no significant impact. Monitoring of this water quality may be required during operations if this pit water is pumped out as part of the water management system.
- Testing and site inspection confirms that a portion of tailings (30% of samples tested) may be PAF and require management to prevent ARD effects, particularly close to spigot discharge points. Inspection of currently deposited tailings shows potential for salt migration from these materials, and localised concentrations of pyritic materials close to spigot points. These aspects will need to be a consideration for final rehabilitation design of tailings storage facilities and options. Risks associated with the upward movement of acid and salinity from PAF tailings can be effectively managed through use of an appropriately designed capping system that controls upward water flux, with the options of surface limestone addition to any PAF hotspots to provide additional security if required.
- Although a portion of the rejects samples tested were PAF, the thorough intermingling of rejects and overburden observed on site, and the excess ANC in the overburden, suggests that these bulk fill zones are unlikely to result in any significant ARD issues or effects on rehabilitation, and no specific management is required apart from isolating rejects from the upper 5 metres or more of overburden dumps.
- Any re-handing of tailings and placement in pit will need to consider potential PAF zones, and ensure appropriate management as per coarse rejects and PAF materials above.
- Weathered Permian materials are likely to be NAF, but the 2013 EGi Study for the Mount Owen Complex indicated these materials were sodic and dispersive, and may require treatment (e.g. with gypsum or lime) to reduce erodibility if used as a plant growing horizon, exposed on dump surfaces or used in engineered structures. Finer grained fresh Permian materials may also be partly sodic and require treatment.
- The low salinity potential of NAF overburden/interburden, and the expected relatively minor PAF overburden/interburden and pit wall materials indicate that the Project is not likely to have a significant impact on the existing pit water quality, or require modification of the current saline water management. More detailed assessment of existing surface and groundwater quality, together with geochemical modelling and water quality prediction has been carried out by Engeny (2022) and EGi (2022).

Overall, with the above management strategies implemented the HVO Continuation Project is expected to present a low risk with respect to ARD and metal leaching. This is consistent with site experience to date and as demonstrated in previous work at HVO along with other mine sites with similar stratigraphy. The key focus of materials management will be to ensure any potentially problematic materials are excluded from the near surface region of overburden/interburden dumps and TSF capping layers, and ensure upward migration of salts is controlled to prevent impacts on rehabilitation. This will be readily achievable given the overall low proportion of problematic materials.

Although there is an expected low ARD risk for the site, the following are recommended during operations to help confirm assessment findings and verify predictions:

- Carry out visual inspection supported with S testing as required of stored and any new core drilling in the Project Area for evidence of pyrite occurrence to confirm the strong dominance of NAF overburden/interburden across the deposit, and confirm stratigraphic trends in ARD potential indicated to date.
- Ensure appropriate overburden/interburden ARD mixing in the mine planning and handling schedule to ensure low ARD risk (NAF) materials (as defined above) are placed in the outer 5m or more of the waste rock dump. The existing HVO Rehabilitation Management Plan (ERR Australia, 2022) includes completion criteria that are expected to address the above, and should continue to be followed.
- Inspection of waste rock dump and TSF final rehabilitation areas as part of routine rehabilitation monitoring for any evidence of impacts on vegetation growth die back etc.
- If adverse results from site monitoring are determined to be as a result of ARD, carry out leach column testing of overburden/interburden, washery rejects and tailings, and coal to verify the leaching characteristics of key materials controlling mine water quality, confirm predictions and improve inputs for any follow-up geochemical modelling.
- Continue collection and total S testing of rejects and tailings discharge streams from the process plant to better represent the variability and proportions of ARD material types. Sampling should focus on washery waste from seams identified as having higher acid forming and salinity potential (such as Upper Liddell, Lower Arties and Barratt Seam Groups), along with seams not yet tested (such as Lemington, Woodlands Hill and Glen Munro Seam Groups), and would need to include sampling of deposited tailings materials to ascertain the potential extent of any segregation and concentration of pyritic materials. This requirement could be phased out over time once a reasonable database is built up.
- Prior to capping of tailings dams, prepare a detailed plan for a cover design system supported with water flux performance modelling. The design should provide adequate control of upward migration of salts and acid so that rehabilitation efforts are not compromised. The detailed cover design should consider:
    - The physical and hydrological characteristic of tailings (using current deposited tailings to represent the range of properties due to gravity segregation effects) and potential cover materials;
    - The optimal thickness, configuration and placement methodology of the cover system based on water flux modelling to assess performance;
    - The distribution and extent of any PAF tailings;
    - The need for incorporation of crushed (agricultural) limestone into the final tailings surface in the zone around the spigot points to ensure neutralisation of any existing acidity; and
    - Maximum rooting depth of selected rehabilitation species.
- Continue routine water quality monitoring of pit water and water storages to check for ARD effects and assist in model calibration.

9. References

AGE, 2022	Hunter Valley Operations Continuation Project - Groundwater Impact Assessment
Australian Government, 2016	Preventing Acid and Metalliferous Drainage – Leading Practice Sustainable Development Program for the Mining Industry, September 2016. Australian Government Department of Industry Tourism and Resources, 2016.
Bowen, 1979	Environmental Chemistry of the Elements. Academic Press, New York, p 36-37. Bowen, H.J.M. (1979)
Coal & Allied, 2011	Hunter Valley Operations, Acid Rock Drainage and Mineral Waste Management Plan, Revision 2, 14 September, 2011
EGi et al., 2002	ARD Test Handbook, Australian Mineral Industries Research Association, Ian Wark Research Institute (S. Aust.), Environmental Geochemistry International Pty Ltd. Published by AMIRA International, 2002.
EGi et al., 2008	ACARP Project C15034: Development of ARD Assessment for Coal Process Wastes, EGi Document No. 3207/817, July 2008. Environmental Geochemistry International, Levay and Co. and ACeSSS, 2008.
EGi, 2012	Geochemical Assessment of the Bulga Complex Optimisation Project, Document No. 2603/997, November 2012
EGi, 2013	Geochemical Assessment of the Mount Owen Optimisation Project, Document No. 2352/1053, July 2013
EGi, 2014a	Leach Column Test Results for Overburden and Interburden from the Mount Owen Continued Operations Project, Environmental Geochemistry International, Document No. 2352/1126, October 2014.
EGi, 2014b	Follow Up Geochemical Assessment of the Bulga Complex Optimisation Project, Document No. 2603/1125, October 2014
EGi, 2018	Geochemical Assessment of the Mount Owen Continued Operations Project Modification 2, Environmental Geochemistry International, Document No. 2352/1238, May 2018
EGi, 2022	Water Quality Predictions for Final Pit Voids, Hunter Valley Operations – Continuation Project, Document No. S2357 / J000314 / R1480, February 2022
EMM, 2022	Hunter Valley Operations Continuation Project Environmental Impact Statement, 2022
Engeny, 2022	Hunter Valley Operations Continuation Project Surface Water Impact Assessment
ERR Australia, 2022	Hunter Valley Operations Rehabilitation Management Plan, Document Number: HVOOC-748212775-24, 1 July 2022
Glencore, 2020	United Wambo Rehabilitation Management Plan – 2020 - 2022, Version 1, 6 November 2020
Glencore, 2021	Ravensworth Open Cut, Mining Operations Plan, 1 January – 31 December 2023, RAVCX-1962359669-15
INAP, 2009	Global Acid Rock Drainage Guide (GARD Guide), http://www.gardguide.com/. The International Network for Acid Prevention (INAP), 2009.

SLR, 2013 Liddell Coal Operations, Proposed Modification to DA 305-11-01, Environmental Assessment, September 2013

Umwelt, 2010 Ravensworth Operations Project Environmental Assessment, 2383/R11/Final, February 2010

Umwelt, 2016 United Wambo Open Cut Coal Mine Project, Environmental Impact Statement, Final, 3509/R06/FINAL, August 2016

APPENDIX A

Assessment of Acid Forming Characteristics

Environmental Geochemistry International

Assessment of Acid Forming Characteristics

Introduction

Acid rock drainage (ARD) is produced by the exposure of sulphide minerals such as pyrite to atmospheric oxygen and water. The ability to identify in advance any mine materials that could potentially produce ARD is essential for timely implementation of mine waste management strategies.

A number of procedures have been developed to assess the acid forming characteristics of mine waste materials. The most widely used methods are the Acid-Base Account (ABA) and the Net Acid Generation (NAG) test. These methods are referred to as static procedures because each involves a single measurement in time.

Acid-Base Account

The acid-base account involves static laboratory procedures that evaluate the balance between acid generation processes (oxidation of sulphide minerals) and acid neutralising processes (dissolution of alkaline carbonates, displacement of exchangeable bases, and weathering of silicates).

The values arising from the acid-base account are referred to as the potential acidity and the acid neutralising capacity, respectively. The difference between the potential acidity and the acid neutralising capacity value is referred to as the net acid producing potential (NAPP).

The chemical and theoretical basis of the ABA are discussed below.

Potential Acidity

The potential acidity that can be generated by a sample is calculated from an estimate of the pyrite (FeS_2) content and assumes that the pyrite reacts under oxidising conditions to generate acid according to the following reaction:

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

Based on the above reaction, the potential acidity of a sample containing 1 %S as pyrite would be 30.6 kilograms of H_2SO_4 per tonne of material (i.e. kg H_2SO_4/t). The pyrite content estimate can be based on total S and the potential acidity determined from total S is referred to as the maximum potential acidity (MPA), and is calculated as follows:

$$MPA\ (kg\ H_2SO_4/t) = (Total\ \%S) \times 30.6$$

The use of an MPA calculated from total sulphur is a conservative approach because some sulphur may occur in forms other than pyrite. Sulphate-sulphur, organic sulphur and native sulphur, for example, are non-acid generating sulphur forms. Also, some sulphur may occur as other metal sulphides (e.g. covellite, chalcocite, sphalerite, galena) which yield less acidity than pyrite when oxidised or, in some cases, may be non-acid generating.

The total sulphur content is commonly used to assess potential acidity because of the difficulty, costs and uncertainty involved in routinely determining the speciation of sulphur forms within samples, and determining reactive sulphide-sulphur contents. However, if the sulphide mineral forms are known then allowance can be made for non- and lesser acid generating forms to provide a better estimate of the potential acidity.

Acid Neutralising Capacity (ANC)

The acid formed from pyrite oxidation will to some extent react with acid neutralising minerals contained within the sample. This inherent acid buffering is quantified in terms of the ANC.

The ANC is commonly determined by the Modified Sobek method. This method involves the addition of a known amount of standardised hydrochloric acid (HCl) to an accurately weighed sample, allowing the sample time to react (with heating), then back-titrating the mixture with standardised sodium hydroxide (NaOH) to determine the amount of unreacted HCl. The amount of acid consumed by reaction with the sample is then calculated and expressed in the same units as the MPA (kg H_2SO_4/t).

Net Acid Producing Potential (NAPP)

The NAPP is a theoretical calculation commonly used to indicate if a material has potential to produce acidic drainage. It represents the balance between the capacity of a sample to generate acid (MPA) and its capacity to neutralise acid (ANC). The NAPP is also expressed in units of kg H_2SO_4/t and is calculated as follows:

$$\text{NAPP} = \text{MPA} - \text{ANC}$$

If the MPA is less than the ANC then the NAPP is negative, which indicates that the sample may have sufficient ANC to prevent acid generation. Conversely, if the MPA exceeds the ANC then the NAPP is positive, which indicates that the material may be acid generating.

ANC/MPA Ratio

The ANC/MPA ratio is frequently used as a means of assessing the risk of acid generation from mine waste materials. The ANC/MPA ratio is another way of looking at the acid base account. A positive NAPP is equivalent to an ANC/MPA ratio less than 1, and a negative NAPP is equivalent to an ANC/MPA ratio greater than 1. A NAPP of zero is equivalent to an ANC/MPA ratio of 1.

The purpose of the ANC/MPA ratio is to provide an indication of the relative margin of safety (or lack thereof) within a material. Various ANC/MPA values are reported in the literature for indicating safe values for prevention of acid generation. These values typically range from 1 to 3. As a general rule, an ANC/MPA ratio of 2 or more signifies that there is a high probability that the material will remain circum-neutral in pH and thereby should not be problematic with respect to acid rock drainage.

Acid-Base Account Plot

Sulphur and ANC data are often presented graphically in a format similar to that shown in Figure A-1. This figure includes a line indicating the division between NAPP positive samples from NAPP negative samples. Also shown are lines corresponding to ANC/MPA ratios of 2 and 3.

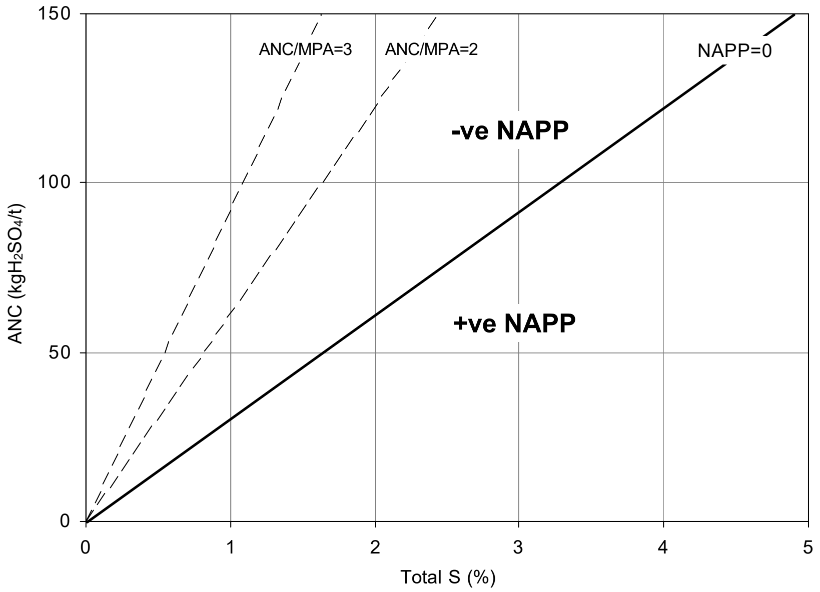

Figure A-1: Acid-base account (ABA) plot

Net Acid Generation (NAG) Test

The NAG test is used in association with the NAPP to classify the acid generating potential of a sample. The NAG test involves reaction of a sample with hydrogen peroxide to rapidly oxidise any sulphide minerals contained within a sample. During the NAG test both acid generation and acid neutralisation reactions can occur simultaneously. The end result represents a direct measurement of the net amount of acid generated by the sample. The final pH is referred to as the NAGpH and the amount of acid produced is commonly referred to as the NAG capacity, and is expressed in the same units as the NAPP (kg H_2SO_4/t).

Several variations of the NAG test have been developed to accommodate the wide geochemical variability of mine waste materials. The four main NAG test procedures currently used by EGi are the single addition NAG test, the sequential NAG test, the kinetic NAG test, and the extended boil and calculated NAG test.

Single Addition NAG Test

The single addition NAG test involves the addition of 250 ml of 15% hydrogen peroxide to 2.5 g of sample. The peroxide is allowed to react with the sample overnight and the following day the sample is gently heated to accelerate the oxidation of any remaining sulphides, then vigorously boiled for several minutes to decompose residual peroxide. When cool, the NAGpH and NAG capacity are measured.

An indication of the form of the acidity is provided by initially titrating the NAG liquor to pH 4.5, then continuing the titration up to pH 7. The titration value at pH 4.5 includes acidity due to free acid (i.e. H_2SO_4) as well as soluble iron and aluminium. The titration value at pH 7 also includes metallic ions that precipitate as hydroxides at between pH 4.5 and 7.

Sequential NAG Test

When testing samples with high sulphide contents it is not uncommon for oxidation to be incomplete in the single addition NAG test. This can sometimes occur when there is catalytic breakdown of the hydrogen peroxide before it has had a chance to oxidise all of the sulphides in a sample. To overcome this limitation, a sequential NAG test is often carried out. This test may also be used to assess the relative geochemical lag of PAF samples with high ANC.

The sequential NAG test is a multi-stage procedure involving a series of single addition NAG tests on the one sample (i.e. 2.5 g of sample is reacted two or more times with 250 ml aliquots of 15% hydrogen peroxide). At the end of each stage, the sample is filtered and the solution is used for measurement of NAGpH and NAG capacity. The NAG test is then repeated on the solid residue. The cycle is repeated until such time that there is no further catalytic decomposition of the peroxide, or when the NAGpH is greater than pH 4.5. The overall NAG capacity of the sample is then determined by summing the individual acid capacities from each stage.

Kinetic NAG Test

The kinetic NAG test is the same as the single addition NAG test except that the temperature and pH of the liquor are recorded. Variations in these parameters during the test provide an indication of the kinetics of sulphide oxidation and acid generation. This, in turn, can provide an insight into the behaviour of the material under field conditions. For example, the pH trend gives an estimate of relative reactivity and may be related to prediction of lag times and oxidation rates similar to those measured in leach columns. Also, sulphidic samples commonly produce a temperature excursion during the NAG test due to the decomposition of the peroxide solution, catalysed by sulphide surfaces and/or oxidation products.

Extended Boil and Calculated NAG Test

Organic acids may be generated in NAG tests due to partial oxidation of carbonaceous materials[1] such as coal washery wastes. This can lead to low NAGpH values and high acidities in standard single addition NAG tests unrelated to acid generation from sulphides. Organic acid effects can therefore result in misleading NAG values and misclassification of the acid forming potential of a sample.

The extended boil and calculated NAG tests can be used to account for the relative proportions of pyrite derived acidity and organic acidity in a given NAG solution, thus providing a more reliable

[1] Stewart, W., Miller, S., Thomas, J.E., and Smart R. (2003), 'Evaluation of the Effects of Organic Matter on the Net Acid Generation (NAG) Test', in *Proceedings of the Sixth International Conference on Acid Rock drainage (ICARD), Cairns, 12-18th July 2003*, 211-222.

measure of the acid forming potential of a sample. The procedure involves two steps to differentiating pyritic acid from organic derived acid:

Extended Boil NAG	decompose the organic acids and hence remove the influence of non-pyritic acidity on the NAG solution.
Calculated NAG	calculate the net acid potential based on the balance of cations and anions in the NAG solution, which will not be affected by organic acid.

The extended boiling test is carried out on the filtered liquor of a standard NAG test, and involves vigorous boiling of the solution on a hot plate for 3-4 hours. After the boiling step the solution is cooled and the pH measured. An extended boil NAGpH less than 4.5 confirms the sample is potentially acid forming (PAF), but a pH value greater than 4.5 does not necessarily mean that the sample is non acid forming (NAF), due to some loss of free acid during the extended boiling procedure. To address this issue, a split of the same filtered NAG solution is assayed for concentrations of S, Ca, Mg, Na, K and Cl, from which a calculated NAG value is determined[2].

The concentration of dissolved S is used to calculate the amount of acid (as H_2SO_4) generated by the sample and the concentrations of Ca, Mg, Na and K are used to estimate the amount of acid neutralised (as H_2SO_4). The concentration of Cl is used to correct for soluble cations associated with Cl salts, which may be present in the sample and unrelated to acid generating and acid neutralising reactions.

The calculated NAG value is the amount of acid neutralised subtracted from the amount of acid generated. A positive value indicates that the sample has excess acid generation and is likely to be PAF, and a zero or negative value indicates that the sample has excess neutralising capacity and is likely to be NAF.

Sample Classification

The acid forming potential of a sample is classified on the basis of the acid-base and NAG test results into one of the following categories:

- Barren;
- Non-acid forming (NAF);
- Potentially acid forming (PAF); and
- Uncertain (UC).

Barren

A sample classified as barren essentially has no acid generating capacity and no acid buffering capacity. This category is most likely to apply to highly weathered materials. In essence, it represents an ‘inert’ material with respect to acid generation. The criteria used to classify a sample

[2] Environmental Geochemistry International, Levay and Co. and ACeSSS, 2008. *ACARP Project C15034: Development of ARD Assessment for Coal Process Wastes*, EGi Document No. 3207/817, July 2008.

as barren may vary between sites, but for hard rock mines it generally applies to materials with a total sulphur content ≤ 0.1 %S and an ANC ≤ 5 kg H_2SO_4/t.

Non-acid forming (NAF)

A sample classified as NAF may, or may not, have a significant sulphur content but the availability of ANC within the sample is more than adequate to neutralise all the acid that theoretically could be produced by any contained sulphide minerals. As such, material classified as NAF is considered unlikely to be a source of acidic drainage. A sample is usually defined as NAF when it has a negative NAPP and the final NAG pH ≥ 4.5.

Potentially acid forming (PAF)

A sample classified as PAF always has a significant sulphur content, the acid generating potential of which exceeds the inherent acid neutralising capacity of the material. This means there is a high risk that such a material, even if pH circum-neutral when freshly mined or processed, could oxidise and generate acidic drainage if exposed to atmospheric conditions. A sample is usually defined as PAF when it has a positive NAPP and a final NAGpH < 4.5.

Uncertain (UC)

An uncertain classification is used when there is an apparent conflict between the NAPP and NAG results (i.e. when the NAPP is positive and NAGpH > 4.5, or when the NAPP is negative and NAGpH ≤ 4.5). Uncertain samples are generally given a tentative classification that is shown in brackets e.g. UC(NAF).

Figure A-2 shows the format of the classification plot that is typically used for presentation of NAPP and NAG data. Marked on this plot are the quadrats representing the NAF, PAF and UC classifications.

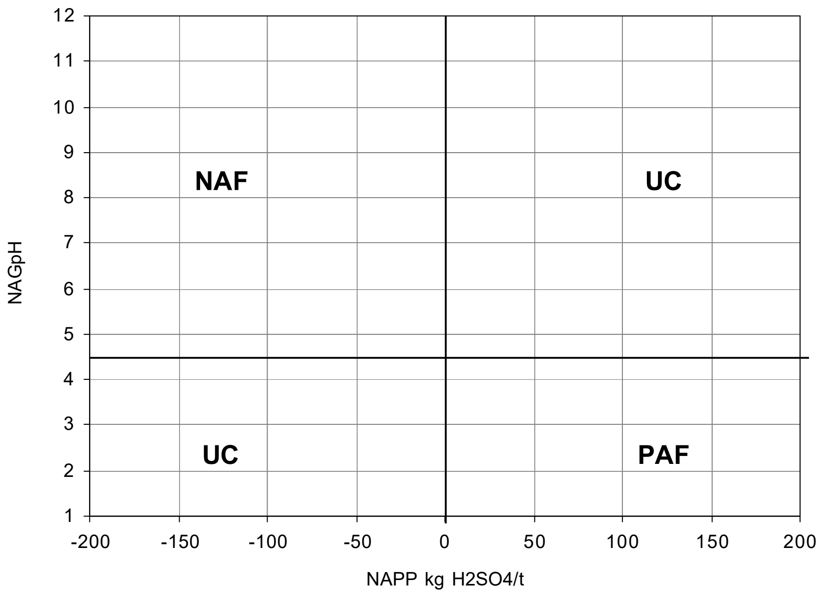

Figure A-2 ARD classification plot

Other Methods

Other test procedures may be used to define the acid forming characteristics of a sample.

pH and Electrical Conductivity

The pH and electrical conductivity (EC) of a sample is determined by equilibrating the sample in deionised water for a minimum of 12 hours (or overnight), typically at a solid to water ratio of 1:2 (w/w). This gives an indication of the inherent acidity and salinity of the waste material when initially exposed in a waste emplacement area.

Acid Buffering Characteristic Curve (ABCC) Test

The ABCC test involves slow titration of a sample with acid while continuously monitoring pH. These data provides an indication of the portion of ANC within a sample that is readily available for acid neutralisation.

APPENDIX B

Acid Forming Characteristics and Multi-Element Testing Tables

Environmental Geochemistry International

Table B1: Acid forming characteristics of overburden / interburden and coal samples from the Hunter Valley Operations Continuation Project

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES		Drill Hole ID	Depth (m)			Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	ACID_BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
				4505C	0.00	35.78	35.78	Not Logged	NS														
17820	414501			4505C	35.78	36.85	1.07	Siltstone	SL/SS			Calcite veins	8.2	0.56	0.02	1	87	-86	142	9.1	0	0	NAF
17821	414502			4505C	36.85	37.33	0.48	Carbonaceous Mudstone	XM/XSL			Siderite and Calcite, incl.s some DB, mr p	7.1	1.04	0.51	16	142	-126	9	8.4	0	0	NAF
17822	414503			4505C	37.33	39.04	1.71	Siltstone	SL/SS/SD			Siderite			0.01	0	65	-65	212	-	-	-	NAF
17823	414504			4505C	39.04	40.33	1.29	Sandstone	SS/SL				8.8	0.40	<0.01	0	90	-90	588	9.4	0	0	NAF
17824	414505			4505C	40.33	43.65	3.32	Sandstone,Siltstone	SS,SL/SD			Calcite veins , Siderite			0.01	0	58	-58	190	-	-	-	NAF
17825	414506			4505C	43.65	47.58	3.93	Siltstone	SL/SS/SD			Sideritic	8.9	0.41	0.01	0	48	-48	157	8.6	0	0	NAF
17826	414507			4505C	47.58	50.92	3.34	Sandstone	SS/SL/SD			Sideritic, calc vns			0.01	0	41	-41	134	-	-	-	NAF
17827	414508			4505C	50.92	53.74	2.82	Sandstone	SS,SL				8.7	0.48	0.02	1	56	-55	92	9.2	0	0	NAF
17828	414509			4505C	53.74	55.85	2.11	Siltstone	SL/SS/SD			Calc vns with SD			0.02	1	36	-35	59	-	-	-	NAF
17829	414510			4505C	55.85	56.54	0.69	Siltstone	SL				8.3	0.46	0.03	1	24	-23	26	8.4	0	0	NAF
17830	414511			4505C	56.54	57.23	0.69	Siltstone	SL/SS				8.2	0.36	0.03	1	7	-6	8	7.4	0	0	NAF
		230420	4505C_1	4505C	57.23	57.39	0.16	Siltstone	SL						0.11	3							NAF
		230421	4505C_2	4505C	57.39	57.72	0.33	Coal	DM	BR1	Broonie				0.54	17							
		230422	4505C_3	4505C	57.72	58.39	0.67	Coal	BB	BR1	Broonie				0.61	19							
		230423	4505C_4	4505C	58.39	58.69	0.30	Siltstone	SL/XM						0.34	10							PAF
		230424	4505C_5	4505C	58.69	58.95	0.26	Coal	BD	BR2	Broonie				1.02	31							
		230425	4505C_6	4505C	58.95	59.08	0.13	Mudstone	SD/MS			SD			0.04	1							NAF
17831	414512			4505C	59.08	59.60	0.52	Sandstone,Siltstone	SS,SL				7.6	0.54	0.05	2	13	-11	8	8.4	0	0	NAF
17832	414513			4505C	59.60	62.24	2.64	Sandstone	SS/SL			Sideritic			0.03	1	69	-68	75	-	-	-	NAF
17833	414514			4505C	62.24	62.86	0.62	Siltstone	SL				4.1	2.21	0.28	9	7	2	0.8	4.7	0	3	UC(NAF)
		230426	4505C_7	4505C	62.86	63.08	0.22	Siltstone	SL						0.73	22							PAF
		230427	4505C_8	4505C	63.08	63.89	0.81	Coal	BD	BR3	Broonie	Pyritic minor in part			0.70	21							
		230428	4505C_9	4505C	63.89	64.11	0.22	Coal	DB	BR3	Broonie				0.58	18							
		230429	4505C_10	4505C	64.11	64.26	0.15	Siltstone	SL						0.18	6							NAF
				4505C	64.26	64.28	0.02	Core Loss	KL														
17834	414515			4505C	64.28	65.44	1.16	Siltstone	SL/SS				7.0	0.49	0.05	2	11	-9	7	7.9	0	0	NAF
17835	414516			4505C	65.44	68.24	2.80	Siltstone	SL/SS			Calcite veins , sideritic, sid nodules			0.02	1	79	-78	129	-	-	-	NAF
17836	414517			4505C	68.24	69.06	0.82	Sandstone	SS				8.5	0.55	0.02	1	36	-35	59	9.6	0	0	NAF
17837	414518			4505C	69.06	69.80	0.74	Siltstone	SL/MS				6.7	0.66	0.12	4	11	-7	3.0	7.5	0	0	NAF
		230430	4505C_11	4505C	69.80	69.90	0.10	Mudstone	MS						0.39	12							PAF
				4505C	69.90	69.93	0.03	Core Loss	KL	BR4A	Broonie												
		230431	4505C_12	4505C	69.93	70.26	0.33	Coal	DM	BR4A	Broonie				0.70	21							
		230432	4505C_13	4505C	70.26	70.39	0.13	Carbonaceous Siltstone	SL/XM/CN	BR4A	Broonie				0.45	14							PAF
		230433	4505C_14	4505C	70.39	70.74	0.35	Coal	DD	BR4A	Broonie				0.73	22							
		230434	4505C_15	4505C	70.74	71.10	0.36	Coal	DM	BR4C	Broonie				0.65	20							
		230435	4505C_16	4505C	71.10	71.26	0.16	Siltstone	SL						0.63	19							PAF
17838	414519			4505C	71.26	71.63	0.37	Siltstone	SL/XM				2.6	6.87	1.38	42	24	18	0.6	3.1	5	16	PAF
17839	414520			4505C	71.63	72.17	0.54	Siltstone	SL,XM				3.1	3.48	0.87	27	55	-28	2.1	2.8	8	19	PAF
17840	414521			4505C	72.17	72.65	0.48	Sandstone,Siltstone	SS,SL				7.0	0.48	0.05	2	24	-22	16	8.0	0	0	NAF
17841	414522			4505C	72.65	73.06	0.41	Siltstone	SL				7.7	0.46	0.06	2	27	-25	15	7.9	0	0	NAF
		230436	4505C_17	4505C	73.06	73.16	0.10	Siltstone	SL						0.26	8							PAF
				4505C	73.16	73.18	0.02	Core Loss	KL	BR5A	Broonie												
		230437	4505C_18	4505C	73.18	73.61	0.43	Coal	DB	BR5A	Broonie				0.74	23							
		230438	4505C_19	4505C	73.61	74.06	0.45	Coal	BD/SL	BR5C	Broonie				0.50	15							
		230439		4505C	74.06	74.18	0.12	Carbonaceous Siltstone	SL/DB	BR5C	Broonie	Coal Quality Total S Not Available											
17842	414523			4505C	74.18	74.47	0.29	Carbonaceous Siltstone	SL/BD			includes some coal	5.2	0.78	0.27	8	9	-1	1.1	6.7	0	0	NAF
17843	414524			4505C	74.47	76.99	2.52	Sandstone	SS						0.01	0	42	-42	137	-	-	-	NAF
17844	414525			4505C	76.99	77.64	0.65	Sandstone	SS				7.1	0.65	0.05	2	5	-3	3	5.2	0	2	NAF
17845	414526			4505C	77.64	79.13	1.49	Sandstone	SS						<0.01	0	192	-192	1255	-	-	-	NAF
17846	414527			4505C	79.13	79.99	0.86	Siltstone	SL				8.2	0.48	0.07	2	8	-6	4	7.5	0	0	NAF
17847	414528			4505C	79.99	80.32	0.33	Sandstone	SS			includes some coal BR6	5.9	2.89	0.21	6	30	-24	5	8.6	0	0	NAF
		230440	4505C_21	4505C	80.32	80.50	0.18	Mudstone	MS	BR6	Broonie				0.06	2							NAF
		230441	4505C_22	4505C	80.50	80.77	0.27	Coal	DM	BR6	Broonie	Calcite veins dominant			0.61	19							
		230442	4505C_23	4505C	80.77	80.91	0.14	Sandstone	SS						0.09	3							NAF
17848	414529			4505C	80.91	81.42	0.51	Sandstone	SS/SL/XM				8.1	0.54	0.07	2	9	-7	4	7.5	0	0	NAF
17849	414530			4505C	81.42	84.76	3.34	Siltstone	SL/SS			Sideritic	8.7	0.36	0.03	1	58	-57	63	8.3	0	0	NAF
17850	414531			4505C	84.76	89.08	4.32	Sandstone	SS			Calcite veins dominant	8.9	0.42	0.08	2	114	-112	47	10.8	0	0	NAF
17851	414532			4505C	89.08	90.15	1.07	Sandstone	SS/SL			Pyritic in part, Calcite veins	6.1	1.26	1.18	36	49	-13	1.4	7.7	0	0	NAF-HS

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES		Drill Hole ID	Depth (m)			Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	ACID_BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
17852	414533			4505C	90.15	91.49	1.34	Siltstone	SL				4.5	1.80	0.17	5	7	-2	1.3	7.3	0	0	NAF
		230443	4505C_24	4505C	91.49	91.68	0.19	Siltstone	SL/KL			Calcite veins dominant			0.14	4							NAF
		230444	4505C_25	4505C	91.68	91.89	0.21	Coal	DD	BY1A	Bayswater				0.22	7							
		230445	4505C_26	4505C	91.89	92.02	0.13	Carbonaceous Mudstone	XM/CN	BY1A	Bayswater				0.20	6							NAF
17853	414534			4505C	92.02	92.33	0.31	Coal	CN/SL	BY1A	Bayswater		6.3	0.48	0.23	7	3	4	0.4	2.3	26	44	PAF-LC
				4505C	92.33	92.34	0.01	Core Loss	KL	BY1C	Bayswater												
17854	414535			4505C	92.34	92.94	0.60	Coal	CN	BY1C	Bayswater	Calcite veins dominant	6.0	2.29	0.77	24	37	-13	1.6	9.8	0	0	NAF
		230446	4505C_27	4505C	92.94	93.13	0.19	Coal	CN	BY1C	Bayswater	Calcite veins dominant			0.53	16							
		230447	4505C_28	4505C	93.13	93.85	0.72	Coal	DD/MS	BY1C	Bayswater				0.64	20							
		230448	4505C_29	4505C	93.85	94.00	0.15	Coal	CN/XM	BY2A	Bayswater	Pyritic. Total S not available											
17855	414536			4505C	94.00	94.59	0.59	Coal	CN	BY2A	Bayswater	incl mr XM, SL	3.9	1.82	0.66	20	1	19	0.0	3.0	8	26	PAF
		230449	4505C_30	4505C	94.59	94.72	0.13	Coal	CN	BY2A	Bayswater				1.46	45							
		230450	4505C_31	4505C	94.72	94.85	0.13	Coal	DD	BY2C	Bayswater				0.26	8							
		230451	4505C_32	4505C	94.85	95.65	0.80	Coal	DD	BY2C	Bayswater	Pyritic bands in part, 2cm pyrite			4.56	140							
		230452	4505C_33	4505C	95.65	96.08	0.43	Coal	BD	BY2C	Bayswater				0.44	13							
		230453	4505C_34	4505C	96.08	96.45	0.37	Coal	DM	BY3	Bayswater				0.57	17							
		230454	4505C_36	4505C	96.45	96.74	0.29	Coal	DB	BY3	Bayswater				0.49	15							
		230455	4505C_37	4505C	96.74	97.05	0.31	Coal	DD	BY3	Bayswater				0.37	11							
		230456	4505C_38	4505C	97.05	97.33	0.28	Coal	DD	BY3	Bayswater				0.78	24							
		230457	4505C_39	4505C	97.33	97.46	0.13	Sandstone	SS/XM						4.42	135							PAF
17856	414537			4505C	97.46	98.65	1.19	Sandstone	SS				3.2	1.69	0.32	10	0	10	0.0	2.9	5	6	PAF-LC
17857	414538			4505C	98.65	101.65	3.00	Sandstone	SS				8.5	0.43	0.02	1	7	-6	11	7.9	0	0	NAF
17858	414539			4505C	101.65	103.10	1.45	Sandstone	SS						0.01	0	41	-41	134	-	-	-	NAF
17859	414540			4505C	103.10	104.70	1.60	Sandstone	SS				6.0	2.35	0.94	29	42	-13	1.5	8.0	0	0	NAF
17860	414541			4505C	104.70	105.00	0.30	Sandstone	SS				7.3	3.58	1.61	49	60	-11	1.2	7.8	0	0	NAF-HS
		230458	4505C_40	4505C	105.00	105.12	0.12	Siltstone	SL						1.38	42							PAF
				4505C	105.12	105.14	0.02	Core Loss	KL	LAU	Lemington												
		230459	4505C_41	4505C	105.14	105.59	0.45	Coal	DM	LAU	Lemington				3.66	112							
				4505C	105.59	105.66	0.07	Core Loss	KL	LAU	Lemington												
		230460	4505C_42	4505C	105.66	105.78	0.12	Siltstone	SL						0.49	15							PAF
17861	414542			4505C	105.78	106.05	0.27	Siltstone	SL			incl.s mr BD	3.8	4.59	0.77	24	1	23	0.0	2.8	8	11	PAF
17862	414543			4505C	106.05	108.25	2.20	Siltstone	SL/SS				8.6	0.49	0.06	2	53	-51	29	8.9	0	0	NAF
17863	414544			4505C	108.25	110.21	1.96	Sandstone,Siltstone	SS,SL			incl.s SD and Calcite vns	8.9	0.54	0.06	2	56	-54	31	9.3	0	0	NAF
		230461	4505C_43	4505C	110.21	110.33	0.12	Siltstone	SD/SL			SD, Calcite veins dominant			0.06	2							NAF
		230462	4505C_44	4505C	110.33	110.68	0.35	Coal	DB	LAL	Lemington	Calcite veins			0.84	26							
		230463	4505C_45	4505C	110.68	110.81	0.13	Coal	DB	LAL	Lemington				1.52	47							
		230464	4505C_46	4505C	110.81	110.94	0.13	Sandstone,Siltstone	SS,SL						0.18	6							NAF
17864	414545			4505C	110.94	112.98	2.04	Sandstone,Siltstone	SS,SL				8.8	0.41	0.05	2	12	-10	8	8.2	0	0	NAF
17865	414546			4505C	112.98	113.68	0.70	Siltstone	SL			incl.s some SD	8.8	0.42	0.03	1	27	-26	29	8.6	0	0	NAF
17866	414547			4505C	113.68	114.26	0.58	Sandstone	SS				9.1	0.49	0.04	1	63	-62	51	9.0	0	0	NAF
17867	414548			4505C	114.26	116.70	2.44	Sandstone	SS/SL						0.02	1	34	-33	56	-	-	-	NAF
17868	414549			4505C	116.70	117.61	0.91	Sandstone	SS/SL			incl.s some DM with calcite vns	9.0	0.52	0.16	5	47	-42	10	9.1	0	0	NAF
		230465	4505C_47	4505C	117.61	117.77	0.16	Carbonaceous Mudstone	XM/TF	LBU	Lemington				0.36	11							PAF
		230466	4505C_48	4505C	117.77	118.09	0.32	Coal	DB	LBU	Lemington				1.66	51							
		230467	4505C_49	4505C	118.09	118.38	0.29	Carbonaceous Mudstone	XM/TF						1.48	45							PAF
		230468	4505C_50	4505C	118.38	118.80	0.42	Coal	DB/DA/XM/TF	LBL	Lemington				0.81	25							
		230469		4505C	118.80	119.30	0.50	Coal	DA/XM/TF	LBL	Lemington	Pyritic laminae. Total S not available											
		230470		4505C	119.30	119.49	0.19	Tuff	TF/CN	LBL	Lemington	Coal Quality Total S Not Available											
17869	414550			4505C	119.49	120.10	0.61	Carbonaceous Mudstone	XM/SL				6.8	0.91	0.20	6	12	-6	2.0	7.7	0	0	NAF
17870	414551			4505C	120.10	121.70	1.60	Sandstone	SS/SL						0.01	0	40	-40	131	-	-	-	NAF
17871	414552			4505C	121.70	125.40	3.70	Siltstone	SL/SS/SD			Calcite vns	8.6	0.61	0.12	4	46	-42	13	8.4	0	0	NAF
17872	414553			4505C	125.40	125.94	0.54	Siltstone	SL/SD				8.8	0.51	0.06	2	22	-20	12	8.3	0	0	NAF
17873	414554			4505C	125.94	126.58	0.64	Sandstone	SS/SL				9.1	0.60	0.08	2	14	-12	6	8.1	0	0	NAF
17874	414555			4505C	126.58	128.36	1.78	Sandstone	SS/SL				9.3	0.62	0.04	1	69	-68	56	10.2	0	0	NAF
17875	414556			4505C	128.36	128.75	0.39	Siltstone	SL				8.7	0.82	0.12	4	12	-8	3	8.1	0	0	NAF
17876	414557			4505C	128.75	130.52	1.77	Siltstone	SL			Sideritic	8.9	0.59	0.03	1	29	-28	32	8.6	0	0	NAF
17877	414558			4505C	130.52	133.31	2.79	Siltstone	SL/SS				9.1	0.55	0.04	1	42	-41	34	8.4	0	0	NAF
17878	414559			4505C	133.31	134.43	1.12	Siltstone	SL/SS				9.1	0.48	0.06	2	28	-26	15	8.2	0	0	NAF
17879	414560			4505C	134.43	134.72	0.29	Sandstone	SS/SL				9.0	0.70	0.11	3	25	-22	7	8.1	0	0	NAF
		230471	4505C_53	4505C	134.72	134.93	0.21	Carbonaceous Mudstone	XM/SL/TF						0.26	8							PAF
		230472	4505C_54	4505C	134.93	135.32	0.39	Coal	DB	LEC	Lemington	Calcite veins dominant			1.20	37							
		230473	4505C_55	4505C	135.32	136.06	0.74	Coal	BB	LEC	Lemington	Pyritic minor laminae			2.04	62							

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES		Drill Hole ID	Depth (m)			Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	ACID_BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
				4505C	136.06	136.08	0.02	Core Loss	KL	LEC	Lemington												
		230474	4505C_56	4505C	136.08	136.28	0.20	Coal	BD/XM/TF	LEC	Lemington				1.82	56							
17880	414561			4505C	136.28	137.00	0.72	Sandstone,Siltstone	SS,SL			Sideritic	8.6	0.60	0.10	3	21	-18	7	8.2	0	0	NAF
17881	414562			4505C	137.00	137.76	0.76	Sandstone,Siltstone	SS,SL			Sideritic	9.0	0.39	0.10	3	13	-10	4	8.1	0	0	NAF
17882	414563			4505C	137.76	141.50	3.74	Sandstone	SS,SL				9.3	0.55	0.06	2	42	-40	23	8.3	0	0	NAF
17883	414564			4505C	141.50	144.17	2.67	Sandstone	SS/SL			Sideritic, incl.s SD			0.02	1	99	-98	162	-	-	-	NAF
17884	414565			4505C	144.17	147.28	3.11	Sandstone	SS/SL				9.3	0.64	0.04	1	101	-100	83	8.5	0	0	NAF
17885	414566			4505C	147.28	147.72	0.44	Sandstone	SS				9.1	0.42	0.09	3	12	-9	4	7.9	0	0	NAF
		230475	4505C_57	4505C	147.72	147.83	0.11	Sandstone	SS						1.00	31							PAF
		230476	4505C_58	4505C	147.83	148.12	0.29	Coal	BD	LDU	Lemington				4.93	151							
		230477	4505C_60	4505C	148.12	148.65	0.53	Coal	DM/TF	LDU	Lemington				0.31	9							
		230478	4505C_61	4505C	148.65	149.00	0.35	Coal	DM	LDL	Lemington				0.46	14							
		230479	4505C_62	4505C	149.00	149.75	0.75	Coal	BR	LDL	Lemington	Pyritic minor nodules			0.53	16							
		230480	4505C_63	4505C	149.75	149.98	0.23	Coal	DB	LDL	Lemington				0.86	26							
		230481	4505C_64	4505C	149.98	150.15	0.17	Siltstone	SL						0.21	6							PAF
17886	414567			4505C	150.15	150.92	0.77	Siltstone	SL			Incl.s DM	5.0	2.15	0.30	9	23	-14	2.5	7.8	0	0	NAF
17887	414568			4505C	150.92	151.74	0.82	Siltstone	SL						0.02	1	25	-24	41	-	-	-	NAF
		230382	4505C_65	4505C	151.74	151.88	0.14	Siltstone	SL						0.10	3							NAF
		230383	4505C_66	4505C	151.88	152.00	0.12	Coal	DB						0.69	21							
		230384	4505C_67	4505C	152.00	152.19	0.19	Siltstone	SL						0.08	2							NAF
17888	414569			4505C	152.19	152.60	0.41	Siltstone	SL/SS				9.1	0.38	0.05	2	18	-16	12	7.9	0	0	NAF
17889	414570			4505C	152.60	153.67	1.07	Siltstone	SL/SS				9.0	0.43	0.07	2	21	-19	10	8.2	0	0	NAF
17890	414571			4505C	153.67	155.72	2.05	Siltstone	SL/SS						0.01	0	85	-85	278	-	-	-	NAF
17891	414572			4505C	155.72	158.77	3.05	Sandstone,Siltstone	SS,SL				9.3	0.58	0.01	0	49	-49	160	8.4	0	0	NAF
17892	414573			4505C	158.77	161.47	2.70	Sandstone	SS/SL			Incl.s some SD			0.01	0	106	-106	346	-	-	-	NAF
17893	414574			4505C	161.47	164.76	3.29	Sandstone	SS				9.2	0.60	0.01	0	27	-27	88	8.3	0	0	NAF
17894	414575			4505C	164.76	165.20	0.44	Sandstone	SS/SL			Incl.s XSL	9.1	0.36	0.07	2	19	-17	9	8.0	0	0	NAF
		230485	4505C_68	4505C	165.20	165.42	0.22	Tuff	TF/DM						0.16	5							NAF
		230486	4505C_69	4505C	165.42	165.80	0.38	Coal	DB	UPT	Pikes Gully				0.82	25							
		230487	4505C_70	4505C	165.80	165.98	0.18	Mudstone	MS						0.50	15							PAF
17895	414576			4505C	165.98	166.51	0.53	Mudstone	MS/XM				9.0	0.46	0.08	2	25	-23	10	8.2	0	0	NAF
		230488	4505C_71	4505C	166.51	166.63	0.12	Carbonaceous Mudstone	MS,XM						0.39	12							PAF
		230489	4505C_72	4505C	166.63	167.04	0.41	Coal	DM	UPB	Pikes Gully				0.70	21							
		230490	4505C_73	4505C	167.04	167.23	0.19	Carbonaceous Mudstone	XM	UPB	Pikes Gully				0.25	8							PAF
		230491	4505C_74	4505C	167.23	167.79	0.56	Coal	BD/SL/TF	UPB	Pikes Gully				0.85	26							
		230492	4505C_75	4505C	167.79	168.05	0.26	Siltstone	SL	UPB	Pikes Gully				0.30	9							PAF
		230493	4505C_76	4505C	168.05	168.18	0.13	Coal	DB	UPB	Pikes Gully				0.99	30							
		230494	4505C_77	4505C	168.18	168.29	0.11	Sandstone,Siltstone	SS,SL						0.04	1							NAF
17896	414577			4505C	168.29	169.24	0.95	Sandstone,Siltstone	SS,SL						0.02	1	41	-40	67	-	-	-	NAF
17897	414578			4505C	169.24	170.60	1.36	Sandstone	SS/SL/SD				9.3	0.55	0.02	1	76	-75	124	8.4	0	0	NAF
17898	414579			4505C	170.60	171.49	0.89	Sandstone	SS/SL			Incl.s mr DB with calcite vns	9.3	0.44	0.16	5	26	-21	5	8.5	0	0	NAF
17899	414580			4505C	171.49	173.42	1.93	Sandstone,Siltstone	SS,SL				9.3	0.49	0.01	0	32	-32	105	8.2	0	0	NAF
17900	414581			4505C	173.42	173.80	0.38	Siltstone	SL/SD/DB			Calc vns, SD nodules	9.2	0.46	0.08	2	64	-62	26	8.3	0	0	NAF
17901	414582			4505C	173.80	174.42	0.62	Siltstone	SL				9.1	0.43	0.03	1	24	-23	26	8.2	0	0	NAF
		230495	4505C_78	4505C	174.42	174.54	0.12	Carbonaceous Mudstone	XM/SL						0.63	19							PAF
		230496	4505C_79	4505C	174.54	174.81	0.27	Coal	DM	MPG	Pikes Gully				0.52	16							
		230497	4505C_80	4505C	174.81	175.14	0.33	Coal	DB/TF	MPG	Pikes Gully				0.41	13							
		230498	4505C_81	4505C	175.14	175.48	0.34	Coal	BD	MPG	Pikes Gully				0.64	20							
		230499	4505C_82	4505C	175.48	175.61	0.13	Siltstone	SL						0.24	7							PAF
17902	414583			4505C	175.61	176.79	1.18	Siltstone	SL/SS						0.02	1	40	-39	65	-	-	-	NAF
17903	414584			4505C	176.79	178.71	1.92	Siltstone	SL/SS				9.1	0.55	0.02	1	37	-36	60	8.4	0	0	NAF
17904	414585			4505C	178.71	179.43	0.72	Siltstone	SL/SD			Calcite veins, sideritic	9.0	0.51	0.04	1	25	-24	20	8.3	0	0	NAF
		233301	4505C_83	4505C	179.43	179.56	0.13	Siltstone	SL						0.52	16							PAF
		233302	4505C_84	4505C	179.56	179.79	0.23	Coal	DB	LPG	Pikes Gully				0.61	19							
		233303	4505C_85	4505C	179.79	180.56	0.77	Coal	BB	LPG	Pikes Gully				0.61	19							
		233304	4505C_86	4505C	180.56	180.68	0.12	Carbonaceous Mudstone	XM						0.94	29							PAF
17905	414586			4505C	180.68	181.60	0.92	Sandstone	SS/SD/SL						0.01	0	23	-23	75	-	-	-	NAF
17906	414587			4505C	181.60	182.66	1.06	Siltstone	SL,SD				9.3	0.56	0.02	1	97	-96	158	8.5	0	0	NAF
17907	414588			4505C	182.66	185.80	3.14	Sandstone	SS			some SL			0.01	0	66	-66	216	-	-	-	NAF
17908	414589			4505C	185.80	189.92	4.12	Sandstone	SS				9.4	0.49	<0.01	0	35	-35	229	8.4	0	0	NAF
17909	414590			4505C	189.92	192.53	2.61	Sandstone	SS						0.01	0	73	-73	239	-	-	-	NAF
17910	414591			4505C	192.53	193.00	0.47	Carbonaceous Siltstone	SL/SD/DB			Calcite veins	8.7	0.57	0.13	4	36	-32	9	8.2	0	0	NAF

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES		Drill Hole ID	Depth (m)			Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	ACID_BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
17911	414592			4505C	193.00	193.66	0.66	Siltstone	SL				9.1	0.40	0.02	1	24	-23	39	8.3	0	0	NAF
		233305	4505C_87	4505C	193.66	193.79	0.13	Siltstone	SL						0.19	6							NAF
		233306	4505C_88	4505C	193.79	194.07	0.28	Coal	DB	UA1	Arties				0.70	21							
		233307	4505C_89	4505C	194.07	194.14	0.07	Carbonaceous Mudstone	XM	UA1	Arties				0.17	5							NAF
		233308	4505C_90	4505C	194.14	194.34	0.20	Coal	DB/XM	UA1	Arties				0.80	24							
		233309	4505C_91	4505C	194.34	194.48	0.14	Carbonaceous Mudstone	XM						0.30	9							PAF
		233310	4505C_92	4505C	194.48	194.79	0.31	Coal	DM	UAA	Arties				0.94	29							
		233311	4505C_93	4505C	194.79	195.58	0.79	Coal	BB	UAA	Arties	Pyritic minor in part			0.64	20							
		233312	4505C_94	4505C	195.58	195.80	0.22	Coal	BD	UAA	Arties				0.79	24							
		233313	4505C_95	4505C	195.80	195.90	0.10	Siltstone	SL						0.08	2							NAF
17912	414593			4505C	195.90	196.18	0.28	Siltstone	SL						0.02	1	20	-19	33	-	-	-	NAF
17913	414594			4505C	196.18	197.78	1.60	Sandstone	SS/SL				9.1	0.39	0.01	0	26	-26	85	8.4	0	0	NAF
17914	414595			4505C	197.78	199.68	1.90	Siltstone	SL/SS			Sideritic			0.01	0	24	-24	78	-	-	-	NAF
17957	414596			4505C	199.68	204.72	5.04	Sandstone	SS				9.3	0.63	0.01	0	86	-86	281	8.6	0	0	NAF
17958	414597			4505C	204.72	207.08	2.36	Siltstone	SL/SS/SD						0.01	0	20	-20	65	-	-	-	NAF
17959	414598			4505C	207.08	210.50	3.42	Sandstone	SS			Siderite nodules	9.3	0.46	<0.01	0	68	-68	444	8.5	0	0	NAF
17960	414599			4505C	210.50	212.91	2.41	Sandstone	SS/SL			Calcite veins			<0.01	0	126	-126	824	-	-	-	NAF
17961	414600			4505C	212.91	217.22	4.31	Sandstone	SS/SL			Includes some SD, calc vns	9.2	0.39	0.01	0	20	-20	65	8.4	0	0	NAF
17962	414601			4505C	217.22	218.42	1.20	Siltstone	SL				9.0	0.40	0.03	1	11	-10	12	8.2	0	0	NAF
17963	414602			4505C	218.42	218.58	0.16	Mudstone	MS				9.0	0.53	0.01	0	5	-5	16	6.3	0	1	NAF
		233314	4505C_96	4505C	218.58	218.71	0.13	Mudstone	MS						0.06	2							NAF
				4505C	218.71	218.81	0.10	Core Loss	KL	UAB	Arties												
		233315	4505C_97	4505C	218.81	218.95	0.14	Coal	DB	UAB	Arties				0.68	21							
		233316	4505C_99	4505C	218.95	219.16	0.21	Coal	DB	UAB	Arties				0.53	16							
		233317	4505C_100	4505C	219.16	219.40	0.24	Coal	DB	UAB	Arties				0.54	17							
		233318	4505C_101	4505C	219.40	220.12	0.72	Coal	DD	UAB	Arties	Pyritic minor in part			0.67	21							
		233319	4505C_102	4505C	220.12	220.27	0.15	Coal	BB	UAB	Arties				0.55	17							
				4505C	220.27	220.35	0.08	Core Loss	KL	UAB	Arties												
		233320	4505C_103	4505C	220.35	220.62	0.27	Carbonaceous Mudstone	XM/KL/BB						0.63	19							PAF
		233321	4505C_104	4505C	220.62	220.75	0.13	Carbonaceous Siltstone	SL/DM	LAA	Arties				0.16	5							NAF
		233322	4505C_105	4505C	220.75	221.41	0.66	Coal	BB/DM	LAA	Arties	Pyritic minor in part			0.55	17							
				4505C	221.41	221.54	0.13	Core Loss	KL	LAA	Arties												
		233323	4505C_106	4505C	221.54	221.64	0.10	Siltstone	SL/XM						0.67	21							PAF
17964	414603			4505C	221.64	222.86	1.22	Siltstone	SL						0.02	1	24	-23	39	-	-	-	NAF
17965	414604			4505C	222.86	223.82	0.96	Mudstone	MS/SL/XM				9.0	0.41	0.04	1	17	-16	14	8.2	0	0	NAF
17966	414605			4505C	223.82	225.48	1.66	Siltstone	SD/SL			SD, Calcite veins common	9.1	0.54	0.03	1	130	-129	142	8.3	0	0	NAF
				4505C	225.48	225.52	0.04	Core Loss	KL														
17967	414606			4505C	225.52	226.01	0.49	Siltstone	SD/SL/TF			SD, Incl.s some DM, calc vns dominant	9.0	0.52	0.03	1	37	-36	40	8.2	0	0	NAF
		233324	4505C_107	4505C	226.01	226.12	0.11	Carbonaceous Mudstone	XM	LB1	Arties				0.25	8							PAF
		233325	4505C_108	4505C	226.12	226.25	0.13	Coal	DB	LB1	Arties				0.50	15							
		233326	4505C_109	4505C	226.25	226.41	0.16	Coal	DB/TF	LB2	Arties				0.44	13							
		233327	4505C_110	4505C	226.41	226.70	0.29	Coal	BD	LB2	Arties				3.35	103							
		233328	4505C_111	4505C	226.70	227.32	0.62	Coal	BR	LB2	Arties	Pyritic minor in part			0.58	18							
		233329	4505C_112	4505C	227.32	227.42	0.10	Carbonaceous Mudstone	XM	LB3	Arties				0.46	14							PAF
17968	414607			4505C	227.42	227.87	0.45	Carbonaceous Siltstone	SL/DB	LB3	Arties		8.7	0.59	0.12	4	17	-13	5	8.3	0	0	NAF
17969	414608			4505C	227.87	230.83	2.96	Siltstone	SL/SS			Calcite veins dominant	9.1	0.40	0.01	0	27	-27	88	8.1	0	0	NAF
		233330	4505C_113	4505C	230.83	230.95	0.12	Siltstone	SL						0.07	2							NAF
		233331	4505C_114	4505C	230.95	231.19	0.24	Coal	BD	ULT	Liddell				0.72	22							
		233332	4505C_115	4505C	231.19	231.30	0.11	Siltstone	SL						0.04	1							NAF
17970	414609			4505C	231.30	231.96	0.66	Siltstone	SL						0.01	0	14	-14	46	-	-	-	NAF
17971	414610			4505C	231.96	232.57	0.61	Sandstone	SS				9.2	0.40	0.01	0	9	-9	29	8.2	0	0	NAF
17972	414611			4505C	232.57	233.31	0.74	Siltstone	SL/MS				7.9	0.81	0.17	5	16	-11	3	8.1	0	0	NAF
17973	414612			4505C	233.31	234.04	0.73	Sandstone	SS			Calcite veins common	8.4	0.41	0.01	0	93	-93	304	8.5	0	0	NAF
17974	414613			4505C	234.04	236.91	2.87	Siltstone	SL/SS						0.01	0	24	-24	78	-	-	-	NAF
17975	414614			4505C	236.91	237.80	0.89	Siltstone	SL/SS			Pyrite nodules dominant	8.5	0.51	1.32	40	38	2	0.9	7.2	0	0	UC(NAF-HS)
17976	414615			4505C	237.80	238.79	0.99	Siltstone	SL/SS			Pyrite nodules dominant	8.3	0.41	0.01	0	17	-17	56	8.3	0	0	NAF
17977	414616			4505C	238.79	239.03	0.24	Siltstone	SL				8.2	0.52	0.04	1	12	-11	10	7.8	0	0	NAF
		233333	4505C_116	4505C	239.03	239.14	0.11	Siltstone	SL						2.01	62							PAF
		233334	4505C_117	4505C	239.14	239.29	0.15	Coal	DB	ULD	Liddell				0.96	29							
		233335	4505C_118	4505C	239.29	239.41	0.12	Siltstone	SL/TF	ULD	Liddell				0.07	2							NAF
		233336	4505C_119	4505C	239.41	239.56	0.15	Siltstone	SL	ULD	Liddell				0.29	9							PAF
		233337	4505C_120	4505C	239.56	239.66	0.10	Coal	DB	ULD	Liddell				0.77	24							

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES		Drill Hole ID	Depth (m)			Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	ACID_BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
		233338	4505C_121	4505C	239.66	240.34	0.68	Coal	BB	ULD	Liddell	Pyritic common throughout			1.02	31							
		233339	4505C_122	4505C	240.34	240.67	0.33	Coal	DB/SL	UL1	Liddell				0.78	24							
		233340	4505C_123	4505C	240.67	240.77	0.10	Siltstone	SL						0.59	18							PAF
17978	414617			4505C	240.77	242.11	1.34	Siltstone	SL				7.9	0.39	0.03	1	23	-22	25	7.6	0	0	NAF
17979	414618			4505C	242.11	242.70	0.59	Carbonaceous Siltstone	SL/SD/DM			SD Pyritic Calcite veins dominant	8.4	0.38	1.28	39	90	-51	2.3	7.5	0	0	NAF-HS
		233341	4505C_124	4505C	242.70	242.81	0.11	Coal	DB/SL	U2A	Liddell				0.28	9							
		233342	4505C_125	4505C	242.81	243.26	0.45	Coal	DB	U2A	Liddell				0.57	17							
		233343	4505C_126	4505C	243.26	243.37	0.11	Siltstone	SL	U2A	Liddell				0.06	2							NAF
		233344	4505C_127	4505C	243.37	243.57	0.20	Coal	DB	U2A	Liddell				0.47	14							
		233345	4505C_128	4505C	243.57	243.79	0.22	Siltstone	SL						1.59	49							PAF
		233346	4505C_129	4505C	243.79	243.92	0.13	Coal	DB	U2B	Liddell				0.41	13							
		233347	4505C_130	4505C	243.92	244.13	0.21	Siltstone	SL						0.37	11							PAF
17980	414619			4505C	244.13	244.30	0.17	Siltstone	SL				7.8	0.43	0.17	5	51	-46	10	7.8	0	0	NAF
17981	414620			4505C	244.30	245.66	1.36	Siltstone	SL/SS						0.01	0	20	-20	65	-	-	-	NAF
17982	414621			4505C	245.66	248.73	3.07	Siltstone	SL/SS				8.3	0.28	0.01	0	26	-26	85	8.2	0	0	NAF
17983	414622			4505C	248.73	249.65	0.92	Siltstone	SL/SS			Incl.s some SD with calc veins and py in p	8.5	0.33	0.29	9	60	-51	7	8.1	0	0	NAF
17984	414623			4505C	249.65	252.24	2.59	Sandstone	SS/SL						0.01	0	25	-25	82	-	-	-	NAF
17985	414624			4505C	252.24	253.13	0.89	Siltstone	SL				8.9	0.42	0.02	1	23	-22	38	7.8	0	0	NAF
		233348	4505C_131	4505C	253.13	253.30	0.17	Carbonaceous Siltstone	SL/DM	LLT	Liddell	Calcite veins dominant			0.09	3							NAF
		233349	4505C_132	4505C	253.30	253.70	0.40	Coal	CN	LLT	Liddell				1.04	32							
		233350	4505C_133	4505C	253.70	253.98	0.28	Coal	DM/TF/XM	LLB	Liddell				0.13	4							
		233351	4505C_134	4505C	253.98	254.40	0.42	Coal	DM	LLB	Liddell				0.32	10							
		233352	4505C_135	4505C	254.40	254.51	0.11	Siltstone	SL						0.18	6							NAF
17986	414625			4505C	254.51	254.99	0.48	Siltstone	SL/SS			Incl.s mr XM, pyritic in part, calc vns	8.7	0.35	0.30	9	24	-15	2.6	7.2	0	0	NAF
17987	414626			4505C	254.99	255.46	0.47	Sandstone	SS/SL						0.01	0	17	-17	56	-	-	-	NAF
17988	414627			4505C	255.46	257.95	2.49	Sandstone	SS				7.9	0.42	0.51	16	42	-26	2.7	8.4	0	0	NAF
17989	414628			4505C	257.95	261.95	4.00	Sandstone	SS				7.8	0.51	0.01	0	47	-47	154	7.9	0	0	NAF
17990	414629			4505C	261.95	263.00	1.05	Siltstone	SL						0.02	1	29	-28	47	-	-	-	NAF
17991	414630			4505C	263.00	266.22	3.22	Sandstone	SS				8.4	0.38	<0.01	0	107	-107	699	8.2	0	0	NAF
17992	414631			4505C	266.22	268.10	1.88	Siltstone	SL/SS/SD			Calc vns with SD	8.6	0.37	0.03	1	28	-27	31	8.2	0	0	NAF
17993	414632			4505C	268.10	269.59	1.49	Siltstone	SL						0.01	0	27	-27	88	-	-	-	NAF
		233353	4505C_136	4505C	269.59	269.68	0.09	Siltstone	SL						0.04	1							NAF
		233354	4505C_137	4505C	269.68	269.97	0.29	Coal	HS			Calcite veins dominant			0.13	4							
		233355	4505C_138	4505C	269.97	270.28	0.31	Coal	HS			Calcite veins dominant			0.07	2							
		233356	4505C_139	4505C	270.28	270.87	0.59	Coal	DD/TF	BAR	Barrett	Pyritic minor in part			0.58	18							
				4505C	270.87	270.91	0.04																
17994	414633			4505C	270.91	271.11	0.20	Coal	DB/TF/SL	BAR	Barrett		7.5	1.31	0.62	19	10	9	0.5	3.8	1	6	PAF-LC
		233357	4505C_140	4505C	271.11	271.35	0.24	Coal	BD	BAR	Barrett				0.73	22							
				4505C	271.35	271.41	0.06	Core Loss	KL	BAR	Barrett												
		233358	4505C_141	4505C	271.41	271.48	0.07	Tuff	TF	BAR	Barrett				0.48	15							PAF
		233359	4505C_142	4505C	271.48	271.78	0.30	Coal	BD	BAR	Barrett				1.55	47							
		233360	4505C_143	4505C	271.78	271.94	0.16	Siltstone	SL/SS						0.19	6							NAF
17995	414634			4505C	271.94	272.75	0.81	Siltstone	SL/SS			Sideritic			0.02	1	52	-51	85	-	-	-	NAF
17996	414635			4505C	272.75	273.17	0.42	Coal	DB/SL/XM				5.8	3.75	1.27	39	29	10	0.7	3.3	3	9	PAF-LC
17997	414636			4505C	273.17	273.94	0.77	Sandstone	SS				7.8	0.53	0.09	3	51	-48	19	7.9	0	0	NAF
17998	414637			4505C	273.94	275.02	1.08	Siltstone	SL/MS				6.6	2.97	1.13	35	28	7	0.8	4.7	0	1	UC(PAF)
				4505C	275.02	275.08	0.06	Core Loss	KL														
17999	414638			4505C	275.08	275.54	0.46	Carbonaceous Siltstone	SL/DB/TF				4.5	3.66	2.20	67	26	41	0.4	2.7	14	22	PAF
18000	414639			4505C	275.54	278.02	2.48	Siltstone	SL				6.5	1.79	1.07	33	26	7	0.8	6.4	0	0	UC(PAF)
18001	414640			4505C	278.02	278.65	0.63	Sandstone	SS/SL				6.1	1.85	1.84	56	12	44	0.2	2.7	14	23	PAF
				G3	0.00	3.00	3.00	Soil	SO														
				G3	3.00	7.00	4.00	Clay	CL														
				G3	7.00	10.00	3.00	Sand	SA														
				G3	10.00	16.10	6.10	Gravel	GV			DOW 16.1											
		11000	G3_1	G3	16.10	16.89	0.79	Coal	CO	MA3J	Mt Arthur				0.55	17							
		11001	G3_2	G3	16.89	17.19	0.29	Carbonaceous Mudstone	MS/XH/CO			Carbonate layers			0.32	10							PAF
		11002	G3_3	G3	17.19	17.25	0.07	Coal	CO	MA3L	Mt Arthur				0.69	21							
		11003	G3_4	G3	17.25	17.35	0.10	Sandstone	SS			Coal Quality Total S Not Available											
17755	414301			G3	17.35	17.91	0.56	Sandstone	SS				7.7	0.61	0.02	1	5	-4	8	7.4	0	0	NAF
17756	414302			G3	17.91	19.00	1.10	Sandstone	SS/SH			Siderite	6.7	0.11	0.15	5	16	-11	3	7.1	0	0	NAF
17757	414303			G3	19.00	19.29	0.29	Mudstone	SD/CS			SD	7.4	0.69	0.08	2	282	-280	115	8.2	0	0	NAF
17758	414304			G3	19.29	20.08	0.79	Siltstone	SH/Siltshale				4.5	1.29	0.26	8	2	6	0.3	3.4	2	6	PAF-LC

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES		Drill Hole ID	Depth (m)			Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	ACID_BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
		11004	G3_5	G3	20.08	20.17	0.09	Mudstone	CS			Coal Quality Total S Not Available											
		11005	G3_7	G3	20.17	21.62	1.45	Coal	CO	PF1A/PF1C	Piercefield				0.47	14							
		11007	G3_8	G3	21.62	21.97	0.35	Coal	CO	PF2A	Piercefield				0.44	13							
		11008	G3_9	G3	21.97	22.00	0.03	Carbonaceous Mudstone	XM						1.92	59							PAF
		11009	G3_10	G3	22.00	22.70	0.70	Coal	CO	PF2C	Piercefield				0.43	13							
		11010	G3_11	G3	22.70	22.75	0.05	Carbonaceous Mudstone	CS/CO			Sideritic			0.85	26							PAF
		11011	G3_12	G3	22.75	23.25	0.50	Coal	CO	PF3	Piercefield				0.52	16							
		11012	G3_13	G3	23.25	23.33	0.08	Mudstone	CS						1.76	54							PAF
		11013	G3_14	G3	23.33	23.92	0.59	Coal	CO	PF4	Piercefield				0.57	17							
		11014	G3_15	G3	23.92	24.13	0.22	Siltstone	Siltshale						0.62	19							PAF
		11015	G3_16	G3	24.13	24.19	0.06	Coal	CO	PF5A	Piercefield				0.53	16							
		11016	G3_17	G3	24.19	24.23	0.04	Mudstone	CS						0.05	2							NAF
		11017	G3_18	G3	24.23	24.68	0.46	Coal	CO	PF5C	Piercefield				0.44	13							
		11018	G3_19	G3	24.68	24.79	0.11	Siltstone	Siltshale			Coal Quality Total S Not Available											
17759	414305			G3	24.79	25.09	0.31	Siltstone	Siltshale				5.2	0.98	0.20	6	2	4	0.3	3.8	2	5	PAF-LC
		11019	G3_20	G3	25.09	25.18	0.09	Siltstone	Siltshale			Coal Quality Total S Not Available											
		11020	G3_21	G3	25.18	25.73	0.56	Coal	CO	VA1A	Vaux				0.52	16							
		11021	G3_22	G3	25.73	25.94	0.21	Sandstone	SS/XM						0.45	14							PAF
		11022	G3_23	G3	25.94	26.31	0.38	Coal	CO	VA1C	Vaux				0.55	17							
		11023	G3_24	G3	26.31	26.63	0.32	Siltstone	Siltshale						0.28	9							PAF
		11024	G3_25	G3	26.63	26.98	0.36	Coal	CO	VA2	Vaux				0.54	17							
		11025	G3_26	G3	26.98	27.16	0.18	Sandstone	SS/XH			Carbonate layers, sideritic			0.34	10							PAF
		11026	G3_27	G3	27.16	27.25	0.09	Coal	CO		Vaux	Coal Quality Total S Not Available											
		11027	G3_28	G3	27.25	27.35	0.10	Siltstone	Siltshale			Coal Quality Total S Not Available											
17760	414306			G3	27.35	27.54	0.19	Siltstone	Siltshale				4.9	1.20	0.25	8	3	5	0.4	3.6	2	5	PAF-LC
		11028	G3_29	G3	27.54	27.63	0.09	Siltstone	Siltshale			Coal Quality Total S Not Available											
		11029	G3_31	G3	27.63	28.55	0.92	Coal	CO	VA3A	Vaux				0.49	15							
		11033	G3_35	G3	28.55	28.90	0.35	Carbonaceous Mudstone	Coaly Shale						0.36	11							PAF
		11034	G3_37	G3	28.90	29.10	0.20	Coal	CO	VA3C	Vaux				0.55	17							
		11036	G3_39	G3	29.10	29.18	0.07	Siltstone	ST			Coal Quality Total S Not Available											
17761	414307			G3	29.18	29.88	0.70	Siltstone	ST/SS				3.9	2.42	0.46	14	3	11	0.2	3.0	5	9	PAF-LC
17762	414308			G3	29.88	32.00	2.12	Sandstone	SS/ST				7.5	0.78	0.04	1	17	-16	14	8.3	0	0	NAF
17763	414309			G3	32.00	33.53	1.53	Siltstone	Siltshale/ST/SS			Incl.s SD and CS	8.2	0.47	0.05	2	134	-132	88	8.4	0	0	NAF
17764	414310			G3	33.13	36.02	2.89	Sandstone	SS/ST/CS			Sideritic	8.6	0.46	0.03	1	161	-160	175	8.3	0	0	NAF
17765	414311			G3	36.02	39.00	2.98	Sandstone	SS/SH/SD			Sideritic			0.01	0	39	-39	127	-	-	-	NAF
17766	414312			G3	39.00	40.30	1.30	Sandstone	SS				8.7	0.42	0.01	0	52	-52	170	8.7	0	0	NAF
17767	414313			G3	40.30	41.59	1.29	Sandstone	SS				8.0	0.58	0.03	1	25	-24	27	8.3	0	0	NAF
17768	414314			G3	41.59	43.04	1.45	Sandstone	SS						<0.01	0	180	-180	1176	-	-	-	NAF
17769	414315			G3	43.04	45.44	2.40	Sandstone	SS/SH/SD			Siderite	8.6	0.52	0.01	0	43	-43	141	8.5	0	0	NAF
17770	414316			G3	45.44	46.83	1.39	Sandstone	SS			Incl.s SD			<0.01	0	189	-189	1235	-	-	-	NAF
17771	414317			G3	46.83	49.14	2.31	Sandstone	SS				8.8	0.41	0.01	0	48	-48	157	8.7	0	0	NAF
17772	414318			G3	49.14	49.77	0.63	Sandstone	SS						0.01	0	24	-24	78	-	-	-	NAF
17773	414319			G3	49.77	50.30	0.53	Mudstone	SH				8.3	0.45	0.01	0	10	-10	33	7.8	0	0	NAF
		11037	G3_40	G3	50.30	50.51	0.21	Mudstone	SD/MS			Coal Quality Total S Not Available											
		11038	G3_41	G3	50.51	51.34	0.84	Coal	CO	BR1	Broonie				0.61	19							
		11039	G3_42	G3	51.34	51.79	0.45	Mudstone	XH						0.19	6							NAF
		11040	G3_43	G3	51.79	51.93	0.14	Coal	CO	BR2	Broonie				1.24	38							
		11041	G3_44	G3	51.93	52.08	0.16	Mudstone	MS			Coal Quality Total S Not Available											
		11042		G3	52.08	52.11	0.03	Coal	CO		Broonie	Coal Quality Total S Not Available											
				G3	52.11	52.13	0.02	Core Loss	KL														
		11043		G3	52.13	52.19	0.05	Sandstone	SS			Coal Quality Total S Not Available											
		11044		G3	52.19	52.22	0.03	Coal	CO		Broonie	Coal Quality Total S Not Available											
		11045		G3	52.22	52.35	0.13	Mudstone	XH			Carbonate layers. Total S not available											
		11046		G3	52.35	52.42	0.06	Coal	CO		Broonie	Coal Quality Total S Not Available											
		11047		G3	52.42	52.56	0.15	Mudstone	XH			Coal Quality Total S Not Available											
17774	414320			G3	52.56	53.48	0.92	Carbonaceous Mudstone	XH/CO			Carbonate layers	7.7	0.36	0.16	5	11	-6	2.2	5.7	0	2	NAF
17775	414321			G3	53.48	54.90	1.42	Sandstone	SS/SH				8.9	0.48	0.02	1	114	-113	186	9.0	0	0	NAF
17776	414322			G3	54.90	55.86	0.97	Sandstone	SS/SH						0.01	0	24	-24	78	-	-	-	NAF
17777	414323			G3	55.86	56.42	0.56	Sandstone	SS/Siltshale				8.4	0.39	0.02	1	18	-17	29	8.1	0	0	NAF
		11048	G3_51	G3	56.42	56.62	0.20	Siltstone	Siltshale			Coal Quality Total S Not Available											
		11049	G3_53	G3	56.62	57.40	0.78	Coal	CO	BR3	Broonie				0.54	17							
		11054	G3_58	G3	57.40	57.58	0.18	Siltstone	Siltshale			Coal Quality Total S Not Available											

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES		Drill Hole ID	Depth (m)			Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	ACID_BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
17778	414324			G3	57.58	58.43	0.85	Sandstone	SS						0.01	0	19	-19	62	-	-	-	NAF
17779	414325			G3	58.43	58.79	0.36	Siltstone	Siltshale				8.1	0.79	0.04	1	68	-67	56	8.6	0	0	NAF
17780	414326			G3	58.79	60.10	1.31	Sandstone	SS						0.01	0	76	-76	248	-	-	-	NAF
17781	414327			G3	60.10	60.45	0.35	Siltstone	Siltshale				8.3	0.49	0.02	1	13	-12	21	8.0	0	0	NAF
		11055	G3_59	G3	60.45	60.61	0.16	Siltstone	Siltshale			Minor sideritic nodules											
		11056	G3_61	G3	60.61	61.57	0.97	Coal	CO	BR4A	Broonie				0.58	18							
		11060	G3_65	G3	61.57	61.71	0.14	Mudstone	XH			Carbonate layers			0.18	6							NAF
		11061	G3_67	G3	61.71	61.96	0.24	Coal	CO/XH	BR4C	Broonie				0.49	15							
		11064	G3_70	G3	61.96	62.17	0.22	Siltstone	Siltshale			Coal Quality Total S Not Available											
17782	414328			G3	62.17	63.28	1.11	Sandstone	SS						0.02	1	26	-25	42	-	-	-	NAF
17783	414329			G3	63.28	64.20	0.92	Mudstone	SH			Mr CO	8.8	0.54	0.06	2	107	-105	58	8.5	0	0	NAF
17784	414330			G3	64.20	65.22	1.02	Sandstone	SS						0.02	1	49	-48	80	-	-	-	NAF
17785	414331			G3	65.22	65.52	0.30	Mudstone	SH				8.0	0.66	0.07	2	11	-9	5	7.6	0	0	NAF
		11065	G3_71	G3	65.52	65.66	0.14	Mudstone	SH			Coal Quality Total S Not Available											
		11066	G3_72	G3	65.66	66.01	0.35	Coal	CO	BR5A	Broonie				0.79	24							
		11067	G3_73	G3	66.01	66.14	0.13	Mudstone	XH	BR5A	Broonie				0.47	14							PAF
		11068	G3_74	G3	66.14	66.57	0.43	Coal	CO	BR5A	Broonie				0.77	24							
		11069	G3_75	G3	66.57	66.63	0.06	Mudstone	XH						0.46	14							PAF
		11070	G3_76	G3	66.63	67.04	0.41	Carbonaceous Mudstone	ZH/CO	BR5C	Broonie				0.76	23							PAF
		11071	G3_77	G3	67.04	67.09	0.05	Mudstone	XH	BR5C	Broonie	Carbonate layers			0.35	11							PAF
		11072	G3_78	G3	67.09	67.18	0.09	Coal	CO	BR5C	Broonie	Calcite bands			0.31	9							
17786	414332			G3	67.18	67.96	0.77	Sandstone	SS/Siltshale			Incl.s mr CO	7.6	1.28	0.08	2	16	-14	7	7.9	0	0	NAF
17787	414333			G3	67.96	68.99	1.03	Carbonaceous Mudstone	XM/XH			Sideritic	8.5	0.64	0.30	9	103	-94	11	8.5	0	0	NAF
17788	414334			G3	68.99	70.72	1.73	Sandstone	SS						0.02	1	19	-18	31	-	-	-	NAF
17789	414335			G3	70.72	72.12	1.40	Carbonaceous Mudstone	XM/Siltshale				8.5	0.54	0.06	2	10	-8	5	8.0	0	0	NAF
17790	414336			G3	72.12	75.44	3.32	Sandstone	SS						0.01	0	36	-36	118	-	-	-	NAF
17791	414337			G3	75.44	77.93	2.50	Sandstone	SS/CG				7.9	0.87	0.02	1	57	-56	93	9.0	0	0	NAF
17792	414338			G3	77.93	79.20	1.27	Sandstone	SS						0.01	0	33	-33	108	-	-	-	NAF
17793	414339			G3	79.20	79.97	0.77	Sandstone	SS			Sideritic	8.2	0.58	0.03	1	27	-26	29	8.5	0	0	NAF
		11073	G3_79	G3	79.97	80.11	0.14	Siltstone	ST			Coal Quality Total S Not Available											
		11074	G3_81	G3	80.11	80.79	0.68	Coal	CO	BR6	Broonie				0.59	18							
		11079	G3_86	G3	80.79	80.92	0.13	Mudstone	CS						0.40	12							PAF
		11080	G3_87	G3	80.92	81.40	0.47	Coal	CO	BR7A	Broonie				0.60	18							
		11081	G3_88	G3	81.40	81.43	0.03	Sandstone	SS						0.19	6							NAF
		11082	G3_89	G3	81.43	81.66	0.22	Coal	CO	BR7C	Broonie				0.71	22							
		11083	G3_90	G3	81.66	81.83	0.17	Sandstone	SS/SH			Sideritic. Total S not available											
17794	414340			G3	81.83	82.68	0.85	Siltstone	Siltshale/SS			Sideritic	8.5	0.42	0.02	1	10	-9	16	8.0	0	0	NAF
17795	414341			G3	82.68	85.99	3.31	Sandstone	SS						<0.01	0	104	-104	680	-	-	-	NAF
17796	414342			G3	85.99	88.84	2.85	Sandstone	SS			incl mr CO	8.8	0.47	0.01	0	18	-18	59	8.5	0	0	NAF
17797	414343			G3	89.86	91.25	1.40	Sandstone	SS			incl mr CO			0.02	1	13	-12	21	-	-	-	NAF
17798	414344			G3	91.25	91.54	0.29	Sandstone	SS				8.4	0.43	0.01	0	4	-4	13	7.3	0	0	NAF
		11084		G3	91.54	91.69	0.15	Sandstone	SS			Coal Quality Total S Not Available											
		11085		G3	91.69	91.76	0.07	Coal	CO	BY1A	Bayswater	Coal Quality Total S Not Available											
		11086		G3	91.76	91.78	0.02	Mudstone	CS	BY1A	Bayswater	Coal Quality Total S Not Available											
		11087		G3	91.78	91.92	0.14	Coal	CO	BY1A	Bayswater	Coal Quality Total S Not Available											
		11088		G3	91.92	91.96	0.04	Mudstone	CS	BY1A	Bayswater	Coal Quality Total S Not Available											
		11127		G3	91.96	92.22	0.26	Coal	CO	BY1A	Bayswater	Coal Quality Total S Not Available											
		11087		G3	92.22	92.83	0.61	Coal	CO	BY1A	Bayswater	Coal Quality Total S Not Available											
		11089		G3	92.83	92.91	0.08	Coal	CO	BY1C	Bayswater	Coal Quality Total S Not Available											
		11128		G3	92.91	93.10	0.19	Coal	CO	BY1C	Bayswater	Coal Quality Total S Not Available											
		11090		G3	93.10	93.60	0.49	Coal	CO	BY1C	Bayswater	Coal Quality Total S Not Available											
		11091		G3	93.60	93.67	0.08	Mudstone	CS			Coal Quality Total S Not Available											
		11092		G3	93.67	94.00	0.33	Coal	CO	BY2A	Bayswater	Coal Quality Total S Not Available											
		11129		G3	94.00	94.20	0.20	Coal	CO	BY2A	Bayswater	Coal Quality Total S Not Available											
		11093		G3	94.20	94.22	0.02	Coal	CO	BY2A	Bayswater	Coal Quality Total S Not Available											
		11094		G3	94.22	94.26	0.04	Mudstone	CS			Coal Quality Total S Not Available											
		11095		G3	94.26	94.77	0.51	Coal	CO	BY2C	Bayswater	Coal Quality Total S Not Available											
		11130		G3	94.77	94.99	0.22	Coal	CO	BY2C	Bayswater	Coal Quality Total S Not Available											
		11096		G3	94.99	95.82	0.83	Coal	CO	BY2C	Bayswater	Coal Quality Total S Not Available											
		11131		G3	95.82	96.05	0.23	Coal	CO	BY2C	Bayswater	Coal Quality Total S Not Available											
		11097		G3	96.05	96.78	0.73	Coal	CO	BY2C	Bayswater	Coal Quality Total S Not Available											
		11132		G3	96.78	96.99	0.21	Coal	CO	BY2C	Bayswater	Coal Quality Total S Not Available											
		11098		G3	96.99	97.03	0.03	Mudstone	CS			Coal Quality Total S Not Available											
		11099		G3	97.03	97.20	0.17	Coal	CO	BY3	Bayswater	Coal Quality Total S Not Available											
		11100		G3	97.20	97.46	0.26	Coal	CO	BY3	Bayswater	Coal Quality Total S Not Available											

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES		Drill Hole ID	Depth (m)			Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	ACID_BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
		11133		G3	97.46	97.66	0.20	Coal	CO	BY3	Bayswater	Coal Quality Total S Not Available											
		11101		G3	97.66	98.25	0.59	Coal	CO	BY3	Bayswater	Coal Quality Total S Not Available											
		11134		G3	98.25	98.45	0.21	Coal	CO	BY3	Bayswater	Coal Quality Total S Not Available											
		1102		G3	98.45	98.67	0.22	Sandstone	SS			Coal Quality Total S Not Available											
17799	414345			G3	98.67	100.25	1.58	Sandstone	SS				8.6	0.33	0.01	0	2	-2	7	6.4	0	3	NAF
17800	414346			G3	100.25	101.55	1.30	Sandstone	SS/CG				8.5	0.41	0.01	0	5	-5	16	7.6	0	0	NAF
17801	414347			G3	101.55	102.30	0.75	Sandstone	SS				8.4	0.51	0.02	1	6	-5	10	7.7	0	0	NAF
17802	414348			G3	102.30	103.18	0.88	Sandstone	SS				8.8	0.65	0.02	1	11	-10	18	8.3	0	0	NAF
17803	414349			G3	103.18	105.00	1.82	Sandstone	SS						0.01	0	26	-26	85	-	-	-	NAF
17804	414350			G3	105.00	106.00	1.00	Sandstone	SS				7.5	2.51	0.33	10	44	-34	4	8.4	0	0	NAF
17805	414351			G3	106.00	106.95	0.94	Sandstone	SS/XH			Carbonate layers, sideritic	5.5	5.22	3.39	104	123	-19	1.2	7.8	0	0	NAF-HS
17806	414352			G3	106.95	108.24	1.30	Sandstone	SS				8.7	0.91	0.34	10	8	2	0.8	8.0	0	0	UC(NAF)
17807	414353			G3	108.24	109.24	1.00	Sandstone	SS				8.0	1.26	0.68	21	7	14	0.3	7.3	0	0	UC(PAF-LC)
17808	414354			G3	109.24	109.51	0.27	Mudstone	SH				8.5	0.51	0.24	7	1	6	0.1	6.9	0	0	UC(NAF)
		11103		G3	109.51	109.63	0.12	Mudstone	SH			Coal Quality Total S Not Available											
		11104		G3	109.63	110.02	0.39	Coal	CO	LAU	Lemington	Coal Quality Total S Not Available											
		11135		G3	110.02	110.21	0.19	Coal	CO	LAU	Lemington	Coal Quality Total S Not Available											
		11105		G3	110.21	110.36	0.14	Coal	CO	LAU	Lemington	Coal Quality Total S Not Available											
		11106	G3_113	G3	110.36	110.39	0.03	Mudstone	CS	LAU	Lemington				0.04	1							NAF
		11107	G3_114	G3	110.39	110.60	0.20	Coal	CO	LAU	Lemington				0.77	24							
		11108	G3_115	G3	110.60	110.82	0.22	Sandstone	SS/SH			Coal Quality Total S Not Available											
17809	414355			G3	110.82	112.25	1.43	Sandstone	SS				8.1	0.55	0.03	1	1	0	1.1	8.3	0	0	NAF
17810	414356			G3	112.25	115.21	2.96	Sandstone	SS				8.8	0.54	0.03	1	12	-11	13	8.7	0	0	NAF
17811	414357			G3	115.21	118.26	3.05	Sandstone	SS				9.0	0.52	0.01	0	8	-8	26	8.6	0	0	NAF
17812	414358			G3	118.26	120.18	1.92	Sandstone	SS						<0.01	0	98	-98	641	-	-	-	NAF
17813	414359			G3	120.18	120.78	0.60	Siltstone	ST/SS/SH			incl.s mr CO	9.1	0.57	0.01	0	43	-43	141	9.2	0	0	NAF
17814	414360			G3	120.78	122.75	1.97	Sandstone	SS/SH			Sideritic			0.01	0	118	-118	386	-	-	-	NAF
17815	414361			G3	122.75	125.01	2.27	Sandstone	SS				9.0	0.43	0.01	0	4	-4	13	8.3	0	0	NAF
17816	414362			G3	125.01	126.01	1.00	Sandstone	SS						<0.01	0	136	-136	889	-	-	-	NAF
		11109		G3	126.01	126.19	0.17	Sandstone	SS			Coal Quality Total S Not Available											
		11110		G3	126.19	126.25	0.06	Coal	CO		Lemington	Coal Quality Total S Not Available											
		11111	G3_118	G3	126.25	126.39	0.14	Mudstone	XH			Coal Quality Total S Not Available											
		11112	G3_120	G3	126.39	127.07	0.68	Coal	CO/XH	LBU1/LBU2	Lemington				0.68	21							
		11116	G3_124	G3	127.07	127.28	0.21	Mudstone	SH			Coal Quality Total S Not Available											
		11117		G3	127.28	127.41	0.13	Mudstone	SH			Coal Quality Total S Not Available											
		11118		G3	127.41	127.51	0.11	Coal	CO	LBL1	Lemington	Coal Quality Total S Not Available											
		11136		G3	127.51	127.75	0.24	Coal	CO/XM	LBL1	Lemington	Coal Quality Total S Not Available											
		11121		G3	127.75	127.77	0.02	Mudstone	CS	LBL1	Lemington	Coal Quality Total S Not Available											
		11122		G3	127.77	127.95	0.17	Coal	CO	LBL1	Lemington	Coal Quality Total S Not Available											
		11123		G3	127.95	128.11	0.16	Carbonaceous Mudstone	XM,SH			Coal Quality Total S Not Available											
17817	414363			G3	128.11	128.31	0.20	Mudstone	SH				8.7	0.52	0.14	4	2	2	0.5	8.0	0	0	UC(NAF)
		11124		G3	128.31	128.42	0.12	Mudstone	SH			Coal Quality Total S Not Available											
		11125		G3	128.42	128.72	0.30	Coal	CO/XM	LBL2	Lemington	Coal Quality Total S Not Available											
		11126		G3	128.72	128.87	0.15	Sandstone	SS			Coal Quality Total S Not Available											
17818	414364			G3	128.87	129.93	1.06	Sandstone	SS						0.01	0	40	-40	131	-	-	-	NAF
17819	414365			G3	129.93	130.31	0.38	Siltstone	ST/SD			Siderite, sideritic			0.02	1	114	-113	186	-	-	-	NAF
18002	416001			4095C	21.15	21.80	0.65	Tuff	TF/SD/XM/CO				7.7	0.38	0.04	1	10	-9	8	7.2	0	0	NAF
18003	416002			4095C	21.80	23.29	1.49	Siltstone	ST			Sideritic	7.8	0.39	0.23	7	35	-28	5	7.5	0	0	NAF
18004	416003			4095C	23.29	23.96	0.67	Carbonaceous Siltstone	ST/CO/XM				7.9	0.29	0.28	9	17	-8	2.0	3.6	**7**	**27**	NAF
		410151	4095C_1	4095C	23.96	24.06	0.10	Siltstone	ST						0.28	9							PAF
		410152	4095C_2	4095C	24.06	24.70	0.64	Coal	CO	BR7C	Broonie				0.62	19							
		410153	4095C_3	4095C	24.70	24.84	0.14	Siltstone	ST						0.02	1							NAF
18005	416004			4095C	24.84	26.01	1.17	Sandstone	SS						0.02	1	14	-13	23	-	-	-	NAF
				4095C	26.01	32.13	6.12					Not Sampled											
18006	416005			4095C	32.13	32.63	0.50	Sandstone	SS						0.02	1	11	-10	18	-	-	-	NAF
18007	416006			4095C	32.63	33.01	0.38	Coal	CO/KL/XM	BY1C	Bayswater		8.3	0.29	0.33	10	8	2	0.8	2.9	**11**	**25**	PAF-LC
18008	416007			4095C	33.01	33.74	0.73	Sandstone	SS/ST				8.4	0.78	0.06	2	37	-35	20	7.5	0	0	NAF
18009	416008			4095C	33.74	34.10	0.36	Siltstone	ST			Incl.s some XM	8.2	0.62	0.07	2	455	-453	212	8.3	0	0	NAF
18010	416009			4095C	34.10	35.19	1.09	Sandstone,Siltstone	SS/SL						0.02	1	22	-21	36	-	-	-	NAF
18011	416010			4095C	35.19	36.74	1.55	Sandstone	SS/ST						<0.01	0	286	-286	1869	-	-	-	NAF
				4095C	36.74	40.54	3.80					Not Sampled											
18012	416011			4095C	40.54	41.37	0.83	Siltstone	ST/SD						0.01	0	145	-145	474	-	-	-	NAF
18013	416012			4095C	41.37	42.46	1.09	Sandstone	SS						0.02	1	13	-12	21	-	-	-	NAF
18014	416013			4095C	42.46	43.64	1.18	Sandstone	SS				8.1	0.52	0.01	0	9	-9	29	7.6	0	0	NAF

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES		Drill Hole ID	Depth (m)			Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	ACID_BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
		410154	4095C_4	4095C	43.64	43.77	0.13	Sandstone	SS						0.06	2							NAF
		410155	4095C_5	4095C	43.77	44.02	0.25	Coal	CO	BY2A	Bayswater				0.33	10							
		4095C001		4095C	44.02	44.82	0.80	Coal	CO	BY2A	Bayswater	Coal Quality Total S Not Available											
		410157	4095C_7	4095C	44.82	47.04	2.22	Coal	CO	BY2C	Bayswater				0.38	12							
		410161	4095C_11	4095C	47.04	47.56	0.52	Coal	CO	BY3	Bayswater				0.34	10							
		410162	4095C_12	4095C	47.56	47.67	0.11	Sandstone	SS						0.26	8							PAF
18015	416014			4095C	47.67	48.59	0.92	Sandstone	SS				7.9	0.42	0.02	1	2	-1	3	4.5	0	2	NAF
18016	416015			4095C	48.59	50.44	1.85	Sandstone	SS				7.8	0.48	0.01	0	5	-5	16	7.1	0	0	NAF
18017	416016			4095C	50.44	51.56	1.12	Sandstone	SS				8.0	0.38	0.02	1	7	-6	11	7.6	0	0	NAF
18018	416017			4095C	51.56	54.60	3.04	Sandstone	SS						<0.01	0	41	-41	268	-	-	-	NAF
18019	416018			4095C	54.60	56.14	1.54	Sandstone	SS						0.01	0	43	-43	141	-	-	-	NAF
18020	416019			4095C	56.14	56.64	0.50	Sandstone	SS				8.3	0.39	0.95	29	29	0.1	1.0	7.0	0	0	UC(NAF)
18021	416020			4095C	56.64	56.95	0.31	Carbonaceous Mudstone	XM/ST				2.5	4.46	2.01	62	0	62	0.0	2.4	28	36	PAF
		410163	4095C_13	4095C	56.95	57.05	0.10	Carbonaceous Mudstone	XM,ST						3.50	107							PAF
		410164	4095C_15	4095C	57.05	57.53	0.48	Coal	CO/ST/XM	LAL	Lemington				2.88	88							
		410166	4095C_17	4095C	57.53	57.63	0.10	Siltstone	ST						0.68	21							PAF
18022	416021			4095C	57.63	57.92	0.29	Siltstone	ST				5.5	0.62	0.56	17	14	3	0.8	3.8	1	7	PAF-LC
18023	416022			4095C	57.92	59.50	1.58	Sandstone	SS				7.3	0.43	0.11	3	17	-14	5	7.1	0	0	NAF
18024	416023			4095C	59.50	60.54	1.04	Siltstone	ST				7.4	0.46	0.07	2	61	-59	28	7.7	0	0	NAF
18025	416024			4095C	60.54	61.24	0.70	Sandstone	SS				7.8	0.31	0.12	4	46	-42	13	8.1	0	0	NAF
		410167	4095C_18	4095C	61.24	61.40	0.16	Sandstone	SS/XM/ST						0.04	1							NAF
		4095C002		4095C	61.40	62.20	0.80	Coal	CO/XM/TF	LBU	Lemington	py bands and lenses. Total S not available											
		410169		4095C	62.20	62.56	0.36	Coal	CO	LBU	Lemington	Coal Quality Total S Not Available											
		410170	4095C_21	4095C	62.56	63.45	0.89	Coal	CO/XM/TF	LBL	Lemington				0.80	24							
		410173	4095C_25	4095C	63.45	63.59	0.14	Sandstone	SS						0.02	1							NAF
18026	416025			4095C	63.59	63.91	0.32	Sandstone	SS				8.1	0.30	0.02	1	9	-8	15	7.0	0	0	NAF
18027	416026			4095C	63.91	65.20	1.29	Siltstone	ST			Incl.s some XM			0.01	0	46	-46	150	-	-	-	NAF
				4095C	65.20	66.33	1.13					Not Sampled											
18028	416027			4095C	66.33	68.54	2.21	Siltstone	ST/SD						0.02	1	30	-29	49	-	-	-	NAF
				4095C	68.54	76.46	7.92					Not Sampled											
18029	416028			4095C	76.46	78.05	1.59	Sandstone	SS						0.01	0	28	-28	92	-	-	-	NAF
18030	416029			4095C	78.05	78.38	0.33	Siltstone	ST/XM/KL				8.2	0.35	0.05	2	9	-7	6	3.9	2	13	NAF
		410074	4095C_35	4095C	78.38	78.49	0.11	Carbonaceous Mudstone	XM						0.37	11							PAF
		410075	4095C_36	4095C	78.49	78.72	0.23	Coal	CO	LEC	Lemington				0.82	25							
		4095C003		4095C	78.72	79.50	0.78	Coal	CO/XM	LEC	Lemington	Coal Quality Total S Not Available											
		410077	4095C_37	4095C	79.50	79.59	0.09	Coal	CO	LEC	Lemington				1.58	48							
		410078	4095C_38	4095C	79.59	79.73	0.14	Siltstone	ST/XM						0.10	3							NAF
18031	416030			4095C	79.73	80.53	0.80	Siltstone	ST/SS/XM			Incls mr coaly lamination	7.4	0.32	0.06	2	15	-13	8	7.0	0	0	NAF
				4095C	80.53	84.69	4.16					Not Sampled											
18032	416031			4095C	84.69	87.02	2.33	Sandstone	SS						<0.01	0	91	-91	595	-	-	-	NAF
18033	416032			4095C	87.02	87.29	0.27	Carbonaceous Siltstone	ST/CO/XM				3.8	1.76	0.70	21	1	20	0.0	3.1	6	13	PAF
18034	416033			4095C	87.29	87.89	0.60	Sandstone	SS						0.01	0	15	-15	49	-	-	-	NAF
				4095C	87.89	91.03	3.14					Not Sampled											
18035	416034			4095C	91.03	93.22	2.19	Sandstone	SS/SD						0.04	1	36	-35	29	-	-	-	NAF
18036	416035			4095C	93.22	93.64	0.42	Siltstone	ST						0.02	1	14	-13	23	-	-	-	NAF
		410179	4095C_39	4095C	93.64	93.74	0.10	Siltstone	ST						0.03	1							NAF
		410180	4095C_41	4095C	93.74	93.84	0.10	Tuff	TF/CO						1.34	41							PAF
		410181		4095C	93.84	94.41	0.57	Coal	CO	LDL	Lemington	Coal Quality Total S Not Available											
		410182		4095C	94.41	94.65	0.24	Coal	CO	LDL	Lemington	Coal Quality Total S Not Available											
		410183		4095C	94.65	94.92	0.27	Coal	CO	LDL	Lemington	Coal Quality Total S Not Available											
		410184	4095C_45	4095C	94.92	95.04	0.12	Sandstone	SS						0.03	1							NAF
18037	416036			4095C	95.04	95.47	0.43	Sandstone	SS				8.2	0.31	0.01	0	61	-61	199	8.2	0	0	NAF
18038	416037			4095C	95.47	96.40	0.93	Siltstone	ST/SD						0.02	1	154	-153	252	-	-	-	NAF
				4095C	96.40	97.75	1.35					Not Sampled											
18039	416038			4095C	97.75	98.70	0.95	Sandstone	SS/ST						0.02	1	55	-54	90	-	-	-	NAF
18040	416039			4095C	98.70	99.18	0.48	Sandstone	SS						0.02	1	23	-22	38	-	-	-	NAF
		410185	4095C_46	4095C	99.18	99.36	0.18	Tuff	TF/XM						0.08	2							NAF
		410186	4095C_48	4095C	99.36	100.22	0.86	Coal	CO/TF/ST	UPT	Pikes Gully				0.75	23							
		4095C004		4095C	100.22	100.98	0.76	Coal	CO/XM/TF	UPT	Pikes Gully	incls py wisps. Total S not available											
		410191	4095C_52	4095C	100.98	101.17	0.19	Siltstone	ST						0.09	3							NAF
18041	416040			4095C	101.17	101.81	0.64	Siltstone	ST				8.1	0.53	0.13	4	17	-13	4	4.7	0	2	NAF
18042	416041			4095C	101.81	102.51	0.70	Carbonaceous Siltstone	ST/CO				7.9	0.45	0.09	3	31	-28	11	7.2	0	0	NAF

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES		Drill Hole ID	Depth (m)			Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	ACID_BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
18043	416042			4095C	102.51	104.23	1.72	Siltstone	SS/ST/SD						0.01	0	40	-40	131	-	-	-	NAF
18044	416043			4095C	104.23	104.55	0.32	Siltstone	ST						0.03	1	17	-16	19	-	-	-	NAF
		410192	4095C_53	4095C	104.55	104.67	0.12	Siltstone	ST						0.24	7							PAF
		410193	4095C_55	4095C	104.67	105.55	0.88	Coal	CO/TF	MPG	Pikes Gully				0.49	15							
		410195	4095C_57	4095C	105.55	105.67	0.12	Sandstone	SS						0.02	1							NAF
18045	416044			4095C	105.67	107.40	1.73	Siltstone	ST/SS						0.02	1	24	-23	39	-	-	-	NAF
				4095C	107.40	111.90	4.50					Not Sampled											
18046	416045			4095C	111.90	113.36	1.46	Sandstone	SS/ST/SD						0.02	1	21	-20	34	-	-	-	NAF
		410196	4095C_58	4095C	113.36	113.53	0.17	Siltstone	ST/XM						0.19	6							NAF
		4095C005		4095C	113.53	114.31	0.78	Coal	CO	LPG	Pikes Gully	Coal Quality Total S Not Available											
		410198	4095C_59	4095C	114.31	114.46	0.15	Coal	CO	LPG	Pikes Gully				3.16	97							
		410199	4095C_60	4095C	114.63	114.74	0.11	Siltstone	ST						0.37	11							PAF
18047	416046			4095C	114.74	115.73	0.99	Sandstone	SS/ST						0.02	1	30	-29	49	-	-	-	NAF
18048	416047			4095C	115.73	117.55	1.82	Sandstone	SS			Sideritic			0.01	0	90	-90	294	-	-	-	NAF
				4095C	117.55	122.59	5.04					Not Sampled											
18049	416048			4095C	122.59	124.93	2.34	Sandstone	SS/ST/SD						0.03	1	55	-54	60	-	-	-	NAF
18050	416049			4095C	124.93	125.61	0.68	Siltstone	ST			Incls mr CO	8.2	0.36	0.04	1	7	-6	6	7.5	0	0	NAF
				4095C	125.61	126.00	0.39					Not Sampled											
		4095C006		4095C	126.00	126.76	0.76	Sandstone	SS/ST			Coal Quality Total S Not Available											
				4095C	126.76	136.80	10.04					Not Sampled											
18051	416050			4095C	136.80	138.26	1.46	Siltstone	ST/SS						0.02	1	39	-38	64	-	-	-	NAF
		410001	4095C_61	4095C	138.26	138.40	0.14	Siltstone	ST						0.10	3							NAF
		410002	4095C_62	4095C	138.40	138.97	0.57	Coal	CO/XM/KL	UA1	Arties				0.60	18							
		410003	4095C_63	4095C	138.97	139.15	0.18	Carbonaceous Mudstone	XM	UA1	Arties				0.67	21							PAF
		410004	4095C_64	4095C	139.15	139.35	0.20	Coal	CO	UA1	Arties				0.81	25							
		410005	4095C_65	4095C	139.35	139.48	0.13	Tuff	TF/CO	UA1	Arties				0.21	6							PAF
		410006	4095C_66	4095C	139.48	140.13	0.65	Coal	CO	UAA	Arties				0.52	16							
		4095C007		4095C	140.13	140.94	0.81	Siltstone	ST/SS/MS/TF			Sideritic. Total S not available											
		410008	4095C_67	4095C	140.94	141.01	0.07	Sandstone	SS						0.03	1							NAF
18052	416051			4095C	141.01	141.45	0.44	Siltstone	ST/SS						0.02	1	30	-29	49	-	-	-	NAF
		410009	4095C_68	4095C	141.45	141.57	0.12	Siltstone	ST/XM						1.03	32							PAF
		410010	4095C_69	4095C	141.57	141.71	0.14	Coal	CO	UAB	Arties				0.55	17							
		410011	4095C_70	4095C	141.71	142.75	1.04	Coal	CO	UAB	Arties				0.58	18							
		4095C008		4095C	142.75	143.52	0.77	Coal	CO	LAL/LB1	Arties	Coal Quality Total S Not Available											
		410013	4095C_71	4095C	143.52	143.75	0.23	Coal	CO	LB1	Arties				0.59	18							
		410014	4095C_72	4095C	143.75	143.84	0.09	Tuff	TF						0.11	3							NAF
		410015	4095C_73	4095C	143.84	144.31	0.47	Coal	CO	LB2	Arties				0.49	15							
		410016	4095C_74	4095C	144.31	144.40	0.09	Coal	CO	LB2	Arties				0.53	16							
		410017	4095C_75	4095C	144.40	144.72	0.32	Carbonaceous Mudstone	XM/CO						4.46	136							PAF
		410018	4095C_76	4095C	144.72	145.15	0.43	Coal	CO	LB3	Arties				0.54	17							
		410019	4095C_77	4095C	145.15	145.35	0.20	Coal	CO	LB3	Arties				0.66	20							
		410020	4095C_78	4095C	145.35	145.51	0.16	Siltstone	ST						0.03	1							NAF
18053	416052			4095C	145.51	146.16	0.65	Sandstone	SS/ST/CO						0.03	1	32	-31	35	-	-	-	NAF
18054	416053			4095C	146.16	146.45	0.29	Coal	CO/XM/ST				8.4	0.29	0.42	13	23	-10	1.8	4.3	1	12	NAF
18055	416054			4095C	146.45	148.48	2.03	Sandstone	SS/ST			Incls SD	8.3	0.38	0.06	2	25	-23	14	7.7	0	0	NAF
				4095C	148.48	162.33	13.85					Not Sampled											
		4095C009		4095C	162.33	163.12	0.79	Sandstone	SS			Sideritic. Total S not available											
				4095C	163.12	165.28	2.16					Not Sampled											
18056	416055			4095C	165.28	165.92	0.64	Sandstone	SS/ST						0.04	1	12	-11	10	-	-	-	NAF
		410022	4095C_79	4095C	165.92	166.10	0.18	Siltstone	ST/XM						0.26	8							PAF
		410023	4095C_80	4095C	166.10	166.37	0.27	Coal	CO	ULD	Liddell				0.66	20							
		4095C010		4095C	166.37	167.15	0.78	Coal	CO	ULD	Liddell	incls py. Total S not available											
		410025	4095C_81	4095C	167.15	167.66	0.51	Coal	CO	ULD	Liddell				0.76	23							
		410026	4095C_82	4095C	167.66	167.85	0.19	Carbonaceous Mudstone	XM						4.87	149							PAF
		410027	4095C_83	4095C	167.85	168.25	0.40	Coal	CO	U1A	Liddell				0.65	20							
		410028	4095C_84	4095C	168.25	168.62	0.37	Coal	CO	U1A	Liddell				0.73	22							
		410029	4095C_85	4095C	168.62	168.76	0.14	Sandstone	SS						1.09	33							PAF
18057	416056			4095C	168.76	169.47	0.71	Siltstone	ST/SS/XM				7.9	0.52	0.13	4	23	-19	6	7.3	0	0	NAF
		4095C011		4095C	169.47	170.27	0.80	Siltstone	ST			Coal Quality Total S Not Available											
18058	416057			4095C	170.27	170.47	0.20	Carbonaceous Mudstone	XM/ST/CO				7.4	0.45	0.37	11	18	-7	1.6	7.5	0	0	NAF
		410031	4095C_86	4095C	170.47	170.65	0.18	Siltstone	SD/ST			SD			0.04	1							NAF
		410032	4095C_88	4095C	170.65	171.42	0.77	Coal	CO/TF	U2A	Liddell				1.76	54							

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES			Depth (m)										ACID_BASE ANALYSIS					SINGLE ADDITION NAG			
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2	Drill Hole ID	From	To	Interval	Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	ARD Classification
		410035	4095C_91	4095C	171.42	171.52	0.10	Tuff	TF						0.08	2							NAF
		410036	4095C_92	4095C	171.52	171.86	0.34	Coal	CO	U2B	Liddell				0.46	14							
		410037	4095C_93	4095C	171.86	171.98	0.12	Siltstone	ST/SD						0.01	0							NAF
18059	416058			4095C	171.98	172.29	0.31	Siltstone	ST/SD						0.02	1	24	-23	39	-	-	-	NAF
				4095C	172.29	180.47	8.18					Not Sampled											
18060	416059			4095C	180.47	181.81	1.34	Siltstone	ST						0.03	1	37	-36	40	-	-	-	NAF
18061	416060			4095C	181.81	182.45	0.64	Siltstone	ST						0.04	1	37	-36	30	-	-	-	NAF
		410038	4095C_94	4095C	182.45	182.59	0.14	Siltstone	ST						0.01	0							NAF
		410039	4095C_95	4095C	182.59	183.21	0.62	Coal	CO	LLT	Liddell				0.73	22							
		410040	4095C_97	4095C	183.21	183.47	0.26	Coal	CO	LLT	Liddell				0.62	19							
		4095C012		4095C	183.47	184.26	0.79	Coal	CO/TF	LLB	Liddell	Coal Quality Total S Not Available											
		410042	4095C_98	4095C	184.26	184.33	0.07	Coal	CO	LLB	Liddell				0.52	16							
		410043	4095C_100	4095C	184.33	184.47	0.14	Carbonaceous Mudstone	XM/ST						0.19	6							NAF
18062	416061			4095C	184.47	185.58	1.11	Siltstone	ST			Incls mr TF, XM			0.02	1	35	-34	57	-	-	-	NAF
				4095C	185.58	192.62	7.04					Not Sampled											
18063	416062			4095C	192.62	195.25	2.63	Sandstone	SS/SD						0.01	0	36	-36	118	-	-	-	NAF
18064	416063			4095C	195.25	196.42	1.17	Siltstone	ST						0.01	0	22	-22	72	-	-	-	NAF
		410044	4095C_101	4095C	196.42	196.54	0.12	Carbonaceous Mudstone	XM/CO						0.50	15							PAF
		4095C013		4095C	196.54	197.29	0.75	Coal	CO	BAR	Barrett	Coal Quality Total S Not Available											
		4095C014		4095C	197.29	198.09	0.80	Coal	CO	BAR	Barrett	incls py. Total S not available											
		410047	4095C_102	4095C	198.09	198.25	0.16	Coal	CO	BAR	Barrett				0.63	19							
		410048	4095C_104	4095C	198.25	198.46	0.21	Coal	CO/SS	BAR	Barrett				0.46	14							
		410049	4095C_105	4095C	198.46	198.74	0.28	Coal	CO	BAR	Barrett				0.60	18							
		410050	4095C_106	4095C	198.74	199.07	0.33	Sandstone	SS/ST/XM						0.48	15							PAF
18065	416064			4095C	199.07	199.77	0.70	Sandstone	SS/ST/XM				6.8	0.83	0.11	3	21	-18	6	7.4	0	0	NAF
				4095C	199.77	201.14	1.37					Not Sampled											
18066	416065			4095C	201.14	202.30	1.16	Sandstone	SS/ST/XM				4.2	1.95	1.82	56	14	42	0.3	2.6	15	22	PAF
17724	414251			GHD23	15.54	15.74	0.20	Coal	CO/KL	MA2	Mt Arthur		2.4	1.59	0.47	14	0	14	0.0	1.8	69	103	PAF
				GHD23	15.74	17.35	1.61					Not Sampled											
17725	414252			GHD23	17.35	18.25	0.90	Carbonaceous Siltstone	SL/SH/CO/MS				6.1	1.03	0.09	3	8	-5	2.9	7.5	0	0	NAF
17726	414253			GHD23	18.25	18.92	0.67	Sandstone	SS						0.02	1	12	-11	20	-	-	-	NAF
17727	414254			GHD23	18.92	20.26	1.34	Siltstone	SL/SH			sideritic			0.01	0	12	-12	39	-	-	-	NAF
17728	414255			GHD23	20.26	21.82	1.56	Sandstone	SS			sideritic			0.01	0	214	-214	699	-	-	-	NAF
				GHD23	21.82	31.39	9.57					Not Sampled											
17729	414256			GHD23	31.39	32.59	1.20	Siltstone	SL/SD			Mr CO, XSH			0.04	1	97	-96	79	-	-	-	NAF
				GHD23	32.59	38.38	5.79					Not Sampled											
17730	414257			GHD23	38.38	39.94	1.56	Mudstone	X						0.04	1	13	-12	11	-	-	-	NAF
17731	414258			GHD23	39.94	40.89	0.95	Siltstone	SL				7.4	0.84	0.15	5	3	2	0.7	3.9	1	5	PAF-LC
17732	414259			GHD23	40.89	42.84	1.95	Coal	CO	PF1	Piercefield		4.5	0.45	0.43	13	0	13	0.0	1.9	51	78	PAF
17733	414260			GHD23	42.84	43.41	0.57	Coal	CO/KL	PF2A	Piercefield		2.6	2.05	0.49	15	0	15	0.0	2.1	46	71	PAF
17734	414261			GHD23	43.41	44.14	0.73	Coal	CO	PF2C	Piercefield		4.5	0.29	0.34	10	0	10	0.0	2.0	45	71	PAF
17735	414262			GHD23	44.14	44.42	0.28	Siltstone	SL/CO				4.5	1.46	0.33	10	2	8	0.2	3.0	5	12	PAF-LC
17736	414263			GHD23	44.42	44.86	0.44	Coal	CO	PF3	Piercefield		4.2	0.20	0.36	11	0	11	0.0	1.8	49	76	PAF
				GHD23	44.86	45.16	0.30					Not Sampled											
17737	414264			GHD23	45.16	45.31	0.15	Mudstone	SH				2.9	3.11	0.62	19	0	19	0.0	2.6	9	16	PAF
17738	414265			GHD23	45.31	46.18	0.87	Coal	CO/KL	PF4	Piercefield		4.6	0.41	0.45	14	0	14	0.0	1.8	52	81	PAF
17739	414266			GHD23	46.18	46.65	0.47	Siltstone	SL/XSH				5.5	1.49	0.31	9	6	3	0.6	3.6	1	6	PAF-LC
17740	414267			GHD23	46.65	47.72	1.07	Coal	CO/KL	PF5	Piercefield		7.3	0.49	0.43	13	9	4	0.7	3.7	2	11	PAF-LC
17741	414268			GHD23	47.72	49.04	1.32	Sandstone	SS/SH				8.5	0.69	0.09	3	7	-4	2.5	7.4	0	0	NAF
				GHD23	49.04	49.12	0.08					Not Sampled											
17742	414269			GHD23	49.12	49.90	0.78	Siltstone	SL/SD			SD			0.02	1	52	-51	85	-	-	-	NAF
				GHD23	49.90	52.04	2.14					Not Sampled											
17743	414270			GHD23	52.04	52.63	0.59	Siltstone	SL			SD			0.02	1	28	-27	46	-	-	-	NAF
				GHD23	52.63	55.04	2.41					Not Sampled											
17744	414271			GHD23	55.04	55.87	0.83	Siltstone	SL/XSH			SD			0.05	2	76	-74	50	-	-	-	NAF
17745	414272			GHD23	55.87	56.00	0.13	Coal	CO	VA1A	Vaux		8.0	0.15	0.47	14	22	-8	1.5	4.6	0	10	NAF
				GHD23	56.00	56.45	0.45					Not Sampled											
17746	414273			GHD23	56.45	56.88	0.43	Coal	CO/SH		Vaux		6.2	1.18	0.32	10	9	1	0.9	4.0	2	11	PAF-LC
17747	414274			GHD23	56.88	57.32	0.44	Coal	CO	VA1C	Vaux		7.7	0.11	0.51	16	3	13	0.2	2.4	26	47	PAF
17748	414275			GHD23	57.32	58.04	0.72	Sandstone	SS/SL			Incls some CO			0.01	0	17	-17	56	-	-	-	NAF
				GHD23	58.04	59.85	1.81					Not Sampled											
17749	414276			GHD23	59.85	60.48	0.63	Mudstone	SH/SL						0.02	1	12	-11	20	-	-	-	NAF

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES		Drill Hole ID	Depth (m)			Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	ACID_BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
17750	414277			GHD23	60.52	61.04	0.52	Coal	CO	VA2	Vaux		4.0	0.68	0.56	17	0	17	0.0	2.2	30	49	PAF
				GHD23	61.04	61.20	0.16					Not Sampled											
17751	414278			GHD23	61.20	61.70	0.50	Mudstone	SH/SD/MS						0.03	1	270	-269	294	-	-	-	NAF
17752	414279			GHD23	61.70	62.56	0.86	Coal	CO	VA3A	Vaux		7.4	0.17	0.40	12	4	8	0.3	2.2	36	59	PAF-LC
17753	414280			GHD23	62.56	63.10	0.54	Coal	CO/SH		Vaux		8.6	0.46	0.23	7	19	-12	2.7	6.3	0	1	NAF
17754	414281			GHD23	63.10	64.32	1.22	Sandstone	SS / SD			Sideritic			0.03	1	30	-29	33	-	-	-	NAF
				4073C	0.00	2.00	2.00	Clay	CL			No Core											
				4073C	2.00	5.00	3.00	Clay	CL			No Core											
				4073C	5.00	12.00	7.00	Clay	CL			No Core											
				4073C	12.00	14.85	2.85	Siltstone	SL			No Core											
20115	4073C001			4073C	14.85	15.42	0.57	Sandstone	SS/SL/SD			Carbonaceous, Calcite	9.0	0.63	0.02	1	174	-173	284	8.4	0	0	NAF
20116	4073C002			4073C	15.42	19.59	4.17	Sandstone	SS			Sideritic			<0.01	0	108	-108	706	-	-	-	NAF
20117	4073C003			4073C	19.59	21.03	1.44	Siltstone	SL//SS			Carbonaceous	9.0	0.73	0.05	2	54	-52	35	8.7	0	0	NAF
20118	4073C004			4073C	21.03	21.53	0.50	Siltstone	SL//SS			Carbonaceous, Sideritic	8.2	0.79	0.10	3	10	-7	3	7.4	0	0	NAF
		403680		4073C	21.53	21.66	0.13	Mudstone	CS			BHLW 21.57			0.11	3							NAF
		403681		4073C	21.66	21.88	0.22	Coal	DD	GMA	Glen Munro				0.54	17							
		403682		4073C	21.88	21.95	0.07	Carbonaceous Mudstone	XM	GMA	Glen Munro				0.35	11							PAF
		403683_685		4073C	21.95	22.75	0.80	Coal	DM	GMA	Glen Munro				0.64	20							
		403686		4073C	22.75	22.86	0.11	Carbonaceous Siltstone	XS			Coaly			0.95	29							PAF
20119	4073C005			4073C	22.86	23.76	0.90	Sandstone	SS				8.6	0.76	0.04	1	49	-48	40	8.2	0	0	NAF
20120	4073C006			4073C	23.76	27.62	3.86	Sandstone	SS//SL			Calcite, Sideritic, Carbonaceous			0.02	1	75	-74	123	-	-	-	NAF
20121	4073C007			4073C	27.62	29.58	1.96	Sandstone	SS//SL				8.9	0.59	0.05	2	50	-48	33	8.6	0	0	NAF
20122	4073C008			4073C	29.58	30.08	0.50	Sandstone	SS//SL				8.3	0.88	0.21	6	38	-32	6	8.1	0	0	NAF
		403687		4073C	30.08	30.18	0.10	Siltstone	SL			Coaly			0.28	9							PAF
		403688		4073C	30.18	30.39	0.21	Coal	DM		Glen Munro				0.68	21							
		403689		4073C	30.39	30.54	0.15	Siltstone	SL			Carbonaceous			0.22	7							PAF
20123	4073C009			4073C	30.54	30.68	0.14	Siltstone	SL			Carbonaceous, 'Fe after PY @ 30.6m	7.5	1.03	0.31	9	10	-1	1	7.1	0	0	NAF
		403690		4073C	30.68	30.78	0.10	Siltstone	SL			Carbonaceous, Coaly			0.90	28							PAF
		403691		4073C	30.78	31.16	0.38	Coal	DM	GMC	Glen Munro				0.58	18							
		403692		4073C	31.16	31.25	0.09	Carbonaceous Mudstone	XM	GMC	Glen Munro	Coaly			0.72	22							PAF
		403693_697		4073C	31.25	31.99	0.74	Coal	BD	GMC	Glen Munro				0.85	26							
		403698		4073C	31.99	32.09	0.10	Siltstone	SL			Carbonaceous			0.63	19							PAF
20124	4073C010			4073C	32.09	32.59	0.50	Sandstone	SS//SL			Carbonaceous	8.7	0.71	0.11	3	50	-47	15	8.5	0	0	NAF
20125	4073C011			4073C	32.59	33.49	0.90	Sandstone	SS			Carbonaceous	8.8	0.60	0.05	2	32	-30	21	8.4	0	0	NAF
20126	4073C012			4073C	33.49	36.52	3.03	Siltstone	SL//SS			Sideritic			0.02	1	51	-50	83	-	-	-	NAF
20127	4073C013			4073C	36.52	39.15	2.63	Siltstone	SL//SD				9.1	0.64	0.03	1	116	-115	126	8.9	0	0	NAF
20128	4073C014			4073C	39.15	41.82	2.67	Sandstone	SS			Carbonaceous, Sideritic			0.02	1	126	-125	206	-	-	-	NAF
20129	4073C015			4073C	41.82	42.26	0.44	Sandstone	SS//SD			SD, 'Mr PY on fract with SD @ 41.9m	8.9	0.77	0.06	2	88	-86	48	8.4	0	0	NAF
20130	4073C016			4073C	42.26	43.40	1.14	Sandstone	SS//SD				8.7	0.75	0.05	2	55	-53	36	8.3	0	0	NAF
20131	4073C017			4073C	43.40	43.55	0.15	Siltstone	SL			Carbonaceous	6.3	1.13	0.17	5	11	-6	2	7.7	0	0	NAF
		403699		4073C	43.55	43.65	0.10	Carbonaceous Mudstone	XM/SL			Carbonaceous			0.40	12							PAF
		403700_702		4073C	43.65	44.77	1.12	Coal	CN	WHAC	Woodlands Hill				0.56	17							
		403703		4073C	44.77	44.87	0.10	Siltstone	SL						0.08	2							NAF
20132	4073C018			4073C	44.87	45.09	0.22	Carbonaceous Siltstone	SL,SS,XM			Sideritic, X, Coaly	7.4	1.10	0.20	6	55	-49	9	8	0	0	NAF
20133	4073C019			4073C	45.09	46.71	1.62	Sandstone	SS			Carbonaceous			0.01	0	85	-85	278	-	-	-	NAF
20134	4073C020			4073C	46.71	47.46	0.75	Carbonaceous Siltstone	SL//CS//DM				8.0	0.69	0.08	2	33	-31	13	8.1	0	0	NAF
20135	4073C021			4073C	47.46	50.62	3.16	Sandstone	SS			Carbonaceous			0.01	0	76	-76	248	-	-	-	NAF
20136	4073C022			4073C	50.62	51.29	0.67	Siltstone	SL			Carbonaceous, Incls KL	8.9	0.55	0.03	1	53	-52	58	8.4	0	0	NAF
20137	4073C023			4073C	51.29	56.00	4.71	Sandstone	SS//SL			Carbonaceous, Sideritic			0.01	0	125	-125	408	-	-	-	NAF
20138	4073C024			4073C	56.00	56.77	0.77	Siltstone	SL//SD			Carbonaceous, Coaly	9.0	0.64	0.07	2	39	-37	18	8.2	0	0	NAF
20139	4073C025			4073C	56.77	60.59	3.82	Sandstone	SS//SL//SD			Sideritic, Carbonaceous Calcite	9.1	0.56	0.02	1	153	-152	250	9.6	0	0	NAF
20140	4073C026			4073C	60.59	61.09	0.50	Siltstone	SL				8.5	0.56	0.06	2	14	-12	8	7.8	0	0	NAF
20141	4073C027			4073C	61.09	66.49	5.40	Sandstone	SS//SL//SD			Sideritic, Coaly,Carbonaceous			0.02	1	86	-85	141	-	-	-	NAF
20142	4073C028			4073C	66.49	68.78	2.29	Sandstone	SS				8.9	0.53	0.02	1	49	-48	80	8.2	0	0	NAF
20143	4073C029			4073C	68.78	68.95	0.17	Carbonaceous Mudstone	XM			Coaly	8.2	0.50	0.16	5	13	-8	3	6.4	0	1	NAF
20144	4073C030			4073C	68.95	70.40	1.45	Sandstone	SS			Incls KL			0.03	1	46	-45	50	-	-	-	NAF
20145	4073C031			4073C	70.40	70.90	0.50	Sandstone	SS				8.4	0.57	0.04	1	20	-19	16	7.8	0	0	NAF
		403704		4073C	70.90	71.00	0.10	Sandstone	SS			Carbonaceous			0.36	11							PAF
		403705		4073C	71.00	71.29	0.29	Coal	DM	WHE	Woodlands Hill				0.70	21							
		403706		4073C	71.29	71.39	0.10	Mudstone	CS			Carbonaceous, Coaly			0.65	20							PAF
20146	4073C032			4073C	71.39	72.45	1.06	Sandstone	SS//SD			Coaly	8.1	1.28	0.14	4	65	-61	15	8.3	0	0	NAF
		403707		4073C	72.45	72.56	0.11	Siltstone	SL			Carbonaceous, Coaly			0.86	26							PAF
		403708_711		4073C	72.56	74.07	1.51	Coal	DM//XM/CS	WHGL	Woodlands Hill				0.67	21							

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES		Drill Hole ID	Depth (m)			Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	ACID_BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
		403712		4073C	74.07	74.17	0.10	Sandstone	SS						0.04	1							NAF
20147	4073C033			4073C	74.17	74.75	0.58	Sandstone	SS//SL			Carbonaceous	7.2	1.12	0.19	6	23	-17	4	7.8	0	0	NAF
20148	4073C034			4073C	74.75	75.17	0.42	Siltstone	SL//SS			Carbonaceous, 'Mr PY on bedding @	7.7	1.03	0.20	6	34	-28	6	7.6	0	0	NAF
		403713		4073C	75.17	75.27	0.10	Carbonaceous Mudstone	XM			Coaly, PY			1.62	50							PAF
		403714		4073C	75.27	75.38	0.11	Coal	DM						1.29	39							
		403715		4073C	75.38	75.48	0.10	Sandstone	SS			Carbonaceous			<0.01	0							NAF
20149	4073C035			4073C	75.48	75.81	0.33	Sandstone	SS			Coaly			0.02	1	77	-76	126	-	-	-	NAF
20150	4073C036			4073C	75.81	76.27	0.46	Siltstone	SL			Carbonaceous	7.7	1.20	0.17	5	15	-10	3	7.4	0	0	NAF
20151	4073C037			4073C	76.27	79.00	2.73	Sandstone	SS//SD			Calcite, Carbonaceous, Sideritic	8.9	0.71	0.04	1	129	-128	105	9.2	0	0	NAF
20152	4073C038			4073C	79.00	80.00	1.00	Siltstone	SL			Carbonaceous, 'Mr PY on bedding @	7.8	0.94	0.09	3	17	-14	6	7.7	0	0	NAF
		403716		4073C	80.00	80.10	0.10	Siltstone	SL			Carbonaceous			0.09	3							NAF
		403717		4073C	80.10	80.20	0.10	Coal	CN	AFO	Arrowfield				0.38	12							
		403718		4073C	80.20	80.59	0.39	Mudstone	CS			MCL			0.05	2							NAF
		403719_721		4073C	80.59	81.56	0.97	Coal	DD	AF1	Arrowfield				0.44	13							
		403722		4073C	81.56	81.59	0.03	Mudstone	CS			Carbonaceous			0.66	20							PAF
		403723_724		4073C	81.59	82.26	0.67	Coal	DM	AF3	Arrowfield				0.65	20							
		403725		4073C	82.26	82.36	0.10	Carbonaceous Siltstone	XS			Carbonaceous			0.28	9							PAF
20153	4073C039			4073C	82.36	82.58	0.22	Siltstone	SL				8.7	0.44	0.03	1	21	-20	23	8	0	0	NAF
20154	4073C040			4073C	82.58	83.58	1.00	Sandstone	SS			Carbonaceous	8.9	0.52	0.01	0	22	-22	72	8.1	0	0	NAF
20155	4073C041			4073C	83.58	84.35	0.77	Sandstone	SS			Carbonaceous			0.01	0	73	-73	239	-	-	-	NAF
		403726		4073C	84.35	84.45	0.10	Siltstone	SL			Carbonaceous			0.10	3							NAF
		403727		4073C	84.45	84.46	0.01	Coal	DM						0.38	12							
		403728		4073C	84.46	84.49	0.03	Coal	DM						0.55	17							
		403729		4073C	84.49	84.61	0.12	Siltstone	SL			Carbonaceous			0.10	3							NAF
		403730		4073C	84.61	85.12	0.51	Coal	DM	BF1	Bowfield				0.56	17							
		403731		4073C	85.12	85.22	0.10	Carbonaceous Siltstone	SL,XM			Carbonaceous, Coaly			0.27	8							PAF
20156	4073C042			4073C	85.22	85.81	0.59	Sandstone	SS			Carbonaceous	8.8	0.49	0.01	0	24	-24	78	7.9	0	0	NAF
20157	4073C043			4073C	85.81	87.10	1.29	Siltstone	SL//SD			Coaly,Calcite	8.9	0.56	0.07	2	43	-41	20	8.3	0	0	NAF
20158	4073C044			4073C	87.10	90.52	3.42	Sandstone	SS//SD			Sideritic, Calcite,Coaly			0.02	1	102	-101	167	-	-	-	NAF
20159	4073C045			4073C	90.52	92.52	2.00	Sandstone	SS			Coaly	9.0	0.60	0.01	0	103	-103	337	9.4	0	0	NAF
20160	4073C046			4073C	92.52	93.02	0.50	Sandstone	SS			Coaly	8.6	0.31	0.06	2	20	-18	11	7.7	0	0	NAF
		403732		4073C	93.02	93.17	0.15	Siltstone	SL			Carbonaceous			0.12	4							NAF
		403733_734		4073C	93.17	93.52	0.35	Coal	DM	BF2A	Bowfield	Carbonaceous			0.38	12							
		403735		4073C	94.04	94.13	0.09	Mudstone	CS						0.30	9							PAF
		403736_738		4073C	94.13	94.75	0.62	Coal	DM	BF2C	Bowfield				0.33	10							
		403739_741		4073C	94.75	96.33	1.58	Coal	DM	BF2E	Bowfield				0.35	11							
		403442		4073C	96.33	96.43	0.10	Sandstone	SS						0.01	0							NAF
20161	4073C047			4073C	96.43	97.49	1.06	Siltstone	SL/SS				8.8	0.36	0.01	0	15	-15	49	7.6	0	0	NAF
20162	4073C048			4073C	97.49	101.62	4.13	Sandstone	SS			Carbonaceous, Coaly			0.01	0	68	-68	222	-	-	-	NAF
20163	4073C049			4073C	101.62	102.54	0.92	Siltstone	SL//SS			Carbonaceous	8.9	0.33	0.01	0	27	-27	88	7.39	0	0	NAF
20164	4073C050			4073C	102.54	106.53	3.99	Sandstone	SS			Carbonaceous			<0.01	0	87	-87	569	-	-	-	NAF
20165	4073C051			4073C	106.53	107.61	1.08	Conglomerate	CG				8.9	0.71	0.01	0	83	-83	271	8.9	0	0	NAF
20166	4073C052			4073C	107.61	111.32	3.71	Sandstone	SS						0.01	0	73	-73	239	-	-	-	NAF
20167	4073C053			4073C	111.32	114.54	3.22	Sandstone	SS/CG			Coaly	8.9	0.83	0.01	0	105	-105	343	9.6	0	0	NAF
20168	4073C054			4073C	114.54	117.56	3.02	Conglomerate	CG						0.01	0	81	-81	265	-	-	-	NAF
20169	4073C055			4073C	117.56	120.59	3.03	Conglomerate	CG//SS			Carbonaceous	8.8	0.83	0.01	0	83	-83	271	9.4	0	0	NAF
20170	4073C056			4073C	120.59	123.59	3.00	Sandstone	SS			Carbonaceous, Coaly, Sideritic			0.01	0	114	-114	373	-	-	-	NAF
20171	4073C057			4073C	123.59	127.58	3.99	Sandstone	SS			Carbonaceous	9.2	0.47	0.01	0	49	-49	160	9.2	0	0	NAF
20172	4073C058			4073C	127.58	128.28	0.70	Siltstone	SL			Carbonaceous	8.7	0.38	0.05	2	19	-17	12	8.1	0	0	NAF
		403743		4073C	128.28	128.38	0.10	Carbonaceous Mudstone	XM						0.27	8							PAF
		403744		4073C	128.38	128.53	0.15	Coal	DB	BF3	Bowfield				0.62	19							
		403745		4073C	128.53	128.57	0.04	Mudstone	CS						<0.01	0							NAF
		403746		4073C	128.57	129.00	0.43	Coal	DM	BF4	Bowfield				0.55	17							
		403747		4073C	129.00	129.08	0.08	Carbonaceous Siltstone	XS			Carbonaceous			0.14	4							NAF
		403748		4073C	129.08	129.13	0.05	Coal	BD	WK1	Warkworth				0.60	18							
		403749		4073C	129.13	129.23	0.10	Sandstone	SS						0.01	0							NAF
20173	4073C059			4073C	129.23	129.61	0.38	Sandstone	SS			Carbonaceous, Coaly			0.02	1	16	-15	26	-	-	-	NAF
20174	4073C060			4073C	129.61	131.41	1.80	Sandstone	SS			Sideritic			0.01	0	99	-99	324	-	-	-	NAF
20175	4073C061			4073C	131.41	131.65	0.24	Siltstone	SL			Coaly, Carbonaceous	8.8	0.29	0.02	1	17	-16	28	7.9	0	0	NAF
		403750		4073C	131.65	131.76	0.11	Carbonaceous Mudstone	XM/SL			Carbonaceous			0.12	4							NAF
		403751_752		4073C	131.76	132.42	0.66	Coal	DD	WK2	Warkworth				0.46	14							
		403753		4073C	132.42	132.53	0.11	Siltstone	SL			Carbonaceous, Coaly			0.09	3							NAF
		403754		4073C	132.53	132.68	0.15	Siltstone	SL			Carbonaceous			0.25	8							PAF

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EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
		403755		4073C	132.68	133.01	0.33	Coal	BD	WK3	Warkworth				0.50	15							
		403756		4073C	133.01	133.16	0.15	Siltstone	SL			Carbonaceous			<0.01	0							NAF
20176	4073C062			4073C	133.16	133.88	0.72	Sandstone	SS			Coaly	9.0	0.49	0.02	1	50	-49	82	8.7	0	0	NAF
20177	4073C063			4073C	133.88	134.33	0.45	Siltstone	SL			Carbonaceous, Coaly	8.7	0.28	0.05	2	14	-12	9	7.5	0	0	NAF
		403757		4073C	134.33	134.43	0.10	Siltstone	SL			Carbonaceous, Coaly			0.04	1							NAF
		403758		4073C	134.43	134.55	0.12	Coal	DM	WK4	Warkworth				0.37	11							
		403759		4073C	134.55	134.65	0.10	Mudstone	CS			Coaly			0.01	0							NAF
20178	4073C064			4073C	134.65	135.20	0.55	Sandstone	SS				9.0	0.47	0.03	1	54	-53	59	8.2	0	0	NAF
		403760		4073C	135.20	135.31	0.11	Mudstone	CS						<0.01	0							NAF
		403761_766		4073C	135.31	136.36	1.05	Coal	DD	WK5	Warkworth				0.26	8							
		403767		4073C	136.36	136.59	0.23	Siltstone	SL			Carbonaceous			<0.01	0							NAF
		403768		4073C	136.59	137.14	0.55	Coal	DB	WK6AC	Warkworth				0.37	11							
		403769		4073C	137.14	137.20	0.06	Mudstone	CS						<0.01	0							NAF
		403770		4073C	137.20	137.53	0.33	Coal	BB	WK6E	Warkworth				0.33	10							
		403771		4073C	137.53	138.17	0.64	Coal	DB	WK6E	Warkworth				0.35	11							
		403772		4073C	138.17	138.29	0.12	Siltstone	SL			Carbonaceous,Coaly			0.07	2							NAF
20179	4073C065			4073C	138.29	138.81	0.52	Carbonaceous Siltstone	SL,XM			Carbonaceous, Coaly	8.4	0.28	0.09	3	11	-8	4	7.2	0	0	NAF
20180	4073C066			4073C	138.81	139.56	0.75	Siltstone	SL//CS			Carbonaceous, Coaly	9.0	0.52	0.04	1	70	-69	57	8.4	0	0	NAF
20181	4073C067			4073C	139.56	139.87	0.31	Siltstone	SL			Coaly	9.0	0.43	0.03	1	18	-17	20	7.9	0	0	NAF
		403773		4073C	139.87	139.97	0.10	Siltstone	SL			Carbonaceous			0.02	1							NAF
		403774		4073C	139.97	140.06	0.09	Coal	DM	WK8E	Warkworth				0.40	12							
		403775		4073C	140.06	140.21	0.15	Mudstone	CS	WK8E		Coaly			<0.01	0							NAF
		403776		4073C	140.21	140.45	0.24	Coal	DB	WK8E	Warkworth				0.52	16							
		403777		4073C	140.45	140.61	0.16	Siltstone	SL			Carbonaceous			0.34	10							PAF
20182	4073C068			4073C	140.61	140.80	0.19	Siltstone	SL			Carbonaceous	7.2	0.81	0.23	7	11	-4	2	7.4	0	0	NAF
20183	4073C069			4073C	140.80	144.73	3.93	Sandstone	SS			Carbonaceous			0.01	0	38	-38	124	-	-	-	NAF
20184	4073C070			4073C	144.73	146.73	2.00	Sandstone	SS			Coaly	9.0	0.66	0.01	0	154	-154	503	9.4	0	0	NAF
20185	4073C071			4073C	146.73	147.42	0.69	Sandstone	SS			Coaly			<0.01	0	119	-119	778	-	-	-	NAF
		403778		4073C	147.42	147.54	0.12	Sandstone	SS/XM			Carbonaceous			<0.01	0							NAF
		403779		4073C	147.54	147.69	0.15	Coal	BD	WK9	Warkworth				0.51	16							
		403780		4073C	147.69	147.79	0.10	Mudstone	CS/SL						0.06	2							NAF
20186	4073C072			4073C	147.79	148.53	0.74	Siltstone	SL/SS				8.7	0.38	0.06	2	14	-12	8	7.2	0	0	NAF
20187	4073C073			4073C	148.53	150.53	2.00	Siltstone	SL/SS						0.02	1	23	-22	38	-	-	-	NAF
20188	4073C074			4073C	150.53	154.22	3.69	Sandstone	SS				9.0	0.41	0.02	1	20	-19	33	7.9	0	0	NAF
20189	4073C075			4073C	154.22	159.39	5.17	Sandstone	SS			Sideritic			<0.01	0	76	-76	497	-	-	-	NAF
20190	4073C076			4073C	159.39	159.69	0.30	Siltstone	SL//SD			Carbonaceous,Sideritic	8.8	0.34	0.02	1	39	-38	64	8	0	0	NAF
20191	4073C077			4073C	159.69	162.56	2.87	Sandstone	SS			Coaly			0.01	0	93	-93	304	-	-	-	NAF
20192	4073C078			4073C	162.56	167.56	5.00	Sandstone	SS			Carbonaceous	9.2	0.59	0.01	0	76	-76	248	8.6	0	0	NAF
20193	4073C079			4073C	167.56	168.13	0.57	Siderite	SD						0.01	0	101	-101	330	-	-	-	NAF
20194	4073C080			4073C	168.13	171.53	3.40	Sandstone	SS				9.1	0.48	0.01	0	41	-41	134	9.4	0	0	NAF
20195	4073C081			4073C	171.53	174.20	2.67	Sandstone	SS						<0.01	0	82	-82	536	-	-	-	NAF
20196	4073C082			4073C	174.20	174.54	0.34	Conglomerate	CG				8.8	0.77	0.01	0	76	-76	248	8.8	0	0	NAF
20197	4073C083			4073C	174.54	177.45	2.91	Sandstone	SS			Coaly			0.01	0	85	-85	278	-	-	-	NAF
20198	4073C084			4073C	177.45	179.17	1.72	Sandstone	SS//SD				9.1	0.64	<0.01	0	54	-54	353	9.4	0	0	NAF
20199	4073C085			4073C	179.17	181.52	2.35	Sandstone	SS//CG						0.01	0	116	-116	379	-	-	-	NAF
20200	4073C086			4073C	181.52	183.47	1.95	Sandstone	SS//SD			Carbonaceous, Calcite	9.2	0.61	0.01	0	45	-45	147	9.2	0	0	NAF
20201	4073C087			4073C	183.47	183.64	0.17	Siltstone	SL						0.01	0	28	-28	92	-	-	-	NAF
20202	4073C088			4073C	183.64	186.54	2.90	Sandstone	SS//SD			Sideritic, Carbonaceous	9.0	0.52	0.01	0	46	-46	150	9.1	0	0	NAF
20203	4073C089			4073C	186.54	187.09	0.55	Sandstone	SS			Carbonaceous			0.01	0	39	-39	127	-	-	-	NAF
		403781		4073C	187.09	187.19	0.10	Sandstone	SS/XM			Carbonaceous			<0.01	0							NAF
		403782		4073C	187.19	187.70	0.51	Coal	DB	WK10	Warkworth				0.52	16							
		403783		4073C	187.70	187.80	0.10	Mudstone	CS/XM			FCL			<0.01	0							NAF
20204	4073C090			4073C	187.80	188.54	0.74	Mudstone	CS			FCL	9.1	0.47	0.01	0	37	-37	121	7.5	0	0	NAF
20205	4073C091			4073C	188.54	189.54	1.00	Mudstone	CS			FCL			0.01	0	42	-42	137	-	-	-	NAF
20206	4073C092			4073C	189.54	192.55	3.01	Mudstone	CS			FCL	9.2	0.49	0.01	0	71	-71	232	8.3	0	0	NAF
20207	4073C093			4073C	192.55	193.11	0.56	Mudstone	CS			FCL			0.01	0	39	-39	127	-	-	-	NAF
		403784		4073C	193.11	193.21	0.10	Mudstone	CS			FCL			<0.01	0							NAF
		403785		4073C	193.21	193.52	0.31	Coal	CN//XM						0.13	4							
		403786		4073C	193.52	193.67	0.15	Coal	DM	MA1	Mount Arthur				0.42	13							
		403787		4073C	193.67	194.16	0.49	Coal	DM	MA1	Mount Arthur				0.36	11							
		403788		4073C	194.16	194.19	0.03	Mudstone	CS						0.04	1							NAF
		403789_790		4073C	194.19	195.16	0.97	Coal	DM	MA2	Mount Arthur				0.30	9							
		403791		4073C	195.16	195.26	0.10	Siltstone	SL			Carbonaceous			<0.01	0							NAF

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EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
		403792		4073C	195.93	196.03	0.10	Siltstone	SL						0.05	2							NAF
		403793		4073C	196.03	196.33	0.30	Coal	DD	MA3A	Mount Arthur				0.38	12							
		403794		4073C	196.33	196.36	0.03	Mudstone	CS						<0.01	0							NAF
		403795		4073C	196.36	196.57	0.21	Coal	DB	MA3C	Mount Arthur				0.35	11							
		403796		4073C	196.57	196.59	0.02	Mudstone	CS						<0.01	0							NAF
		403797		4073C	196.59	197.09	0.50	Coal	DB	MA3E	Mount Arthur				0.37	11							
		403798		4073C	197.09	197.17	0.08	Mudstone	CS						<0.01	0							NAF
		403799		4073C	197.17	197.49	0.32	Coal	DB	MA3G	Mount Arthur				0.41	13							
		403800		4073C	197.49	197.56	0.07	Mudstone	CS						0.12	4							NAF
		403801_802		4073C	197.56	198.54	0.98	Coal	DD	MA3J	Mount Arthur				0.40	12							
		403803		4073C	198.54	198.67	0.13	Coal	DB	MA3J	Mount Arthur				0.58	18							
		403804		4073C	198.67	198.77	0.10	Siltstone	SL			Coaly, Carbonaceous			0.05	2							NAF
20208	4073C094			4073C	198.77	198.94	0.17	Carbonaceous Siltstone	SL/DM			X, iIncls MA3L 'Sm PY zone @ 199m	4.4	2.06	0.30	9	5	4	1	7.2	0	0	NAF
20209	4073C095			4073C	198.94	199.78	0.84	Siltstone	SL			Carbonaceous, Coaly	8.8	0.80	0.13	4	60	-56	15	7.9	0	0	NAF
20210	4073C096			4073C	199.78	201.54	1.76	Sandstone	SS/SL			Coaly			0.01	0	14	-14	46	-	-	-	NAF
20211	4073C097			4073C	201.54	202.30	0.76	Sandstone	SS/SL				8.8	0.35	0.02	1	12	-11	20	7.8	0	0	NAF
		403805		4073C	202.30	202.40	0.10	Siltstone	SL			Carbonaceous			<0.01	0							NAF
		403806_807		4073C	202.40	203.41	1.01	Coal	DM	PF1	Piercefield				0.41	13							
		403808		4073C	203.41	203.82	0.41	Coal	DD	PF1	Piercefield				0.32	10							
		403809		4073C	203.82	203.92	0.10	Mudstone	CS			Carbonaceous			0.06	2							NAF
		403810		4073C	203.92	204.24	0.32	Coal	DB	PF2A	Piercefield				0.30	9							
		403811		4073C	204.24	204.29	0.05	Mudstone	CS	PF2A	Piercefield	Carbonaceous			0.29	9							PAF
		403812		4073C	204.29	204.38	0.09	Coal	DB	PF2A	Piercefield				0.30	9							
		403813		4073C	204.38	204.48	0.10	Siltstone	SL			Carbonaceous			0.02	1							NAF
		403814_816		4073C	204.48	205.28	0.80	Coal	DB	PF2C	Piercefield				0.36	11							
		403817		4073C	205.28	205.57	0.29	Mudstone	CS//XM						<0.01	0							NAF
		403818		4073C	205.57	205.83	0.26	Coal	DD	PF3	Piercefield				0.42	13							
		403819		4073C	205.83	206.26	0.43	Coal	DD	PF4	Piercefield				0.60	18							
		403820		4073C	206.26	206.36	0.10	Siltstone	SL			Coaly			<0.01	0							NAF
20212	4073C098			4073C	206.36	207.10	0.74	Siltstone	SL			Carbonaceous, Coaly	8.5	0.40	0.10	3	11	-8	4	7.5	0	0	NAF
20213	4073C099			4073C	207.10	208.16	1.06	Sandstone	SS/SL//CS			Carbonaceous			0.02	1	17	-16	28	-	-	-	NAF
20214	4073C100			4073C	208.16	209.57	1.41	Siltstone	SL			Coaly	8.9	0.38	0.03	1	17	-16	19	7.7	0	0	NAF
		403821		4073C	209.57	209.68	0.11	Siltstone	SL			Coaly			<0.01	0							NAF
		403822		4073C	209.68	209.74	0.06	Coal	DM			Carbonaceous			0.16	5							
		403823		4073C	209.74	209.99	0.25	Siltstone	SL			Coaly			<0.01	0							NAF
		403824		4073C	209.99	210.11	0.12	Coal	DM			Carbonaceous			0.17	5							
		403825		4073C	210.11	210.21	0.10	Siltstone	SL			Coaly			0.02	1							NAF
				4073C	210.21	219.94	9.73					Not Sampled											
		403826		4073C	219.94	220.04	0.10	Carbonaceous Mudstone	XM//SS						0.28	9							PAF
		403827		4073C	220.04	220.50	0.46	Coal	DM	VA1A	Vaux				0.57	17							
		403828		4073C	220.50	220.93	0.43	Siltstone	SL/SS/SD			Carbonaceous			<0.01	0							NAF
		403829		4073C	220.93	221.24	0.31	Coal	DM	VA1C	Vaux	Carbonaceous			0.52	16							
		403830		4073C	221.24	221.53	0.29	Sandstone	SS/SL			Sideritic, Coaly			0.13	4							NAF
		403831_832		4073C	221.53	221.85	0.32	Coal	DM	VA2	Vaux				0.54	17							
		403833		4073C	221.85	221.95	0.10	Carbonaceous Mudstone	XM						0.41	13							PAF
		403834		4073C	221.95	222.54	0.59	Coal	DM	VA3	Vaux				0.49	15							
				4073C	222.54	222.75	0.21	Core Loss	KL	VA3	Vaux												
		403835		4073C	222.75	223.04	0.29	Coal	BB	VA3	Vaux				0.46	14							
		403836		4073C	223.04	223.19	0.15	Siltstone	SL			Carbonaceous			0.02	1							NAF
				4073C	223.19	234.12	10.93					Not Sampled											
		403837		4073C	234.12	234.23	0.11	Siltstone	SL/XM			Carbonaceous			0.04	1							NAF
		403838_839		4073C	234.23	235.16	0.93	Coal	DM	BR1	Broonie				0.56	17							
		403840		4073C	235.16	235.25	0.09	Siltstone	SL			Carbonaceous			0.22	7							PAF
		403841		4073C	235.25	235.52	0.27	Coal	DB	BR2	Broonie				0.87	27							
				4073C	235.52	235.62	0.10	Core Loss	KL														
		403842		4073C	235.62	235.72	0.10	Siltstone	SL			Carbonaceous			0.38	12							PAF
		403843		4073C	235.72	236.08	0.36	Coal	DB	BR3A	Broonie				0.65	20							
		403844		4073C	236.08	236.19	0.11	Siltstone	SL			Coaly			0.32	10							PAF
				4073C	236.19	245.01	8.82					Not Sampled											
		403845		4073C	245.01	245.11	0.10	Sandstone	SS,SL			Carbonaceous			0.02	1							NAF
		403846		4073C	245.11	245.32	0.21	Coal	DM	BR3C	Broonie				0.61	19							
		403847		4073C	245.32	245.66	0.34	Siltstone	SL/SS						<0.01	0							NAF
		403848_849		4073C	245.66	246.32	0.66	Coal	DD	BR4A	Broonie				0.54	17							

GEOCHEMICAL SAMPLES		COAL QUALITY SAMPLES		Drill Hole ID	Depth (m)			Dominant Lithology	Included Lithologies	Seam Name	Seam Group	Comments from log &/or inspection	$pH_{1:2}$	$EC_{1:2}$	ACID_BASE ANALYSIS					SINGLE ADDITION NAG			ARD Classification
EGi Sample ID	Site Sample ID	Site Sample ID 1	Site Sample ID 2		From	To	Interval								Total % S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
		403850		4073C	246.32	246.48	0.16	Siltstone	SL			Carbonaceous			<0.01	0							NAF
		403851		4073C	246.48	246.56	0.08	Coal	CN	BR4C	Broonie				0.33	10							
		403852		4073C	246.56	246.72	0.16	Siltstone	SL			Coaly			0.04	1							NAF
		403853		4073C	246.72	246.90	0.18	Coal	DM						0.49	15							
		403854		4073C	246.90	247.00	0.10	Siltstone	SL			Carbonaceous			0.04	1							NAF
				4073C	247.00	248.52	1.52					Not Sampled											
		403855		4073C	248.52	248.62	0.10	Siltstone	SL			Carbonaceous			0.19	6							NAF
		403856_858		4073C	248.62	249.14	0.52	Coal	DB	BR5A	Broonie				0.64	20							
		403859		4073C	249.14	249.37	0.23	Coal	DM	BR5C	Broonie				0.67	21							
		403860		4073C	249.37	249.47	0.10	Sandstone	SS						<0.01	0							NAF
				4073C	249.47	276.80	27.33					Not Sampled											
		403861		4073C	276.80	276.90	0.10	Sandstone	SS			Carbonaceous			0.13	4							NAF
		403862		4073C	276.90	277.35	0.45	Coal	DD	BR6	Broonie	DM			0.61	19							
		403863		4073C	277.35	277.37	0.02	Carbonaceous Mudstone	XM						0.13	4							NAF
		403864		4073C	277.37	277.75	0.38	Coal	DD	BR7A	Broonie				0.57	17							
		403865		4073C	277.75	277.78	0.03	Carbonaceous Mudstone	XM						0.63	19							PAF
		403866		4073C	277.78	278.04	0.26	Coal	DM	BR7C	Broonie				0.65	20							
		403867		4073C	278.04	278.08	0.04	Mudstone	CS						0.06	2							NAF
		403868		4073C	278.08	278.45	0.37	Coal	CN	BR8A	Broonie				0.45	14							
		403869		4073C	278.45	278.69	0.24	Coal	CN	BR8C	Broonie				0.46	14							
		403870		4073C	278.69	278.72	0.03	Carbonaceous Mudstone	XM						0.22	7							PAF
		403871_873		4073C	278.72	279.46	0.74	Coal	DM	BY1A	Bayswater				0.33	10							
		403874_877		4073C	279.46	280.20	0.74	Coal	CN	BY1C	Bayswater				0.36	11							
		403878_880		4073C	280.20	281.28	1.08	Coal	DD	BY2A	Bayswater	Calcite			0.32	10							
		403881_887		4073C	281.28	283.50	2.22	Coal	DD	BY2C	Bayswater				0.34	10							
		403888_891		4073C	283.50	285.21	1.71	Coal	DM	BY3	Bayswater				0.40	12							
		403892		4073C	285.21	285.31	0.10	Sandstone	SS						<0.01	0							NAF
				4073C	285.31	297.57	12.26					Not Sampled											

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Electrical Conductivity of 1:2 extract (dS/m)
MPA = Maximum Potential Acidity (kgH_2SO_4/t)
ANC = Acid Neutralising Capacity (kgH_2SO_4/t)
NAPP = Net Acid Producing Potential (kgH_2SO_4/t)

NAGpH = pH of NAG liquor
$NAG_{(pH4.5)}$ = Net Acid Generation capacity to pH 4.5 (kgH_2SO_4/t)
$NAG_{(pH7.0)}$ = Net Acid Generation capacity to pH 7.0 (kgH_2SO_4/t)

Red Text Samples showing organic acid effects.

NAF = Non-Acid Forming
NAF-HS = NAF - high sulphur
PAF = Potentially Acid Forming
PAF-LC = PAF - lower capacity
UC = Uncertain Classification
(expected classification in brackets)

Coal seam interval.

Interval not available for geochemical testing (core loss, open hole or removed for coal quality testwork)

Table B2: Extended boil and calculated NAG test results for selected overburden/interburden and coal samples.

EGi Sample ID	Hole ID	Drill Hole Depth (m)		Dominant Lithology	Seam	ACID-BASE ANALYSIS					STANDARD NAG TEST			Extended Boil NAGpH	Calculated NAG
		From	To			Total %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$		
17853	4505C	92.02	92.33	Coal	BY1A	0.23	7	3	4	0.43	2.3	26	45	7.1	0.3
17855	4505C	94	94.59	Coal	BY2A	0.66	20	1	19	0.05	3.0	8	26	3.8	9
18004	4095C	23.29	23.96	Carbonaceous Siltstone		0.28	9	17	-8	1.98	3.6	7	27	6.9	-8
18007	4095C	32.63	33.01	Coal	BY1C	0.33	10	8	2	0.79	2.9	11	25	7.2	0.4
18054	4095C	146.16	146.45	Coal		0.42	13	23	-10	1.79	4.3	1	12	7.3	-4
17724	GHD23	15.54	15.74	Coal	MA2	0.47	14	0	14	0.00	1.8	70	103	4.1	12
17732	GHD23	40.89	42.84	Coal	PF1	0.43	13	0	13	0.00	1.9	51	78	4.5	6
17733	GHD23	42.84	43.41	Coal		0.49	15	0	15	0.00	2.1	46	71	3.4	8
17734	GHD23	43.41	44.14	Coal	PF2C	0.34	10	0	10	0.00	2.0	45	71	4.3	7
17736	GHD23	44.42	44.86	Coal	PF3	0.36	11	0	11	0.00	1.8	49	77	4.2	7
17738	GHD23	45.31	46.18	Coal	PF4	0.45	14	0	14	0.00	1.8	52	81	4.3	7
17747	GHD23	56.88	57.32	Coal	VA1C	0.51	16	3	13	0.19	2.4	26	47	7.2	7
17750	GHD23	60.52	61.04	Coal	VA2	0.56	17	0	17	0.00	2.2	30	49	4.2	10
17752	GHD23	61.7	62.56	Coal	VA3A	0.40	12	4	8	0.33	2.2	36	59	6.9	4

KEY

MPA = Maximum Potential Acidity (kgH_2SO_4/t)
ANC = Acid Neutralising Capacity (kgH_2SO_4/t)
NAPP = Net Acid Producing Potential (kgH_2SO_4/t)
NAGpH = pH of NAG liquor
$NAG_{(pH4.5)}$ = Net Acid Generation capacity to pH 4.5 (kgH_2SO_4/t)
$NAG_{(pH7.0)}$ = Net Acid Generation capacity to pH 7.0 (kgH_2SO_4/t)
Extended Boil NAGpH = pH of NAG liquor after extended heating
Calculated NAG = The net acid potential based on assay of anions and cations released to the NAG solution (kgH_2SO_4/t)

Table B3: Sulphur speciation results for selected overburden/interburden and coal samples.

EGi Sample ID	Drill Hole ID	Dominant Lithology	Drill Core Depth (m)			Total %S	Pyritic S (%)	Acid Sulphate %S	Total Acid Generating S (%)	Non-Acid Sulphate %S	Other S Forms (%)	Proportion Total Acid Generating to Total S
			From	To	Interval							
17724	GHD23	Coal	15.54	15.74	0.20	0.54	0.04	0.06	0.10	0.02	0.42	18%
17733	GHD23	Coal	42.84	43.41	0.57	0.48	0.05	0.06	0.11	0.05	0.32	24%
17750	GHD23	Coal	60.52	61.04	0.52	0.49	0.01	0.07	0.08	0.00	0.41	16%
17821	4505C	Carbonaceous Mudstone	36.85	37.33	0.48	0.47	0.36	0.00	0.36	0.02	0.09	77%
17833	4505C	Siltstone	62.24	62.86	0.62	0.27	0.09	0.07	0.16	0.00	0.11	59%
17839	4505C	Siltstone	71.63	72.17	0.54	0.98	0.34	0.09	0.43	0.06	0.49	44%
17853	4505C	Coal	92.02	92.33	0.31	0.28	0.03	0.01	0.04	0.00	0.24	15%
17854	4505C	Coal	92.34	92.94	0.60	0.75	0.38	0.00	0.38	0.11	0.26	51%
17855	4505C	Coal	94.00	94.59	0.59	0.66	0.35	0.03	0.38	0.05	0.22	58%
17860	4505C	Sandstone	104.70	105.00	0.30	1.65	1.15	0.00	1.15	0.25	0.25	70%
17805	G3	Sandstone	106.00	106.95	0.94	3.59	1.88	0.00	1.88	0.68	1.03	52%
17806	G3	Sandstone	106.95	108.24	1.30	0.36	0.32	0.00	0.32	0.04	0.00	89%
17807	G3	Sandstone	108.24	109.24	1.00	0.78	0.59	0.00	0.59	0.03	0.16	76%
17975	4505C	Siltstone	236.91	237.80	0.89	1.21	1.11	0.00	1.11	0.02	0.08	92%
18007	4095C	Coal	32.63	33.01	0.38	0.36	0.10	0.00	0.10	0.03	0.23	28%
18020	4095C	Sandstone	56.14	56.64	0.50	0.97	0.61	0.00	0.61	0.15	0.21	63%
18054	4095C	Coal	146.16	146.45	0.29	0.43	0.05	0.01	0.06	0.03	0.34	14%
20122	4073C	Sandstone	29.58	30.08	0.50	0.21	0.14	0.00	0.14	0.02	0.05	67%
20123	4073C	Siltstone	30.54	30.68	0.14	0.29	0.18	0.00	0.18	0.02	0.09	62%
20132	4073C	Carbonaceous Siltstone	44.87	45.09	0.22	0.21	0.11	0.00	0.11	0.02	0.08	52%
20148	4073C	Siltstone	74.75	75.17	0.42	0.20	0.11	0.00	0.11	0.02	0.07	55%
20150	4073C	Siltstone	75.81	76.27	0.46	0.17	0.11	0.00	0.11	0.03	0.03	65%
20208	4073C	Carbonaceous Siltstone	198.77	198.94	0.17	0.31	0.06	0.03	0.09	0.02	0.19	30%
20209	4073C	Siltstone	198.94	199.78	0.84	0.16	0.03	0.00	0.03	0.01	0.12	19%

Pyritic S (%) = CRS (%)

Acid Sulphate S = KCl Acid Sulphate S

Total Acid Generating S = Pyritic S + Acid Sulphate S

Non-Acid Sulphate S = KCl S – KCl Acid Sulphate S

Other S Forms = Total S - (CRS + KCl S)

Table B4: Multi-element composition of selected HVO overburden/interburden and coal solids samples (mg/kg except where shown).

Element	Detection Limit	Sample Number / Lithology / Total S																									
		17724	17745	17750	17752	17759	17785	17787	17805	17806	17821	17837	17838	17839	17847	17851	17852	17856	17861	17886	17979	17999	18004	18021	18033	18054	18066
		Coal	Coal	Coal	Coal	Siltstone	Mudstone	Carb Mudstone	Sandstone	Sandstone	Carb Mudstone	Siltstone	Siltstone	Siltstone	Sandstone	Sandstone	Siltstone	Sandstone	Siltstone	Siltstone	Carb Siltstone	Carb Siltstone	Carb Siltstone	Carb Mudstone	Carb Siltstone	Coal	Sandstone
		0.47%S	0.47%S	0.56%S	0.4%S	0.2%S	0.07%S	0.3%S	3.39%S	0.34%S	0.51%S	0.12%S	1.38%S	0.87%S	0.21%S	1.18%S	0.17%S	0.32%S	0.77%S	0.3%S	1.28%S	2.2%S	0.28%S	2.01%S	0.7%S	0.42%S	1.82%S
Ag	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Al	0.01%	0.64%	1.10%	2.02%	1.42%	10.64%	9.80%	7.02%	6.48%	9.14%	3.46%	9.49%	6.75%	8.09%	6.71%	7.42%	10.07%	5.87%	7.84%	8.51%	6.15%	8.20%	7.97%	8.41%	8.08%	5.29%	8.08%
As	20	<20	<20	<20	<20	<20	<20	48	50	<20	43	27	110	29	32	<20	<20	21	<20	<20	<20	<20	<20	66	81	31	<20
B	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	61	<50	<50	<50	<50	<50	<50	<50	<50	<50
Ba	1	14	29	45	29	225	348	491	254	357	234	278	266	277	572	527	571	278	390	330	874	285	256	258	280	1043	487
Be	1	<1	2	3	<1	2	2	2	2	2	2	2	1	2	1	2	3	<1	2	2	2	2	2	2	3	3	2
Bi	0.1	0.2	0.3	0.3	0.2	0.7	0.8	0.9	0.3	0.4	0.2	0.5	0.5	0.6	0.3	0.3	0.7	0.3	0.6	0.6	0.7	0.3	0.6	0.8	0.6	0.5	0.3
Ca	0.1%	<0.1%	<0.1%	<0.1%	0.20%	<0.1%	0.20%	1.60%	5.60%	0.60%	4.10%	0.20%	0.10%	<0.1%	0.90%	1.20%	0.20%	<0.1%	0.20%	0.20%	2.30%	0.90%	0.30%	0.20%	0.30%	0.20%	0.90%
Cd	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	11.0	10.0	<10	<10	<10
Co	1	5	13	9	7	8	25	15	19	9	14	11	16	29	16	9	14	5	10	31	19	11	12	20	33	19	12
Cr	50	<50	<50	<50	<50	<50	<50	<50	79	<50	<50	<50	<50	<50	67	<50	50	<50	<50	<50	<50	<50	<50	84	<50	<50	<50
Cs	0.1	0.1	0.3	2.8	0.6	14.2	11.1	9.3	3.9	6.7	3.1	8.4	8.2	11	5.2	4.1	13.4	2.5	9.7	10.4	6	4.5	10.7	18.3	14.1	8.5	4.9
Cu	20	<20	<20	<20	<20	48	31	<20	<20	<20	<20	22	28	36	<20	<20	27	<20	24	30	<20	21	27	32	33	<20	<20
Fe	0.01%	0.18%	0.12%	0.35%	0.17%	0.99%	1.56%	8.86%	5.05%	2.06%	11.40%	1.84%	4.80%	2.31%	1.41%	4.44%	2.43%	0.69%	1.59%	3.54%	13.41%	3.38%	1.26%	3.09%	1.46%	1.86%	4.13%
Ga	1	2	5	7	4	25	25	16	13	19	12	22	17	19	14	15	25	11	19	21	14	18	19	22	26	14	17
Ge	1	<1	5	5	<1	<1	<1	1	1	<1	31	1	1	2	2	1	1	<1	2	2	<1	4	4	3	13	9	5
In	0.1	<0.1	<0.1	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
K	0.05%	0.46%	0.49%	0.93%	0.63%	2.70%	3.38%	2.89%	1.87%	3.31%	1.55%	3.12%	2.47%	2.90%	2.28%	2.34%	3.26%	2.27%	2.96%	2.97%	2.22%	2.70%	2.71%	3.78%	2.99%	2.33%	2.62%
Li	1	8	11	12	13	18	22	15	21	32	12	23	15	17	28	35	20	17	16	27	27	30	23	21	30	17	30
Mg	0.01%	<0.01%	0.04%	0.08%	0.03%	0.43%	0.52%	1.33%	0.59%	0.49%	1.88%	0.52%	0.66%	0.53%	0.31%	0.77%	0.59%	0.20%	0.41%	0.96%	1.24%	0.65%	0.54%	0.59%	0.48%	0.40%	0.58%
Mn	20	<20	<20	21	<20	47	148	1067	379	205	1509	175	405	143	107	506	166	46	109	187	3475	178	62	116	80	269	449
Mo	1	<1	1	1	<1	<1	1	<1	3	<1	1	4	2	3	1	<1	<1	1	<1	2	1	3	1	4	1	6	3
Nb	2	<2	<2	<2	<2	6.0	6.0	4.0	5.0	6.0	4.0	7.0	3.0	4.0	4.0	6.0	8.0	3.0	5.0	7.0	4.0	6.0	7.0	7.0	6.0	5.0	7.0
Ni	20	181	216	70	67	42	92	41	31	118	71	1758	68	388	53	36	28	62	22	41	49	1816	28	65	54	35	45
P	10	<10	<10	<10	<10	20	30	50	20	20	50	30	20	20	20	50	40	20	10	40	50	30	20	20	20	20	30
Pb	20	31	27	<20	<20	26	31	20	<20	23	<20	23	28	<20	33	<20	30	<20	<20	<20	<20	<20	<20	<20	<20	151	<20
Rb	0.5	3.2	2.8	22.9	5.3	147.1	148.3	120.8	71.3	119.5	38.9	121.3	105.8	131.2	69.5	76.9	136.2	68.9	128.2	134.6	69.7	75.2	111.8	176.4	131.5	86.5	86.2
Re	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
S	0.05%	0.44%	0.42%	0.50%	0.36%	0.19%	0.07%	0.42%	3.62%	0.35%	0.50%	0.12%	1.24%	0.91%	0.24%	1.20%	0.18%	0.33%	0.68%	0.36%	1.01%	2.20%	0.26%	2.01%	0.68%	0.40%	1.87%
Sb	0.5	<0.5	1.7	2.2	0.7	0.7	1.3	1.5	1.6	0.9	7.5	1.2	2.1	1.9	1.1	1.1	0.9	0.8	1.6	1.4	2.7	0.9	1.8	2.8	5.2	4.5	0.9
Sc	10	<10	<10	<10	<10	17	14	14	<10	11	14	11	14	14	10	<10	15	<10	11	15	<10	<10	<10	13	12	<10	<10
Se	20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Sn	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%	<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%	<0.01%
Sr	20	<20	25	30	<20	197	207	282	309	227	605	214	188	210	127	385	427	254	178	409	353	275	139	170	187	92	196
Ta	0.1	0.4	0.6	0.2	<0.1	0.7	0.9	0.7	0.8	0.8	0.8	1.0	0.6	0.6	0.7	1.2	1.4	0.5	0.8	0.9	0.9	0.9	1.7	1.7	1.5	1.3	1.4
Te	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Th	0.1	1.1	1.5	2.8	1.5	12.9	12.1	9.1	8.2	9.5	4.5	11.3	9.5	10.3	7.6	8.5	13.2	5.9	9.3	11.8	8.1	8.3	11.7	12.3	12.2	7.5	8.5
Ti	0.01%	0.02%	0.07%	0.10%	0.09%	0.50%	0.49%	0.35%	0.31%	0.45%	0.16%	0.47%	0.31%	0.37%	0.31%	0.46%	0.52%	0.21%	0.39%	0.43%	0.32%	0.46%	0.34%	0.36%	0.38%	0.25%	0.42%
Tl	0.5	<0.5	<0.5	<0.5	<0.5	0.8	0.8	1	3.5	0.5	0.8	0.6	1.6	1.5	<0.5	0.5	0.6	1	0.7	1.8	0.7	1.6	0.6	2.4	1.9	0.5	1.3
U	0.1	0.30	0.30	0.60	0.40	3.20	3.30	2.20	2.30	2.30	1.20	2.90	2.30	2.40	2.00	2.10	3.30	1.40	2.60	3.40	2.30	2.90	3.40	3.50	2.80	1.90	2.70
V	20	<20	<20	44	33	154	161	118	135	107	114	122	120	133	90	92	146	36	145	139	87	100	93	186	128	89	101
W	1	4.0	2.0	8.0	3.0	2.0	2.0	1.0	1.0	1.0	<1	5.0	1.0	3.0	2.0	2.0	18.0	<1	3.0	6.0	8.0	10.0	4.0	4.0	8.0	13.0	2.0
Y	0.5	4.1	8.8	10.9	7.7	27.7	26.9	27.3	30.4	24.4	25.4	25.7	23.9	26.5	21.4	21.0	30.3	9.8	19.4	26.8	24.6	21.2	22.9	32.4	25.0	17.3	22.5
Zn	20	27	54	43	56	77	105	89	57	96	58	98	108	105	91	66	109	42	85	130	86	78	90	89	155	51	77

< element at or below analytical detection limit.

Table B5: Multi-element composition of selected HVO South overburden/interburden solids samples (mg/kg except where shown).

Element	Detection Limit	Sample Number / Lithology / Total S									
		20122	20123	20132	20139	20148	20150	20168	20195	20208	20209
		Sandstone	Siltstone	Carb Siltstone	Sandstone	Siltstone	Siltstone	Conglom-erate	Sandstone	Carb Siltstone	Siltstone
		0.21%S	0.31%S	0.2%S	0.02%S	0.2%S	0.17%S	0.01%S	<0.01%S	0.3%S	0.13%S
Ag	0.05	0.1	0.14	0.07	0.44	0.09	0.07	0.1	0.08	0.08	0.13
Al	0.01%	7.40%	8.44%	6.09%	6.55%	8.84%	9.46%	5.52%	6.40%	8.83%	9.06%
As	0.5	8.6	2.5	13	6.9	5.5	41.6	8.9	5	9.2	5.5
B	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Ba	0.1	343.9	167.9	212.2	466.1	512.7	319.3	384.9	419.6	187.6	262.7
Be	0.05	1.97	1.59	2.46	1.34	1.64	2.12	1.15	0.99	1.9	2.23
Bi	0.01	0.29	0.48	0.3	0.23	0.43	0.5	0.14	0.14	0.5	0.53
Ca	0.01%	0.43%	0.04%	0.65%	3.10%	0.10%	0.14%	0.85%	0.83%	0.10%	0.87%
Cd	0.02	0.21	0.22	0.13	0.4	0.21	0.18	0.04	0.06	0.27	0.23
Ce	0.01	50.18	57.35	43.88	39.71	59.36	62.67	51.11	42.34	67.34	67.3
Co	0.1	11.2	7.6	29.5	13.6	24.9	14.9	7.9	8.6	13.7	14.9
Cr	1	53	42	53	173	38	48	120	161	40	50
Cs	0.05	6.43	12.32	6.64	4.3	8.7	11.3	2	2.89	11.39	13.46
Cu	0.5	121.8	56.9	101.3	1149.4	60.4	56.4	196.1	77.8	41.2	48.1
Fe	0.01%	8.98%	1.62%	11.46%	4.32%	2.19%	1.50%	1.45%	1.72%	1.52%	3.17%
Ga	0.05	16.72	23.25	15.06	14.59	21.99	27.81	12.85	14.21	22.56	25.05
Ge	0.10	0.6	0.8	3.8	0.8	0.8	1	1	0.9	1.1	1.5
Hf	0.05	2.74	4.08	2.62	2.22	3.4	3.94	2.44	2.38	3.71	3.26
Hg	0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
In	0.01	0.06	0.08	0.06	0.06	0.07	0.08	0.04	0.04	0.07	0.08
K	0.00%	1.74%	2.41%	1.68%	1.33%	2.50%	3.08%	1.38%	1.58%	2.27%	2.70%
La	0.01	24.14	25.68	20.5	19.69	27.13	28.48	25.56	21.02	30.56	30.12
Li	0.1	19.5	14.7	12.6	18.3	15.2	12.5	14.9	11.8	14.4	13.8
Mg	0.002%	0.74%	0.59%	1.27%	1.26%	0.62%	0.52%	0.40%	0.35%	0.40%	0.70%
Mn	1	1188	90	1208	689	212	119	214	312	83	402
Mo	0.1	1	0.9	1.5	4.2	1.7	1.1	3.6	3.1	1.4	1.1
Na	0.002%	0.14%	0.11%	0.09%	1.25%	0.12%	0.15%	2.15%	2.35%	0.19%	0.22%
Nb	0.05	5.73	7.97	4.81	5.24	6.55	7.57	5.74	5.93	7.44	6.92
Ni	0.5	21.8	15.5	48.5	92.8	29.3	27.3	77.3	64	13.5	28.3
P	50	620	171	549	467	527	357	328	299	108	309
Pb	0.5	23.4	21.7	21.8	85.6	18.9	26.5	22.5	15.4	24.7	19.3
Rb	0.1	89.05	148.74	88.69	63.43	131.72	160.88	57.04	69.92	136.7	157.39
Re	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
S											
Sb	0.05	0.67	0.7	1.98	1.69	0.74	1.14	0.89	0.61	1.19	1.21
Sc	0.1	15.1	15.8	16.5	10.9	15.5	15.6	7.5	8.8	18.8	19.1
Sn	0.1	6.4	3.9	5.2	47.5	3.9	4.1	9.3	4.3	3.2	3.3
Sr	0.05	458.36	163.08	377.13	332.03	301.98	206.65	230.49	195.26	77.02	229.15
Ta	0.01	0.51	0.63	0.41	0.41	0.64	0.69	0.45	0.45	0.63	0.64
Te	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Th	0.01	8.72	10.76	7.68	7.25	10.94	12.36	8.6	7.7	13.77	12.44
Ti	0.001%	0.37%	0.41%	0.30%	0.31%	0.46%	0.50%	0.20%	0.35%	0.43%	0.42%
Tl	0.02	0.45	0.79	0.73	0.35	0.76	1.21	0.36	0.37	0.81	0.9
U	0.01	2.64	3.91	2.58	1.95	3.15	3.16	1.97	1.73	3.88	3.35
V	1	111	121	107	80	137	158	42	71	142	142
W	0.1	1.9	1.8	1.2	16	1.6	2	21.8	23.6	1.7	1.6
Y	0.1	27.3	32.02	29.27	16.85	22.63	20.85	18.77	14.71	26.77	30.67
Zn	1	97	89	118	155	115	117	66	58	68	106
Zr	0.1	91.5	129.6	92.5	69.5	103.9	117.9	76.8	81.7	120.7	113.8

< element at or below analytical detection limit.

Table B6: Geochemical abundance indices (GAI) of selected HVO overburden/interburden and coal solids samples. Values 3 and over are highlighted in yellow .

Element	Mean Crustal Abundance*	Sample Number / Lithology / Total S																									
		17724	17745	17750	17752	17759	17785	17787	17805	17806	17821	17837	17838	17839	17847	17851	17852	17856	17861	17886	17979	17999	18004	18021	18033	18054	18066
		Coal	Coal	Coal	Coal	Siltstone	Mudstone	Carb Mudstone	Sandstone	Sandstone	Carb Mudstone	Siltstone	Siltstone	Siltstone	Sandstone	Sandstone	Siltstone	Sandstone	Siltstone	Siltstone	Carb Siltstone	Carb Siltstone	Carb Siltstone	Carb Mudstone	Carb Siltstone	Coal	Sandstone
		0.47%S	0.47%S	0.56%S	0.4%S	0.2%S	0.07%S	0.3%S	3.39%S	0.34%S	0.51%S	0.12%S	1.38%S	0.87%S	0.21%S	1.18%S	0.17%S	0.32%S	0.77%S	0.3%S	1.28%S	2.2%S	0.28%S	2.01%S	0.7%S	0.42%S	1.82%S
Ag	0.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Al	8.2%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
As	1.5	2	2	2	2	2	2	4	4	2	4	4	6	4	4	2	2	3	2	2	2	2	2	5	5	4	2
B	10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1
Ba	500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Be	2.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bi	0.048	1	2	2	1	3	3	4	2	2	1	3	3	3	2	2	3	2	3	3	3	2	3	3	3	3	2
Ca	4.0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cd	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Co	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cs	3	0	0	0	0	2	1	1	0	1	0	1	1	1	0	0	2	0	1	1	0	0	1	2	2	1	0
Cu	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe	4.1%	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Ga	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ge	1.8	0	1	1	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	1	1	0	2	2	1
In	0.049	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K	2.1%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Li	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mg	2.3%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn	950	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Mo	1.5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Nb	20.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	80	1	1	0	0	0	0	0	0	0	0	4	0	2	0	0	0	0	0	0	0	4	0	0	0	0	0
P	1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pb	14	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	3	0
Rb	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Re																											
S	0.03%	3	3	3	3	2	1	3	6	3	3	1	5	4	2	5	2	3	4	3	4	6	3	5	4	3	5
Sb	0.2	0	3	3	1	1	2	2	2	2	5	2	3	3	2	2	2	1	2	2	3	2	3	3	4	4	2
Sc	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Se	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sn	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sr	370	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ta	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Te																											
Th	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ti	0.56%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tl	0.6	0	0	0	0	0	0	0	2	0	0	0	1	1	0	0	0	0	0	1	0	1	0	1	1	0	1
U	2.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W	1	1	0	2	1	0	0	0	0	0	0	2	0	1	0	0	4	0	1	2	2	3	1	1	2	3	0
Y	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zn	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Bowen H.J.M.(1979) Environmental Chemistry of the Elements. - Inadequate detection limit achievied due to analytical issues with the carbonaceous materials. Median soil abundance for Re and Te not available.

Table B7: Geochemical abundance indices (GAI) of selected HVO South overburden/interburden solids samples. Values 3 and over are highlighted in yellow .

Element	Median Soil Abundance*	Sample Number / Lithology / Total S									
		20122	20123	20132	20139	20148	20150	20168	20195	20208	20209
		Sandstone	Siltstone	Carb Siltstone	Sandstone	Siltstone	Siltstone	Conglom-erate	Sandstone	Carb Siltstone	Siltstone
		0.21%S	0.31%S	0.2%S	0.02%S	0.2%S	0.17%S	0.01%S	<0.01%S	0.3%S	0.13%S
Ag	0.05	0	1	0	3	0	0	0	0	0	1
Al	7.1%	0	0	0	0	0	0	0	0	0	0
As	6	0	0	1	0	0	2	0	0	0	0
B	20	0	0	0	0	0	0	0	0	0	0
Ba	500	0	0	0	0	0	0	0	0	0	0
Be	0.3	2	2	2	2	2	2	1	1	2	2
Bi	0.2	0	1	0	0	1	1	0	0	1	1
Ca	1.5%	0	0	0	0	0	0	0	0	0	0
Cd	0.35	0	0	0	0	0	0	0	0	0	0
Ce	50	0	0	0	0	0	0	0	0	0	0
Co	8	0	0	1	0	1	0	0	0	0	0
Cr	70	0	0	0	1	0	0	0	1	0	0
Cs	4	0	1	0	0	1	1	0	0	1	1
Cu	30	1	0	1	5	0	0	2	1	0	0
Fe	4.0%	1	0	1	0	0	0	0	0	0	0
Ga	20	0	0	0	0	0	0	0	0	0	0
Ge	1	0	0	1	0	0	0	0	0	0	0
Hf	6	0	0	0	0	0	0	0	0	0	0
Hg	0.06	0	1	0	0	0	0	0	0	0	0
In	1	0	0	0	0	0	0	0	0	0	0
K	1.4%	0	0	0	0	0	1	0	0	0	0
La	40	0	0	0	0	0	0	0	0	0	0
Li	25	0	0	0	0	0	0	0	0	0	0
Mg	0.5%	0	0	1	1	0	0	0	0	0	0
Mn	1000	0	0	0	0	0	0	0	0	0	0
Mo	1.2	0	0	0	1	0	0	1	1	0	0
Na	0.5%	0	0	0	1	0	0	2	2	0	0
Nb	10	0	0	0	0	0	0	0	0	0	0
Ni	50	0	0	0	0	0	0	0	0	0	0
P	800	0	0	0	0	0	0	0	0	0	0
Pb	35	0	0	0	1	0	0	0	0	0	0
Rb	150	0	0	0	0	0	0	0	0	0	0
Re											
S	0.07%	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
Sb	1	0	0	0	0	0	0	0	0	0	0
Sc	7	1	1	1	0	1	1	0	0	1	1
Sn	4	0	0	0	3	0	0	1	0	0	0
Sr	250	0	0	0	0	0	0	0	0	0	0
Ta	2	0	0	0	0	0	0	0	0	0	0
Te											
Th	9	0	0	0	0	0	0	0	0	0	0
Ti	0.50%	0	0	0	0	0	0	0	0	0	0
Tl	0.2	1	1	1	0	1	2	0	0	1	2
U	2	0	0	0	0	0	0	0	0	0	0
V	90	0	0	0	0	0	0	0	0	0	0
W	1.5	0	0	0	3	0	0	3	3	0	0
Y	40	0	0	0	0	0	0	0	0	0	0
Zn	90	0	0	0	0	0	0	0	0	0	0
Zr	400	0	0	0	0	0	0	0	0	0	0

*Bowen H.J.M.(1979) Environmental Chemistry of the Elements. Median soil abundance for Re and Te not available.

Table B8: Chemical composition of water extracts from selected HVO overburden/interburden and coal samples.

Parameter		Detection Limit	Sample Number / Lithology / Total S of solids / ARD Classification																									
			17724	17745	17750	17752	17759	17785	17787	17805	17806	17821	17837	17838	17839	17847	17851	17852	17856	17861	17886	17979	17999	18004	18021	18033	18054	18066
			Coal	Coal	Coal	Coal	Siltstone	Mudstone	Carb Mudstone	Sandstone	Sandstone	Carb Mudstone	Siltstone	Siltstone	Siltstone	Sandstone	Sandstone	Siltstone	Sandstone	Siltstone	Siltstone	Carb Siltstone	Carb Siltstone	Carb Siltstone	Carb Mudstone	Carb Siltstone	Coal	Sandstone
			0.47%S	0.47%S	0.56%S	0.4%S	0.2%S	0.07%S	0.3%S	3.39%S	0.34%S	0.51%S	0.12%S	1.38%S	0.87%S	0.21%S	1.18%S	0.17%S	0.32%S	0.77%S	0.3%S	1.28%S	2.2%S	0.28%S	2.01%S	0.7%S	0.42%S	1.82%S
			PAF	NAF	PAF	PAF	PAF-LC	NAF	NAF	NAF-HS	UC(NAF)	NAF	NAF	PAF	PAF	NAF	NAF-HS	NAF	PAF-LC	PAF	NAF	NAF-HS	PAF	UC(NAF)	PAF	PAF	UC(NAF)	PAF
pH		0.1	2.4	7.6	4.1	7.6	5.1	8.07	8.69	5.4	9.02	7.07	6.9	2.58	2.94	5.95	5.95	4.94	3.26	3.94	5.01	9.23	4.54	6.58	2.42	4.00	6.86	4.36
EC	dS/m	0.001	1.485	0.1249	0.43	0.204	0.8	0.689	0.639	3.74	0.791	0.916	0.651	5.99	3.57	2.16	1.355	1.144	1.306	3.61	1.871	0.551	4.29	0.726	4.49	2.82	0.575	2.55
Alkalinity	mg/l	1	-	58	-	62	-	48	99	-	77	104	27	-	-	-	-	-	-	-	-	120	-	51	-	-	23	-
Acidity	mg/l	1	706	-	93	-	15	-	-	2593	-	-	-	3134	832	133	69	28	255	927	82	-	634	-	3307	1478	-	490
Ag	mg/l	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	<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
Al	mg/l	0.01	14.7	0.02	3.21	0.02	0.1	0.03	0.05	<0.01	0.09	<0.01	<0.01	46.8	27.6	<0.01	<0.01	<0.01	3.71	4.33	0.05	0.36	4.67	<0.01	186	10.9	<0.01	1.7
As	mg/l	0.001	<0.001	<0.001	0.001	<0.001	<0.001	0.002	0.008	0.001	0.011	<0.001	0.003	4.1	0.02	<0.001	<0.001	<0.001	0.02	0.001	<0.001	0.035	0.002	0.023	0.368	0.027	<0.001	0.002
B	mg/l	0.05	0.19	<0.05	0.12	<0.05	0.19	0.09	0.09	<0.05	0.12	0.07	<0.05	0.2	0.17	0.05	0.05	0.09	0.11	0.13	0.17	0.12	0.08	0.12	0.12	0.21	0.09	0.14
Ba	mg/l	0.001	0.044	0.464	0.071	0.443	0.058	0.05	0.083	0.084	0.033	0.093	0.038	0.049	0.05	0.102	0.125	0.071	0.062	0.07	0.048	0.276	0.036	0.068	0.038	0.094	0.073	0.057
Be	mg/l	0.001	0.004	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.052	0.043	<0.001	<0.001	<0.001	0.025	0.015	<0.001	<0.001	0.014	<0.001	0.178	0.022	<0.001	0.012
Ca	mg/l	1	27	8	22	9	18	2	3	563	2	49	4	133	100	223	65	21	75	163	19	2	436	4	254	275	30	294
Cd	mg/l	0.0001	0.0042	<0.0001	0.0042	<0.0001	0.0012	<0.0001	<0.0001	0.0066	<0.0001	<0.0001	<0.0001	0.0202	0.0196	0.0006	0.0005	0.0012	0.0035	0.0139	0.0016	0.0001	0.0113	<0.0001	0.0452	0.0221	0.0007	0.013
Cl	mg/l	1	5	6	6	6	42	40	33	26	40	36	20	10	11	24	22	14	15	15	19	23	13	40	11	20	28	13
Co	mg/l	0.001	0.009	<0.001	0.515	0.001	0.118	0.015	<0.001	2.82	<0.001	0.008	0.003	2.43	4.21	0.229	0.133	0.048	0.438	0.694	0.325	<0.001	0.72	0.037	4.14	4.63	0.226	0.798
Cr	mg/l	0.001	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.034	0.014	<0.001	<0.001	<0.001	0.004	0.002	<0.001	<0.001	<0.001	<0.001	0.132	<0.001	<0.001	<0.001
Cu	mg/l	0.001	0.159	<0.001	0.172	<0.001	0.066	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	1.73	1.73	<0.001	<0.001	0.001	0.058	0.158	<0.001	<0.001	0.127	0.018	4.84	0.436	<0.001	0.016
F	mg/l	0.1	0.2	0.4	0.5	0.4	0.2	1.3	1.5	<0.1	3	0.6	0.5	<0.1	0.3	0.1	0.2	0.1	0.2	0.1	0.1	0.6	0.3	0.3	<0.1	<0.1	0.1	0.3
Fe	mg/l	0.05	246	<0.05	7.02	<0.05	0.33	<0.05	<0.05	1680	<0.05	<0.05	<0.05	1460	286	18	3.44	6.52	75.9	481	23.9	<0.05	359	<0.05	1180	844	<0.05	246
Hg	mg/l	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	0.0003	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0002	<0.0001	0.0002	<0.0001	<0.0001	<0.0001
K	mg/l	1	2	1	8	2	13	6	6	7	6	11	9	22	21	18	17	20	16	25	13	3	7	22	1	29	12	<1
Mg	mg/l	1	20	2	21	2	29	3	3	337	2	61	10	372	288	114	73	35	142	189	14	<1	289	15	634	296	45	483
Mn	mg/l	0.001	1.14	0.001	0.328	0.006	0.047	0.001	<0.001	26.1	0.001	0.287	0.013	6.5	2.51	0.397	0.62	0.126	2.28	2.47	0.086	<0.001	7.54	0.026	14.8	1.48	0.208	35.6
Mo	mg/l	0.001	0.001	0.003	<0.001	0.002	<0.001	0.055	0.034	<0.001	0.02	0.002	0.006	0.016	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.107	<0.001	0.023	0.003	<0.001	<0.001	<0.001
Na	mg/l	1	10	23	82	30	154	130	128	123	176	71	109	126	133	150	119	149	129	226	392	133	873	202	113	217	120	146
Ni	mg/l	0.001	0.014	<0.001	0.584	0.002	0.081	0.027	0.002	2.9	<0.001	0.012	0.004	2.81	4.85	0.338	0.105	0.051	0.883	0.799	0.272	<0.001	0.48	0.063	5.69	4.71	0.181	1.13
P	mg/l	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pb	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	0.007	<0.001	<0.001	<0.001	0.007	0.006	<0.001	<0.001	<0.001	<0.001	0.004	0.007	<0.001	<0.001
Sb	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	0.001	0.001	<0.001	<0.001
Se	mg/l	0.01	<0.01	0.01	0.02	0.02	0.05	0.12	0.05	<0.01	<0.01	<0.01	0.05	0.03	0.04	0.02	<0.01	0.03	<0.01	0.06	0.1	0.01	0.01	0.08	0.05	0.05	0.04	0.02
Si	mg/l	0.1	0.5	0.6	2.8	0.7	6.0	2.62	2.32	1.66	13.5	0.85	2.55	11.7	10	1.4	1.84	4.57	4.5	6.68	7.24	1.89	5.08	4.07	6.59	9.27	3.18	5.3
Sn	mg/l	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	<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
SO4	mg/l	1	885	7	314	18	406	178	140	5790	270	318	225	5290	2350	1260	625	510	1160	2540	949	122	4650	380	7130	3760	428	3280
Sr	mg/l	0.001	0.188	0.044	0.312	0.055	0.541	0.065	0.055	2.22	0.035	0.577	0.093	2.9	2.37	2.37	1.45	0.853	2.73	4.68	0.306	0.021	2.01	0.081	3.57	4.92	0.938	3.62
Th	mg/l	0.001	0.008	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.01	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.058	0.003	<0.001	0.001
Tl	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001	0.034	0.005	<0.001	<0.001	<0.001	0.005	0.004	0.002	<0.001	0.01	<0.001	0.017	0.035	0.001	0.003
U	mg/l	0.001	0.004	<0.001	0.001	<0.001	<0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	0.019	0.013	<0.001	<0.001	<0.001	0.014	0.005	<0.001	<0.001	0.006	<0.001	0.092	0.004	<0.001	0.004
Zn	mg/l	0.005	2.2	0.006	3.16	0.034	0.47	0.008	<0.005	2.38	<0.005	0.075	0.042	10.9	8.38	0.224	0.296	0.876	1.64	4.1	0.706	0.02	3.46	0.097	10.6	11.6	0.276	1.4

< element at or below analytical detection limit.

Table B8: (continued)

Parameter		Detection Limit	Sample Number / Lithology / Total S of solids / ARD Classification										BLANK	BLANK
			20122	20123	20132	20139	20148	20150	20168	20195	20208	20209		
			Sandstone	Siltstone	Carb Siltstone	Sandstone	Siltstone	Siltstone	Conglom-erate	Sandstone	Carb Siltstone	Siltstone		
			0.21%S	0.31%S	0.2%S	0.02%S	0.2%S	0.17%S	0.01%S	0.005%S	0.3%S	0.13%S		
			NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF	NAF		
pH		0.1	8.3	7.7	7.5	9.2	7.8	7.8	8.9	9.3	4.7	8.9	6.6	6.5
EC	dS/m	0.001	0.869	0.912	1.09	0.569	0.929	1.17	0.722	0.514	1.89	0.788	0.001	0.002
Alkalinity	mg/l	1	-	-	-	-	-	-	-	-	85	-	-	-
Acidity	mg/l	1	46	35	61	151	40	49	106	181	-	136	-	-
Ag	mg/l	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
Al	mg/l	0.01	0.02	<0.01	<0.01	1.11	0.03	<0.01	0.54	1.42	1.44	0.04	<0.01	<0.01
As	mg/l	0.001	0.002	<0.001	<0.001	0.017	<0.001	0.001	0.007	0.02	<0.001	0.002	<0.001	<0.001
B	mg/l	0.05	<0.05	0.05	<0.05	0.08	0.05	0.05	<0.05	0.1	0.23	0.08	<0.05	<0.05
Ba	mg/l	0.001	0.043	0.039	0.046	0.165	0.029	0.038	0.04	0.071	0.04	0.095	<0.001	<0.001
Be	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.006	<0.001	<0.001	<0.001
Ca	mg/l	1	2	2	24	<1	3	9	2	<1	32	1	<1	<1
Cd	mg/l	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.005	<0.0001	<0.0001	<0.0001
Cl	mg/l	1	35	24	32	22	30	36	22	20	10	18	<1	<1
Co	mg/l	0.001	<0.001	0.005	0.249	<0.001	0.051	0.055	<0.001	<0.001	0.583	0.002	<0.001	<0.001
Cr	mg/l	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
Cu	mg/l	0.001	0.002	0.009	0.002	<0.001	0.001	0.003	<0.001	<0.001	0.221	0.002	<0.001	<0.001
F	mg/l	0.1	1	0.5	0.4	1.4	0.8	0.5	0.7	1.4	0.6	4.6	<0.1	<0.1
Fe	mg/l	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	24.9	<0.05	<0.05	<0.05
Hg	mg/l	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
K	mg/l	1	7	11	13	4	13	17	6	3	16	4	<1	<1
Mg	mg/l	1	6	14	42	1	12	24	2	<1	18	<1	<1	<1
Mn	mg/l	0.001	0.004	0.01	0.225	<0.001	0.03	0.074	0.002	<0.001	0.264	<0.001	<0.001	<0.001
Mo	mg/l	0.001	0.014	0.005	0.004	0.05	0.019	0.008	0.008	0.014	<0.001	0.08	<0.001	<0.001
Na	mg/l	1	140	161	150	125	166	202	161	123	341	186	<1	<1
Ni	mg/l	0.001	<0.001	0.006	0.273	<0.001	0.044	0.072	<0.001	<0.001	0.349	0.007	<0.001	<0.001
P	mg/l	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pb	mg/l	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
Sb	mg/l	0.001	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001	0.001	<0.001	0.002	<0.001	<0.001
Se	mg/l	0.01	0.04	0.03	0.05	0.01	0.08	0.05	<0.01	<0.01	0.07	0.09	<0.01	<0.01
Si	mg/l	0.1	0.8	1.9	1.4	0.3	1.4	1.66	0.34	0.41	8.71	1.3	<0.05	<0.05
Sn	mg/l	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
SO4	mg/l	1	222	318	442	90	321	446	210	54	910	199	<1	<1
Sr	mg/l	0.001	0.043	0.123	0.274	0.009	0.082	0.17	0.024	0.002	0.322	0.01	<0.001	<0.001
Th	mg/l	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
Tl	mg/l	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
U	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005	<0.001	<0.001	<0.001
Zn	mg/l	0.005	0.029	0.09	0.164	<0.005	0.085	0.119	<0.005	<0.005	1.24	<0.005	<0.005	<0.005

< element at or below analytical detection limit.

Table B9: Chemical composition of peroxide extractions of selected overburden / interburden and coal samples (not scaled).

Parameter		Detection Limit	Sample Number / Lithology / Total S of Solids / ARD Classification																							Blank 15% H2O2
			17724	17735	17737	17739	17750	17752	17758	17759	17761	17805	17806	17838	17839	17851	17856	17861	17979	17999	18001	18021	18022	18033	18054	18066	20208	
			Coal	Siltstone	Mudstone	Siltstone	Coal	Coal	Siltstone	Siltstone	Siltstone	Sandstone	Sandstone	Siltstone	Siltstone	Sandstone	Sandstone	Siltstone	Carb Siltstone	Carb Siltstone	Sandstone	Carb Siltstone	Siltstone	Carb Siltstone	Coal	Sandstone	Carb Siltstone	
			0.47%S	0.33%S	0.62%S	0.31%S	0.56%S	0.4%S	0.26%S	0.2%S	0.46%S	3.39%S	0.34%S	1.38%S	0.87%S	1.18%S	0.32%S	0.77%S	1.28%S	2.2%S	1.84%S	2.01%S	0.56%S	0.7%S	0.42%S	1.82%S	0.3%S	
			PAF	PAF-LC	PAF	PAF-LC	PAF	PAF-LC	PAF-LC	PAF-LC	PAF-LC	NAF-HS	UC(NAF)	PAF	PAF	NAF-HS	PAF-LC	PAF	NAF-HS	PAF	PAF	PAF	PAF-LC	PAF	NAF	PAF	NAF	
NAGpH		0.1	2.1	3.0	2.7	3.7	2.3	2.4	3.4	3.7	3	7.6	7.9	3.2	3	7.8	3.1	2.9	7.9	2.8	2.9	2.6	3.9	3.3	4.1	2.6	6.9	4.8
Ag	mg/l	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	<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
Al	mg/l	0.01	1.21	1.09	2.98	1.26	1.77	0.93	0.61	0.79	0.22	<0.01	<0.01	1.88	2.44	0.04	0.16	0.89	0.02	1.5	0.99	4.93	1.08	1.62	1.54	1.48	0.03	0.01
As	mg/l	0.001	0.006	<0.001	<0.001	<0.001	0.029	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.007	<0.001	<0.001	0.003	<0.001	<0.001	<0.001
B	mg/l	0.05	0.26	0.2	0.19	0.18	0.14	0.2	0.16	0.17	0.13	<0.05	<0.05	0.1	0.16	0.06	0.12	0.15	0.06	0.13	0.2	0.17	0.12	0.2	0.2	0.14	0.09	<0.05
Ba	mg/l	0.001	0.466	0.447	0.273	0.321	0.462	0.446	0.433	0.418	0.15	0.066	0.158	0.125	0.076	0.125	0.179	0.117	0.362	0.055	0.051	0.042	0.084	0.31	0.685	0.075	0.382	<0.001
Be	mg/l	0.001	0.002	0.002	0.002	0.001	0.002	0.002	0.002	0.001	0.003	<0.001	<0.001	0.003	0.004	<0.001	0.002	0.004	<0.001	0.006	0.006	0.008	0.003	0.006	0.005	0.004	<0.001	<0.001
Ca	mg/l	1	2	6	8	5	2	17	4	3	8	313	39	13	6	82	8	10	27	87	56	11	12	18	13	63	6	<1
Cd	mg/l	0.0001	0.0002	0.0012	0.002	0.0009	0.0005	0.0004	0.0007	0.0006	0.001	<0.0001	<0.0001	0.0012	0.0013	<0.0001	0.0002	0.0014	<0.0001	0.0011	0.0017	0.0016	0.0009	0.0012	0.0005	0.0011	0.0001	<0.0001
Cl	mg/l	1	35	2	2	2	11	14	3	2	2	2	2	1	2	1	1	1	1	1	<1	2	2	2	2	1	1	5
Co	mg/l	0.001	0.008	0.004	0.11	0.063	0.028	0.013	0.032	0.024	0.083	0.004	<0.001	0.084	0.152	0.006	0.019	0.047	0.002	0.053	0.036	0.127	0.042	0.166	0.056	0.043	0.018	<0.001
Cr	mg/l	0.001	0.008	0.011	0.016	0.018	0.014	0.009	0.01	0.01	0.005	0.002	0.022	0.012	0.018	0.01	0.027	0.021	0.034	0.02	0.019	0.016	0.019	0.013	0.016	0.012	0.01	0.004
Cu	mg/l	0.001	0.197	0.103	0.236	0.164	0.111	0.15	0.308	0.271	0.447	0.011	0.001	0.159	0.256	0.008	0.058	0.159	0.003	0.134	0.064	0.287	0.099	0.223	0.157	0.078	0.012	0.005
F	mg/l	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.2	0.2	0.1	0.1	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.1
Fe	mg/l	0.05	15	8.2	6	2.1	14	6.86	2.97	2.41	1.43	<0.05	<0.05	56.5	42.2	0.42	0.19	11.1	0.12	11.9	12.1	47.8	3.64	15.6	34.3	14.3	<0.05	<0.05
Hg	mg/l	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	<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	<0.0001
K	mg/l	1	1	4	4	4	2	1	3	4	3	3	5	4	3	4	3	2	4	2	2	1	6	2	3	2	4	<1
Mg	mg/l	1	<1	8	6	8	2	2	6	5	12	20	11	38	22	37	7	13	4	44	39	23	27	12	14	22	7	<1
Mn	mg/l	0.001	0.046	0.27	0.288	0.245	0.082	0.121	0.226	0.067	0.481	0.06	0.004	2.26	0.92	0.041	0.173	0.538	0.018	1.33	2.02	0.93	0.898	0.369	0.929	2.89	0.211	<0.001
Mo	mg/l	0.001	0.006	<0.001	0.004	0.01	0.005	0.002	<0.001	0.003	<0.001	0.004	0.003	<0.001	<0.001	<0.001	0.01	<0.001	0.004	<0.001	<0.001	<0.001	<0.001	0.007	0.006	<0.001	0.004	<0.001
Na	mg/l	1	18	26	26	28	20	18	23	22	20	19	28	21	21	20	21	23	31	38	39	19	22	21	20	22	30	14
Ni	mg/l	0.001	0.014	0.008	0.197	0.11	0.038	0.011	0.041	0.025	0.113	0.005	<0.001	0.1	0.188	0.008	0.041	0.066	0.002	0.058	0.064	0.172	0.059	0.184	0.059	0.062	0.019	0.002
P	mg/l	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pb	mg/l	0.001	0.016	<0.001	<0.001	<0.001	0.012	0.025	<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	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Sb	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	0.004	<0.001	<0.001	<0.001
Se	mg/l	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	<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	<0.01
Si	mg/l	0.1	1.6	3.3	3.1	4.2	2.1	1.83	3.74	4.65	4.38	0.85	2.11	3.69	3.9	1.2	3.4	4.04	4.71	5.26	4.45	4.52	6.04	3.86	3.67	5.21	3.04	<0.05
Sn	mg/l	0.001	0.031	<0.001	<0.001	<0.001	0.01	0.014	<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	<0.001	<0.001	<0.001	<0.001	<0.001	0.008
SO4	mg/l	1	61	66	105	68	31	12	53	41	112	714	135	338	205	343	79	163	28	560	466	412	172	129	56	403	58	<1
Sr	mg/l	0.001	0.023	0.084	0.097	0.071	0.031	0.046	0.087	0.073	0.126	0.768	0.215	0.114	0.074	0.39	0.126	0.226	0.123	0.354	0.17	0.092	0.167	0.191	0.144	0.445	0.053	<0.001
Th	mg/l	0.001	0.003	<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	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Tl	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	0.002	0.002	0.003	<0.001	0.003	<0.001	0.001	<0.001	<0.001
U	mg/l	0.001	0.001	<0.001	0.002	<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	0.002	0.003	0.003	<0.001	<0.001	<0.001	0.002	<0.001	<0.001
Zn	mg/l	0.005	0.352	0.471	1.22	0.654	0.503	0.498	0.504	0.437	0.743	0.083	0.043	0.674	0.778	0.092	0.322	0.598	0.02	0.597	0.635	0.792	0.58	0.978	0.448	0.498	0.159	<0.005

< element at or below analytical detection limit.

Table B10: Acid forming characteristics of rejects and tailings samples from the Hunter Valley Operations Continuation Project

EGi Code	SGS Job Number	Date Sampled	Seam	Description	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS					NAG TEST			Final ARD Classification
							Total %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
20559	MUS20-07100	17-Jan-20	ULD	Rejects	4.4	2.780	1.59	49	16	33	0.3	3.1	9	20	PAF
20560	MUS20-07132	23-Jan-20	M35	Rejects	7.6	0.621	0.19	6	17	-11	2.9	7.2	0	0	NAF
20561	MUS20-07131	29-Jan-20	ULD	Rejects	4.8	0.241	0.98	30	13	17	0.4	3.6	2	14	PAF
20562	MUS20-07218	06-Feb-20	M67A	Rejects	7.9	1.110	0.28	9	18	-9	2.1	7.1	0	0	NAF
20563	MUS20-07246	11-Feb-20	LAR	Rejects	6.8	2.190	0.82	25	21	4	0.8	4.8	0	9	UC(PAF)
20564	MUS20-07309	20-Feb-20	LPG	Rejects	7.3	0.476	0.08	2	17	-15	6.9	7.4	0	0	NAF
20565	MUS20-07337	26-Feb-20	BFAE	Rejects	7.2	0.429	0.40	12	10	2	0.8	4.9	0	3	UC(NAF)
20566	MUS20-07296	05-Mar-20	ULD	Rejects	7.4	0.429	0.48	15	16	-1	1.1	5.5	0	3	NAF
20567	MUS20-07432	13-Mar-20	UPG	Rejects	7.6	0.396	0.39	12	23	-11	1.9	7.1	0	0	NAF
20568	MUS20-07457	16-Mar-20	WK6	Rejects	7.7	0.421	0.13	4	19	-15	4.8	7.2	0	0	NAF
20569	MUS20-07481	26-Mar-20	BFAE/MPG	Rejects			0.22	7	24	-17	3.6	7.4	0	0	NAF
20571	MUS20-07558	15-Apr-20	Bays / Lar	Rejects	7.3	0.279	0.70	21	72	-51	3.4	7.1	0	0	NAF
20572	MUS20-07587	22-Apr-20	R3/4	Rejects	7.4	0.375	0.13	4	22	-18	5.5	7.3	0	0	NAF
20573	MUS20-07616	29-Apr-20	Bays / Lar	Rejects	7.6	1.460	0.52	16	24	-8	1.5	7.1	0	0	NAF
20574	MUS20-07678	09-May-20	Bays / Lar	Rejects	7.7	0.465	0.25	8	22	-14	2.9	7.6	0	0	NAF
20575	MUS20-07696	12-May-20	Bays / Lar	Rejects	7.5	0.471	0.22	7	23	-16	3.4	7.9	0	0	NAF
20576	MUS20-07872	10-Jun-20	AFAC	Rejects	7.4	0.487	0.07	2	20	-18	9.3	8.1	0	0	NAF
20577	MUS20-07896	15-Jun-20	AFAC	Rejects	7.3	0.355	0.16	5	28	-23	5.7	8.2	0	0	NAF
20578	MUS20-07929	26-Jun-20	P8-10/BAR	Rejects	7.2	0.329	0.27	8	32	-24	3.9	8.2	0	0	NAF
20579	MUS20-07971	30-Jun-20	BFAE/P4	Rejects	7.4	0.341	0.25	8	25	-17	3.3	8.1	0	0	NAF
20582	MUS20-08080	27-Jul-20	BR3C / BR40 / UAA	Rejects	7.5	0.445	0.34	10	27	-17	2.6	7.9	0	0	NAF
20583	MUS20-08156	03-Aug-20	BFAE	Rejects	7.6	1.210	0.56	17	21	-4	1.2	7.1	0	0	UC(NAF)
20584	MUS20-08186	11-Aug-20	LAR	Rejects	7.9	1.380	0.73	22	21	1	0.9	4.7	0	6	UC(PAF)
20585	MUS20-08217	17-Aug-20	BR3C / BR46	Rejects	8.3	0.279	0.15	5	21	-16	4.6	8.2	0	0	NAF
20586	MUS20-08253	24-Aug-20	BSAE / UA2 / UA3C	Rejects	8.5	0.285	0.19	6	18	-12	3.1	8.1	0	0	NAF
20587	MUS20-08301	02-Sep-20	BR5A / BR5C / UAA	Rejects	8.3	0.521	0.20	6	21	-15	3.4	8.2	0	0	NAF
20588	MUS20-08365	11-Sep-20	LAR BY1A BY3	Rejects	8.2	0.476	0.12	4	32	-28	8.7	8.3	0	0	NAF
20589	MUS20-08403	16-Sep-20	BR3C/BRAC/UA4	Rejects	8.1	0.511	0.38	12	20	-8	1.7	8.0	0	0	NAF
20590	MUS20-08417	22-Sep-20	BY1A / BY2C	Rejects	7.9	0.395	0.16	5	68	-63	13.9	8.2	0	0	NAF
20591	MUS20-08496	14-Oct-20	BY1A / BY2C / BF4	Rejects	7.8	0.466	0.22	7	19	-12	2.8	8.1	0	0	NAF
20592	MUS20-08515	20-Oct-20	BR5A / BR5C / UAA	Rejects	7.9	1.260	0.47	14	16	-2	1.1	7.1	0	0	NAF
20593	MUS20-08554	27-Oct-20	BFAE / BAR	Rejects	5.3	1.990	0.94	29	15	14	0.5	3.8	1	12	PAF
20594	MUS20-08602	04-Nov-20	BY1A / BY2C / LAR	Rejects	8.4	0.794	0.22	7	37	-30	5.5	7.8	0	0	NAF
20595	MUS20-08633	11-Nov-20	BFAE / BAR	Rejects	8.2	0.519	0.47	14	21	-7	1.5	7.2	0	0	NAF

Table B10: Acid forming characteristics of rejects and tailings samples from the Hunter Valley Operations Continuation Project

EGi Code	SGS Job Number	Date Sampled	Seam	Description	$pH_{1:2}$	$EC_{1:2}$	ACID-BASE ANALYSIS					NAG TEST			Final ARD Classification
							Total %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$	
20596	MUS20-07100	17-Jan-20	ULD	Tailings	8.3	2.610	0.83	25	15	10	0.6	5.1	0	7	UC(NAF)
20597	MUS20-07132	23-Jan-20	M35	Tailings	8.5	1.980	0.34	10	7	3	0.7	4.2	2	19	NAF
20598	MUS20-07131	29-Jan-20	ULD	Tailings	8.3	1.820	0.44	13	7	6	0.5	4.4	1	10	PAF-LC
20599	MUS20-07218	06-Feb-20	M67A	Tailings	8.1	1.380	0.42	13	14	-1	1.1	7.1	0	0	NAF
20600	MUS20-07246	11-Feb-20	LAR	Tailings	6.9	2.180	0.32	10	5	5	0.5	3.8	5	23	NAF
20601	MUS20-07337	26-Feb-20	BFAE	Tailings	7.5	1.660	0.46	14	4	10	0.3	3.4	6	21	PAF-LC
20602	MUS20-07296	05-Mar-20	ULD	Tailings	7.4	3.410	0.51	16	5	11	0.3	3.4	7	22	PAF-LC
20603	MUS20-07457	16-Mar-20	WK6	Tailings	7.7	2.620	0.26	8	6	2	0.8	3.7	5	24	NAF
20604	MUS20-07481	26-Mar-20	BFAE/MPG	Tailings	7.4	1.920	0.35	11	5	6	0.5	3.0	14	32	PAF-LC
20605	MUS20-07533	06-Apr-20	R8/9	Tailings	7.9	3.550	0.39	12	7	5	0.6	4.0	3	17	NAF
20606	MUS20-07558	15-Apr-20	Bays / Lar	Tailings	7.5	1.510	0.46	14	4	10	0.3	2.3	90	138	PAF
20607	MUS20-07587	22-Apr-20	R3/4	Tailings	8.0	2.110	0.36	11	7	4	0.6	4.8	0	4	NAF
20608	MUS20-07616	29-Apr-20	Bays / Lar	Tailings	7.6	2.810	0.35	11	6	5	0.6	3.0	28	62	NAF
20610	MUS20-07696	12-May-20	Bays / Lar	Tailings	8.1	1.850	0.38	12	12	-0.4	1.0	6.9	0	0	NAF
20611	MUS20-07872	10-Jun-20	AFAC	Tailings	7.6	1.260	0.39	12	14	-2	1.2	3.0	22	46	NAF
20612	MUS20-07896	15-Jun-20	AFAC	Tailings	8.3	0.446	0.35	11	24	-13	2.2	6.1	0	2	NAF
20613	MUS20-07929	26-Jun-20	P8-10/BAR	Tailings	8.2	2.470	0.48	15	8	7	0.5	3.5	7	24	NAF
20614	MUS20-08080	27-Jul-20	BR3C / BR40 / UAA	Tailings	8.4	1.680	0.42	13	8	5	0.6	3.6	7	26	NAF
20615	MUS20-08156	03-Aug-20	BFAE	Tailings	8.1	2.720	0.49	15	5	10	0.3	4.1	2	10	PAF-LC
20616	MUS20-08253	24-Aug-20	BSAE / UA2 / UA3C	Tailings	8.6	2.310	0.41	13	5	8	0.4	3.3	10	30	NAF
20617	MUS20-08496	14-Oct-20	BY1A / BY2C / BF4	Tailings	8.7	2.020	0.42	13	16	-3	1.2	7.2	0	0	NAF
20618	MUS20-08515	20-Oct-20	BR5A / BR5C / UAA	Tailings	8.5	1.790	0.39	12	7	5	0.6	4.0	4	20	NAF
20619	MUS20-08554	27-Oct-20	BFAE / BAR	Tailings	8.7	2.710	0.72	22	7	15	0.3	4.0	2	12	PAF
20620	MUS20-08602	04-Nov-20	BY1A / BY2C / LAR	Tailings	8.6	4.270	0.40	12	20	-8	1.6	7.3	0	0	NAF
20621	MUS20-08633	11-Nov-20	BFAE / BAR	Tailings	8.5	3.290	0.48	15	10	5	0.7	4.6	0	13	NAF

KEY

$pH_{1:2}$ = pH of 1:2 extract
$EC_{1:2}$ = Electrical Conductivity of 1:2 extract (dS/m)
MPA = Maximum Potential Acidity (kgH_2SO_4/t)
ANC = Acid Neutralising Capacity (kgH_2SO_4/t)
NAPP = Net Acid Producing Potential (kgH_2SO_4/t)

NAGpH = pH of NAG liquor
$NAG_{(pH4.5)}$ = Net Acid Generation capacity to pH 4.5 (kgH_2SO_4/t)
$NAG_{(pH7.0)}$ = Net Acid Generation capacity to pH 7.0 (kgH_2SO_4/t)

Red Text = Samples showing organic acid effects.

NAF = Non-Acid Forming
PAF = Potentially Acid Forming
PAF-LC = PAF - lower capacity
UC = Uncertain Classification
(expected classification in brackets)

Table B11: Site total S screening results for rejects, fine rejects and tailings.

Date Sampled	Seam	Seam Group	Rejects [1]	Fine Reject[2]	Coarse Reject (Calculated[3])	Tailings[4]	Rejects[1]						Fine Rejects[2]						Tailings[4]					
			Average[5]	Average[5]	Average[5]	Average[5]	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
			Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S	Total %S
29-Nov-19	LAR - UPG	Arties - Pikes Gully	**0.32**	0.63	0.26					0.61	0.16	0.18				0.54	0.70	0.64						
6-Dec-19	R 8-9	Broonie	**0.09**	0.39	0.03		0.13	0.11	0.12	0.06	0.05	0.06	0.38	0.51		0.35	0.30	0.42						
12-Dec-19	R1	Broonie	**0.14**	0.26	0.12		0.21	0.39	0.04		0.02	0.03	0.20	0.27			0.32	0.25						
18-Dec-19	P12	Piercefield	**0.05**	0.05	0.05				0.04		0.05	0.05					0.05	0.05						
17-Jan-20	ULD	Liddell	**1.58**	3.29	1.28	**0.92**		1.71	1.45	1.59	1.57			2.60		4.28	2.99		0.77	0.93	0.88	0.99	0.93	0.99
23-Jan-20	M35	Mt Arthur	**0.30**	0.71	0.23	**0.37**	0.18		0.09	0.11	0.97	0.14	2.34			0.18	0.16	0.15	0.51	0.50	0.31	0.29	0.30	0.30
29-Jan-20	ULD	Liddell	**0.82**	2.57	0.51	**0.45**	0.51	0.78	0.93	0.69	1.20	0.81	2.03	3.15	2.8	3.03	2.49	1.89	0.44	0.44	0.47	0.43	0.44	0.46
6-Feb-20	M67A	Mt Arthur	**0.26**	1.17	0.10	**0.45**	0.11		0.74	0.32	0.09	0.06	1.18			1.10	1.04	1.37	0.47		0.45	0.44	0.43	0.46
11-Feb-20	LAR	Arties	**0.61**	0.87	0.57	**0.34**	0.52		0.66			0.66	0.92	0.89	0.93			0.72	0.37	0.31	0.33			0.36
20-Feb-20	LPG	Pikes Gully	**0.09**	0.36	0.04		0.06	0.10	0.13	0.05			0.35	0.34	0.34	0.39								
26-Feb-20	BFAE	Bowfield	**0.35**	2.58	0		0.28	0.40	0.41	0.42		0.25	2.30	3.02		3.31		1.68						
5-Mar-20	ULD	Liddell	**0.46**	1.57	0.26				0.45			0.46			1.90	1.70		1.10						
13-Mar-20	UPG	Pikes Gully	**0.60**	0.97	0.53	**0.38**			0.46	0.46	0.87					0.97					0.38	0.37	0.38	
16-Mar-20	WK6	Warkworth	**0.09**			**0.32**	0.05	0.14	0.04	0.12	0.12	0.06							0.33	0.34	0.32	0.31	0.32	0.31
26-Mar-20	BFAE/MPG	Bowfield / Pikes Gully	**0.09**	2.54	0	**0.40**		0.08	0.06	0.03	0.05	0.24				2.64		2.44		0.39	0.41	0.39	0.41	0.39
6-Apr-20	R8/9	Broonie				**0.41**													0.41	0.36	0.44	0.39		0.47
15-Apr-20	Bays / Lar	Bayswater / Arties	**0.44**	1.65	0.23	**0.54**		0.44						1.57			1.73		0.55	0.58	0.53	0.56	0.48	
22-Apr-20	R3/4	Broonie	**0.06**	0.06	0.06	**0.37**	0.06	0.07	0.06	0.06	0.07	0.06	0.05	0.06	0.06	0.07	0.06	0.07	0.41	0.35	0.36	0.36	0.35	0.37
29-Apr-20	Bays / Lar	Bayswater / Arties	**0.51**	0.97	0.43	**0.32**	0.90	0.69		0.33	0.41	0.22	1.55	0.84		1.05	0.67	0.74	0.32	0.32	0.31	0.31	0.30	0.33
9-May-20	HBAY	Bayswater	**0.25**	0.57	0.20	**0.42**	0.12	0.36	0.21	0.46	0.12		0.65	0.55	0.48	0.64	0.55			0.38	0.39	0.42	0.42	0.48
12-May-20	Bays / Lar	Bayswater / Arties	**0.17**	0.26	0.15	**0.35**																		
10-Jun-20	AFAC	Arrowfield	**0.03**	0.15	0.01	**0.40**																		
15-Jun-20	ASDC	Arrowfield?	**0.04**	0.28	0	**0.41**																		
26-Jun-20	P8-10/BAR	Vaux / Barrett	**0.26**	0.56	0.21	**0.47**																		
30-Jun-20	BFAE/P4	Bowfield / Piercefield	**0.30**	1.15	0.15	**0.54**																		
8-Jul-20	R34 / UAA	Broonie / Arties	**0.05**	0.11	0.04	**0.31**																		
13-Jul-20	P 8/9/10	Vaux	**0.12**	0.39	0.07	**0.46**																		
27-Jul-20	BR3C / BR40 / UAA	Broonie / Arties	**0.33**	0.67	0.27	**0.42**																		
3-Aug-20	BFAE	Bowfield	**0.45**	2.40	0.11	**0.51**																		
11-Aug-20	LAR	Arties	**0.70**	0.37	0.76	**0.36**																		
17-Aug-20	BR3C / BR46	Broonie	**0.14**	1.54	0.00	**0.38**																		
24-Aug-20	BSAE / UA2 / UA3C	Bowfield?/Arties	**0.24**	0.71	0.16	**0.49**																		
2-Sep-20	BR5A / BR5C / UAA	Broonie / Arties	**0.23**	0.39	0.20	**0.84**																		
11-Sep-20	LAR / BY1A / BY3	Bayswater / Arties	**0.08**	0.51	0.00	**0.85**																		
16-Sep-20	BR3C / BRAC + UUA	Broonie / Arties	**0.28**	0.48	0.24	**0.44**																		
21-Sep-20	BAR	Barrett	**0.34**	1.62	0.11	**0.37**																		
22-Sep-20	BY1A / BY2C	Bayswater	**0.22**	0.05	0.25	**0.44**																		
14-Oct-20	BY1A / BY2C / BF4	Bayswater / Bowfield	**0.21**	1.56	0	**0.46**																		
20-Oct-20	BR5A / BR5C / UAA	Broonie / Arties	**0.47**	1.32	0.32	**0.40**																		
27-Oct-20	BFAE / BAR	Bowfield / Barrett	**0.96**	3.53	0.51	**0.75**																		
4-Nov-20	BY1A / BY2C / LAR	Bayswater / Arties	**0.06**	0.40	0.00	**0.42**																		
11-Nov-20	BFAE / BAR	Bowfield / Barrett	**0.45**	2.87	0.02	**0.45**																		
18-Nov-20	BFAE, BR1A, BR1C	Bowfield / Broonie	**0.16**	0.63	0.08	0.42																		

Notes

1 Rejects, sampled from the outflow of the rejects D&R screen, comprising both coarse rejects and fine rejects combined and representing the washery waste stream which reports to the overburden dumps;

2 Fine Rejects, collected from the inlet stream to the rejects D&R screen prior to dewatering, representing the fine fraction (0.125mm to 1.4mm) of the (combined) rejects;

3 Coarse Reject calculated on the basis that Rejects nominally comprise 85% Coarse Reject to 15% Fine Reject

4 Tailings, collected from the desliming cyclone overflow, comprising the ultra fine rejects and representing the washery waste stream which reports to the TSFs

5 Where multiple modules were individually sampled the results have been averaged, otherwise multiple modules were composited prior to testing.

Table B12: Extended boil and calculated NAG test results for selected rejects and tailings samples.

EGi Sample ID	Date Sampled	Seam	Description	ACID-BASE ANALYSIS					STANDARD NAG TEST			Extended Boil NAGpH	Calculated NAG
				Total %S	MPA	ANC	NAPP	ANC/MPA	NAGpH	$NAG_{(pH4.5)}$	$NAG_{(pH7.0)}$		
20559	17-Jan-20	ULD	Rejects	1.59	49	16	33	0.3	3.1	9	20	3.7	22
20561	29-Jan-20	ULD	Rejects	0.98	30	13	17	0.4	3.6	2	14	4.6	14
20593	27-Oct-20	BFAE / BAR	Rejects	0.94	29	15	14	0.5	3.8	1	12	4.3	11
20597	23-Jan-20	M35	Tailings	0.34	10	7	3	0.7	4.2	2	19	4.8	-4
20598	29-Jan-20	ULD	Tailings	0.44	13	7	6	0.5	4.4	1	10	4.7	1
20600	11-Feb-20	LAR	Tailings	0.32	10	5	5	0.5	3.8	5	23	7.3	-3
20601	26-Feb-20	BFAE	Tailings	0.46	14	4	10	0.3	3.4	6	21	4.7	2
20602	05-Mar-20	ULD	Tailings	0.51	16	54	-38	3.5	3.4	7	22	4.8	4.7
20603	16-Mar-20	WK6	Tailings	0.26	8	6	2	0.8	3.7	5	24	7.2	-2
20604	26-Mar-20	BFAE/MPG	Tailings	0.35	11	5	6	0.5	3.0	14	32	5.7	1
20605	06-Apr-20	R8/9	Tailings	0.39	12	7	5	0.6	4.0	3	17	7.4	-3
20606	15-Apr-20	Bays / Lar	Tailings	0.46	14	4	10	0.3	2.3	90	138	4.8	5.2
20608	29-Apr-20	Bays / Lar	Tailings	0.35	11	6	5	0.6	3.0	28	62	7.4	-10
20611	10-Jun-20	AFAC	Tailings	0.39	12	14	-2	1.2	3.0	22	46	7.2	-5
20613	26-Jun-20	P8-10/BAR	Tailings	0.48	15	8	7	0.5	3.5	7	24	7.3	-2
20614	27-Jul-20	BR3C / BR40 / UAA	Tailings	0.42	13	8	5	0.6	3.6	7	26	7.4	-3
20615	03-Aug-20	BFAE	Tailings	0.49	15	5	10	0.3	4.1	2	10	4.6	3
20616	24-Aug-20	BSAE / UA2 / UA3C	Tailings	0.41	13	5	8	0.4	3.3	10	30	7.3	-2
20618	20-Oct-20	BR5A / BR5C / UAA	Tailings	0.39	12	7	5	0.6	4.0	4	20	7.4	-3
20619	27-Oct-20	BFAE / BAR	Tailings	0.72	22	7	15	0.3	4.0	2	12	4.7	5.3

KEY

MPA = Maximum Potential Acidity (kgH_2SO_4/t)

ANC = Acid Neutralising Capacity (kgH_2SO_4/t)

NAPP = Net Acid Producing Potential (kgH_2SO_4/t)

NAGpH = pH of NAG liquor

$NAG_{(pH4.5)}$ = Net Acid Generation capacity to pH 4.5 (kgH_2SO_4/t)

$NAG_{(pH7.0)}$ = Net Acid Generation capacity to pH 7.0 (kgH_2SO_4/t)

Extended Boil NAGpH = pH of NAG liquor after extended heating

Calculated NAG = The net acid potential based on assay of anions and cations released to the NAG solution (kgH_2SO_4/t)

Table B13: Sulphur speciation results for selected rejects and tailings samples.

EGi Sample Number	Sampling Date	Seam	Description	Total %S	Pyritic S (%)	Acid Sulphate %S	Total Acid Generating S (%)	Non-Acid Sulphate %S	Other S Forms (%)	Proportion Total Acid Generating to Total S
20559	17-Jan-20	ULD	Rejects	1.52	1.16	0.00	1.16	0.04	0.32	76%
20561	29-Jan-20	ULD	Rejects	0.99	0.76	0.00	0.76	0.03	0.20	77%
20562	06-Feb-20	M67A	Rejects	0.27	0.19	0.00	0.19	0.01	0.07	70%
20563	11-Feb-20	LAR	Rejects	0.96	0.73	0.00	0.73	0.07	0.16	76%
20565	26-Feb-20	BFAE	Rejects	0.45	0.35	0.00	0.35	0.02	0.08	78%
20567	13-Mar-20	UPG	Rejects	0.37	0.30	0.00	0.30	0.01	0.06	81%
20573	29-Apr-20	Bays / Lar	Rejects	0.51	0.38	0.00	0.38	0.02	0.11	75%
20583	03-Aug-20	BFAE	Rejects	0.57	0.47	0.00	0.47	0.04	0.06	82%
20584	11-Aug-20	LAR	Rejects	0.74	0.59	0.00	0.59	0.02	0.13	80%
20593	27-Oct-20	BFAE / BAR	Rejects	0.91	0.77	0.00	0.77	0.03	0.11	85%
20596	17-Jan-20	ULD	Tailings	0.89	0.42	0.00	0.42	0.07	0.40	47%
20599	06-Feb-20	M67A	Tailings	0.44	0.17	0.00	0.17	0.04	0.23	39%
20602	05-Mar-20	ULD	Tailings	0.50	0.19	0.00	0.19	0.10	0.21	38%
20603	16-Mar-20	WK6	Tailings	0.27	0.07	0.00	0.07	0.05	0.15	26%
20607	22-Apr-20	R3/4	Tailings	0.38	0.03	0.00	0.03	0.04	0.31	8%
20611	10-Jun-20	AFAC	Tailings	0.37	0.07	0.00	0.07	0.03	0.27	19%
20619	27-Oct-20	BFAE / BAR	Tailings	0.69	0.36	0.00	0.36	0.07	0.26	52%
20620	04-Nov-20	BY1A / BY2C / LAR	Tailings	0.39	0.06	0.00	0.06	0.11	0.22	15%
20621	11-Nov-20	BFAE / BAR	Tailings	0.46	0.18	0.00	0.18	0.08	0.20	39%

Pyritic S (%) = CRS (%)

Acid Sulphate S = KCl Acid Sulphate S

Total Acid Generating S = Pyritic S + Acid Sulphate S

Non-Acid Sulphate S = KCl S – KCl Acid Sulphate S

Other S Forms = Total S - (CRS + KCl S)

Table B14: Multi-element composition of selected rejects and tailings solids samples (mg/kg except where shown).

Element	Detection Limit	Sample Number / Sampling Date / Seams / Material Type												
		20559	20563	20573	20578	20592	20593	20596	20599	20604	20611	20613	20619	20620
		17-Jan-20	11-Feb-20	29-Apr-20	26-Jun-20	20-Oct-20	27-Oct-20	17-Jan-20	06-Feb-20	26-Mar-20	10-Jun-20	26-Jun-20	27-Oct-20	04-Nov-20
		ULD	LAR	Bays / Lar	P8-10/BAR	BR5A / BR5C / UAA	BFAE / BAR	ULD	M67A	BFAE/MPG	AFAC	P8-10/BAR	BFAE / BAR	BY1A / BY2C / LAR
		Rejects	Rejects	Rejects	Rejects	Rejects	Rejects	Tailings	Tailings	Tailings	Tailings	Tailings	Tailings	Tailings
Ag	0.01	0.17	0.22	0.19	0.12	0.16	0.12	0.07	0.35	0.17	0.16	0.1	0.07	0.09
Al	0.01%	8.04%	8.31%	9.28%	7.49%	9.08%	10.56%	5.53%	5.27%	6.97%	4.26%	6.45%	6.29%	6.83%
As	0.2	65.8	54.9	32	21.1	31	6.2	10.8	3.5	3.3	3.8	10.7	4.3	6.7
B	10	<10	<10	<10	<10	<10	<10	18	29	<10	14	11	<10	<10
Ba	10	327.6	315.8	273.7	335.9	326.5	282.9	459.7	220.4	486	169.8	289.1	202.3	471.6
Be	0.05	1.23	1.53	1.43	1.27	1.42	1.88	1.48	1.57	2.33	1.81	1.66	1.95	1.58
Bi	0.01	0.52	0.46	0.47	0.4	0.55	0.38	1.21	0.73	0.59	0.41	0.53	0.58	0.44
Ca	0.01%	0.39%	0.45%	0.59%	0.58%	0.25%	0.37%	0.43%	0.36%	0.16%	0.20%	0.24%	0.12%	0.56%
Cd	0.02	0.23	0.2	0.19	0.14	0.22	0.2	0.16	0.09	0.16	0.12	0.13	0.1	0.19
Ce	0.01	53.65	59.01	69.6	50.71	63.87	57.99	39.8	38.56	48.39	35.65	44.17	46.17	54.23
Co	0.1	9.6	12.9	8.6	10	16	5.6	7.8	7.5	6.7	10.1	9.7	10.6	7
Cr	1	65	66	115	94	31	30	22	18	21	19	28	33	34
Cs	0.05	9.15	5.71	5.09	7.95	11.14	8.4	6.76	6.76	9.26	4.61	8.31	9.37	8.08
Cu	0.2	69	60.4	43.4	34.2	46.7	36.1	29.3	23.1	27.1	19.8	29.2	27.6	28.1
Fe	0.01%	2.36%	3.03%	5.20%	4.64%	2.72%	2.66%	2.57%	1.22%	1.11%	0.64%	1.25%	1.43%	1.44%
Ga	0.05	19.27	23.79	25.39	18.67	23.31	23.11	13.18	13.37	18.32	11.97	16.85	15.48	17.4
Ge	0.05	0.9	1.5	1.7	0.8	0.9	0.9	2.3	1.7	4.4	2.9	2.8	4.6	2.7
Hf	0.01	3.06	4.68	4.99	3.11	3.93	4.69	2.03	2.63	3.07	2.11	2.7	2.79	3.35
Hg	0.005	0.46	0.288	0.129	0.073	0.19	0.063	0.104	0.041	0.05	0.022	0.056	0.034	0.039
In	0.005	0.08	0.1	0.1	0.08	0.09	0.1	0.07	0.05	0.07	0.03	0.05	0.06	0.06
K	0.01%	1.64%	1.14%	1.02%	1.67%	1.54%	1.64%	1.14%	0.99%	1.82%	0.77%	1.47%	1.43%	1.34%
La	0.5	25.52	29.81	35.1	24.79	30.93	26.95	19.48	18.58	24.12	17.48	21.92	22.01	25.81
Li	0.2	32.7	49.1	50.8	24.3	35.4	31.8	18.7	22.2	21.7	24	21.3	20	39.4
Mg	0.01%	0.50%	0.55%	0.55%	0.58%	0.55%	0.37%	0.42%	0.33%	0.35%	0.20%	0.32%	0.29%	0.42%
Mn	5	125	344	1066	779	239	292	162	115	77	53	80	89	153
Mo	0.05	5.3	5.1	5.5	3.4	3	1.6	1.7	1.8	1.3	1.9	1.9	2	3.1
Na	0.01%	0.29%	0.23%	0.15%	0.29%	0.19%	0.14%	0.30%	0.17%	0.50%	0.16%	0.28%	0.35%	0.46%
Nb	0.1	5.76	10.32	13.52	6.36	8.1	11.56	4.13	5.43	6.29	3.91	5.23	4.93	6.39
Ni	0.2	43.9	36.9	58.4	53.6	21.7	9.7	11.8	13.1	14.9	14.7	13.6	15.7	12.6
P	10	407	498	420	355	386	449	583	274	238	241	468	302	693
Pb	0.5	17	22	23.9	15.6	21.9	19.6	12.7	12.7	16.4	13.7	14.8	11.4	15.8
Rb	0.1	97.81	62.34	56.62	93.53	103.63	94.82	70.07	64.14	105.24	47.09	88.81	90.01	82.62
Re	0.002	0.003	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.002	<0.003	<0.003
S	0.01%	1.47%	0.91%	0.51%	0.27%	0.44%	0.97%	0.86%	0.43%	0.36%	0.34%	0.43%	0.69%	0.38%
Sb	0.05	1.24	1.01	0.62	0.64	0.78	0.65	1.04	0.84	1.63	1.23	1.22	1.38	0.88
Sc	0.1	12.8	10.8	11.3	12.5	15.1	15.4	10.9	9.4	11.5	7.9	10.6	10.6	10.4
Se	1	4	3	3	2	2	1	2	2	<1	1	2	3	2
Sn	0.2	2.7	3.6	4.3	2.8	3.3	4	4.6	2.9	3.1	2.3	2.4	3	2.9
Sr	0.2	303.92	316.42	250.61	188.77	276.87	334.32	344.5	240.86	154.29	193.13	285.6	290.51	376.19
Ta	0.05	0.54	1.04	1.23	0.61	0.75	1.08	0.34	0.41	0.52	0.27	0.44	0.41	0.53
Te	0.05	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Th	0.2	11.38	11.13	12.78	10.67	13.47	11.4	7.61	8.32	9.61	5.26	8.63	8.12	9.55
Ti	0.005%	0.41%	0.50%	0.54%	0.39%	0.43%	0.55%	0.24%	0.21%	0.32%	0.18%	0.29%	0.27%	0.29%
Tl	0.02	3.1	2.67	1.23	0.75	1.55	0.75	0.99	0.46	0.57	0.37	0.91	0.58	0.47
U	0.1	4.05	3.23	3.94	2.78	3.13	3.02	2.52	2.05	2.25	1.33	2.64	1.98	2.16
V	1	102	78	74	103	102	84	80	64	95	69	99	85	81
W	0.1	6.5	7.6	6	6.5	2.4	4	3	1.9	1.6	1.5	1.5	1.4	1.3
Y	0.1	17.84	21.21	26.55	19.19	20.73	23.22	16.32	16.82	16.91	13.38	17.39	17.15	17.96
Zn	2	98	84	71	77	83	56	63	41	56	38	46	46	44
Zr	0.5	94.4	146.5	159.2	95.3	120.9	145	69.2	91	112.1	84.5	93.1	99.9	120.4

< element at or below analytical detection limit.

Table B15: Geochemical abundance indices (GAI) of selected rejects and tailings solids samples. Values 3 and over are highlighted in yellow .

Element	Median Soil Abundance *	Sample Number / Sampling Date / Seams / Material Type												
		20559	20563	20573	20578	20592	20593	20596	20599	20604	20611	20613	20619	20620
		17-Jan-20	11-Feb-20	29-Apr-20	26-Jun-20	20-Oct-20	27-Oct-20	17-Jan-20	06-Feb-20	26-Mar-20	10-Jun-20	26-Jun-20	27-Oct-20	04-Nov-20
		ULD	LAR	Bays / Lar	P8-10/BAR	BR5A / BR5C / UAA	BFAE / BAR	ULD	M67A	BFAE/MPG	AFAC	P8-10/BAR	BFAE / BAR	BY1A / BY2C / LAR
		Rejects	Rejects	Rejects	Rejects	Rejects	Rejects	Tailings	Tailings	Tailings	Tailings	Tailings	Tailings	Tailings
Ag	0.05	1	2	1	1	1	1	-	2	1	1	-	-	-
Al	7.1%	-	-	-	-	-	-	-	-	-	-	-	-	-
As	6	3	3	2	1	2	-	-	-	-	-	-	-	-
B	20	-	-	-	-	-	-	-	-	-	-	-	-	-
Ba	500	-	-	-	-	-	-	-	-	-	-	-	-	-
Be	0.3	1	2	2	1	2	2	2	2	2	2	2	2	2
Bi	0.2	1	1	1	-	1	-	2	1	1	-	1	1	1
Ca	1.5%	-	-	-	-	-	-	-	-	-	-	-	-	-
Cd	0.35	-	-	-	-	-	-	-	-	-	-	-	-	-
Ce	50	-	-	-	-	-	-	-	-	-	-	-	-	-
Co	8	-	-	-	-	-	-	-	-	-	-	-	-	-
Cr	70	-	-	-	-	-	-	-	-	-	-	-	-	-
Cs	4	1	-	-	-	1	-	-	-	1	-	-	1	-
Cu	30	1	-	-	-	-	-	-	-	-	-	-	-	-
Fe	4.0%	-	-	-	-	-	-	-	-	-	-	-	-	-
Ga	20	-	-	-	-	-	-	-	-	-	-	-	-	-
Ge	1	-	-	-	-	-	-	1	-	2	1	1	2	1
Hf	6	-	-	-	-	-	-	-	-	-	-	-	-	-
Hg	0.06	2	2	1	-	1	-	-	-	-	-	-	-	-
In	1	-	-	-	-	-	-	-	-	-	-	-	-	-
K	1.4%	-	-	-	-	-	-	-	-	-	-	-	-	-
La	40	-	-	-	-	-	-	-	-	-	-	-	-	-
Li	25	-	-	-	-	-	-	-	-	-	-	-	-	-
Mg	0.5%	-	-	-	-	-	-	-	-	-	-	-	-	-
Mn	1000	-	-	-	-	-	-	-	-	-	-	-	-	-
Mo	1.2	2	2	2	1	1	-	-	-	-	-	-	-	1
Na	0.5%	-	-	-	-	-	-	-	-	-	-	-	-	-
Nb	10	-	-	-	-	-	-	-	-	-	-	-	-	-
Ni	50	-	-	-	-	-	-	-	-	-	-	-	-	-
P	800	-	-	-	-	-	-	-	-	-	-	-	-	-
Pb	35	-	-	-	-	-	-	-	-	-	-	-	-	-
Rb	150	-	-	-	-	-	-	-	-	-	-	-	-	-
Re	0													
S	0.07%	4	3	2	1	2	3	3	2	2	2	2	3	2
Sb	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Sc	7	-	-	-	-	1	1	-	-	-	-	-	-	-
Se	0.4	3	2	2	2	2	1	2	2	1	1	2	2	2
Sn	4	-	-	-	-	-	-	-	-	-	-	-	-	-
Sr	250	-	-	-	-	-	-	-	-	-	-	-	-	-
Ta	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Te	0													
Th	9	-	-	-	-	-	-	-	-	-	-	-	-	-
Ti	0.50%	-	-	-	-	-	-	-	-	-	-	-	-	-
Tl	0.2	3	3	2	1	2	1	2	1	1	-	2	1	1
U	2	-	-	-	-	-	-	-	-	-	-	-	-	-
V	90	-	-	-	-	-	-	-	-	-	-	-	-	-
W	1.5	2	2	1	2	-	1	-	-	-	-	-	-	-
Y	40	-	-	-	-	-	-	-	-	-	-	-	-	-
Zn	90	-	-	-	-	-	-	-	-	-	-	-	-	-
Zr	400	-	-	-	-	-	-	-	-	-	-	-	-	-

*Bowen H.J.M.(1979) Environmental Chemistry of the Elements.

Table B16: Chemical composition of water extracts of selected rejects and tailings samples.

Parameter		Detection Limit	Sample ID / Sampling Date / Seams / Total S of Solids / Material Type / ARD Classification													BLANK
			20559	20563	20573	20578	20592	20593	20596	20599	20604	20611	20613	20619	20620	
			17-Jan-20	11-Feb-20	29-Apr-20	26-Jun-20	20-Oct-20	27-Oct-20	17-Jan-20	06-Feb-20	26-Mar-20	10-Jun-20	26-Jun-20	27-Oct-20	04-Nov-20	
			ULD	LAR	Bays / Lar	P8-10 /BAR	BR5A / BR5C / UAA	BFAE / BAR	ULD	M67A	BFAE /MPG	AFAC	P8-10 /BAR	BFAE / BAR	BY1A / BY2C / LAR	
			1.59%S	0.82%S	0.52%S	0.27%S	0.47%S	0.94%S	0.83%S	0.42%S	0.35%S	0.39%S	0.48%S	0.72%S	0.4%S	
			Rejects	Rejects	Rejects	Rejects	Rejects	Rejects	Tailings	Tailings	Tailings	Tailings	Tailings	Tailings	Tailings	
			PAF	UC(PAF)	NAF	NAF	NAF	PAF	UC(NAF)	NAF	PAF-LC	NAF	NAF	PAF	NAF	
pH		0.1	4.3	6.7	7.9	8.2	8.1	5.5	8.2	8.1	7.8	7.9	8.2	8.7	8.8	6.6
EC	dS/m	0.001	2.79	2.18	1.49	0.876	1.25	1.96	2.92	1.45	2.11	1.37	2.73	2.66	4.29	0.001
Acidity	mg/l	1	92	-	-	-	-	11	-	-	-	-	-	-	-	-
Alkalinity	mg/l	1	-	23	37	46	47	-	45	88	54	78	59	80	63	-
Ag	mg/l	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	<0.001
Al	mg/l	0.01	0.63	<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
As	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	0.001	0.001	0.003	0.001	<0.001
B	mg/l	0.05	0.16	0.05	0.05	<0.05	0.09	0.09	0.1	0.12	0.07	0.14	0.11	0.07	0.09	<0.05
Ba	mg/l	0.001	0.042	0.057	0.063	0.046	0.03	0.037	0.062	0.089	0.086	0.102	0.044	0.137	0.06	<0.001
Be	mg/l	0.001	0.014	<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
Ca	mg/l	1	215	140	58	19	43	71	60	33	38	14	69	12	25	<1
Cd	mg/l	0.0001	0.0103	0.0005	<0.0001	<0.0001	0.0011	0.0024	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Cl	mg/l	1	9	18	36	24	37	27	439	186	352	140	318	442	723	<1
Co	mg/l	0.001	0.551	0.038	0.004	0.003	0.064	0.061	0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Cr	mg/l	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	<0.001
Cu	mg/l	0.001	0.33	0.008	0.002	0.005	0.018	0.013	0.01	0.012	0.008	0.014	0.018	0.011	0.01	<0.001
F	mg/l	0.1	0.2	0.2	0.5	1.2	1	0.1	1.6	1.4	1.1	1.1	1.5	1.6	2.2	<0.1
Fe	mg/l	0.05	0.79	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Hg	mg/l	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	<0.0001	<0.0001
K	mg/l	1	16	18	16	11	14	20	18	13	16	8	15	12	15	<1
Mg	mg/l	1	260	140	71	18	50	103	46	25	40	8	49	14	21	<1
Mn	mg/l	0.001	5.52	0.549	0.363	0.049	0.71	1.32	0.023	0.007	0.004	0.006	0.004	<0.001	0.001	<0.001
Mo	mg/l	0.001	<0.001	<0.001	0.001	0.003	0.011	<0.001	0.057	0.019	0.019	0.018	0.032	0.092	0.072	<0.001
Na	mg/l	1	149	168	158	188	210	252	535	241	358	194	460	501	758	<1
Ni	mg/l	0.001	0.837	0.038	0.003	0.004	0.092	0.074	0.003	0.002	0.003	0.002	0.002	0.001	0.001	<0.001
P	mg/l	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pb	mg/l	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	<0.001
Sb	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.002	<0.001
Se	mg/l	0.01	0.06	0.06	0.03	0.05	0.06	0.01	0.04	0.02	0.02	0.01	0.03	0.03	0.03	<0.01
Si	mg/l	0.1	5.9	1.9	1.5	0.8	2.0	2.93	1.3	0.95	1.83	1.06	1.07	1.06	1.25	<0.05
Sn	mg/l	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	<0.001
SO4	mg/l	1	1810	1190	683	440	660	1110	971	394	566	240	935	588	931	<1
Sr	mg/l	0.001	3.65	2.95	0.923	0.346	0.829	1.06	1.51	0.466	1.23	0.192	0.696	0.307	0.682	<0.001
Th	mg/l	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	<0.001
Tl	mg/l	0.001	0.003	<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
U	mg/l	0.001	0.005	<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
Zn	mg/l	0.005	2.01	0.151	0.066	0.032	0.245	0.308	0.043	0.049	0.039	0.048	0.075	0.02	0.018	<0.005

< element at or below analytical detection limit.

Table B17: Chemical composition of peroxide extractions of selected rejects and tailings samples (not scaled).

Parameter		Detection Limit	Sample ID / Sampling Date / Seams / Total S of Solids / Material Type / ARD Classification						Blank 15% H2O2
			20559	20593	20596	20604	20613	20619	
			17-Jan-20	27-Oct-20	17-Jan-20	26-Mar-20	26-Jun-20	27-Oct-20	
			ULD	BFAE / BAR	ULD	BFAE/MPG	P8-10/BAR	BFAE / BAR	
			1.59%S	0.94%S	0.83%S	0.35%S	0.48%S	0.72%S	
			Rejects	Rejects	Tailings	Tailings	Tailings	Tailings	
			PAF	PAF	UC(NAF)	PAF-LC	NAF	PAF	
NAGpH		0.1	3.1	3.7	4.8	3.1	3.5	3.9	4.8
Ag	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Al	mg/l	0.01	1.88	1.61	1.72	2.82	4.37	4.93	0.01
As	mg/l	0.001	<0.001	<0.001	<0.001	0.012	0.015	<0.001	<0.001
B	mg/l	0.05	0.18	0.15	0.18	0.27	0.26	0.21	<0.05
Ba	mg/l	0.001	0.136	0.055	0.191	0.786	0.73	0.203	<0.001
Be	mg/l	0.001	0.005	0.004	0.003	0.007	0.004	0.004	<0.001
Ca	mg/l	1	49	37	35	14	24	13	<1
Cd	mg/l	0.0001	0.0019	0.0014	0.0011	0.0009	0.0009	0.0006	<0.0001
Cl	mg/l	1	2	2	12	4	2	18	5
Co	mg/l	0.001	0.068	0.032	0.032	0.022	0.033	0.05	<0.001
Cr	mg/l	0.001	0.019	0.013	0.023	0.018	0.025	0.019	0.004
Cu	mg/l	0.001	0.506	0.216	0.201	0.171	0.171	0.186	0.005
F	mg/l	0.1	0.2	0.2	0.2	0.3	0.4	0.2	0.1
Fe	mg/l	0.05	38.4	39.2	36.8	33.7	27.4	24.3	<0.05
Hg	mg/l	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
K	mg/l	1	5	6	3	4	4	4	<1
Mg	mg/l	1	28	20	22	10	13	12	<1
Mn	mg/l	0.001	0.811	1.46	0.616	0.329	0.363	0.381	<0.001
Mo	mg/l	0.001	<0.001	<0.001	<0.001	0.005	0.008	<0.001	<0.001
Na	mg/l	1	24	26	36	32	39	51	14
Ni	mg/l	0.001	0.119	0.048	0.055	0.184	0.064	0.066	0.002
P	mg/l	1	<1	<1	<1	2	1	<1	<1
Pb	mg/l	0.001	0.007	<0.001	<0.001	0.02	0.005	0.001	0.001
Sb	mg/l	0.001	<0.001	<0.001	<0.001	0.003	0.002	<0.001	<0.001
Se	mg/l	0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Si	mg/l	0.1	6.52	5.43	3.42	4.2	3.9	3.67	<0.05
Sn	mg/l	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.008
SO4	mg/l	1	469	306	223	84	89	176	<1
Sr	mg/l	0.001	0.624	0.193	0.323	0.198	0.157	0.146	<0.001
Th	mg/l	0.001	0.002	<0.001	<0.001	0.001	0.001	<0.001	<0.001
Tl	mg/l	0.001	0.006	0.002	0.003	<0.001	<0.001	<0.001	<0.001
U	mg/l	0.001	0.003	0.002	0.002	0.002	0.003	0.002	<0.001
Zn	mg/l	0.005	0.964	0.579	0.613	0.53	0.496	0.52	<0.005

< element at or below analytical detection limit.

APPENDIX C

Kinetic NAG and ABCC Plots

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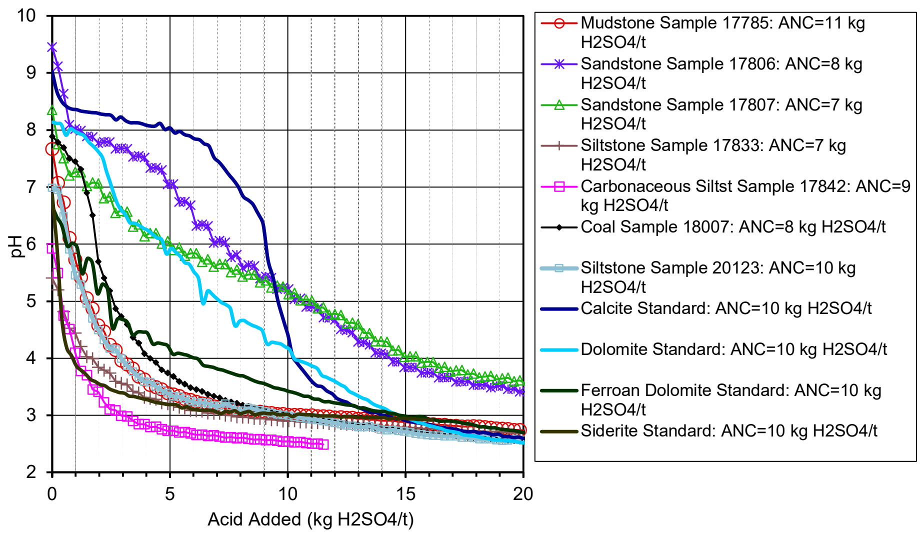


Figure C1: ABCC profile for samples with an ANC value close to 10 kg H_2SO_4/t. Carbonate standard curves are included for reference.

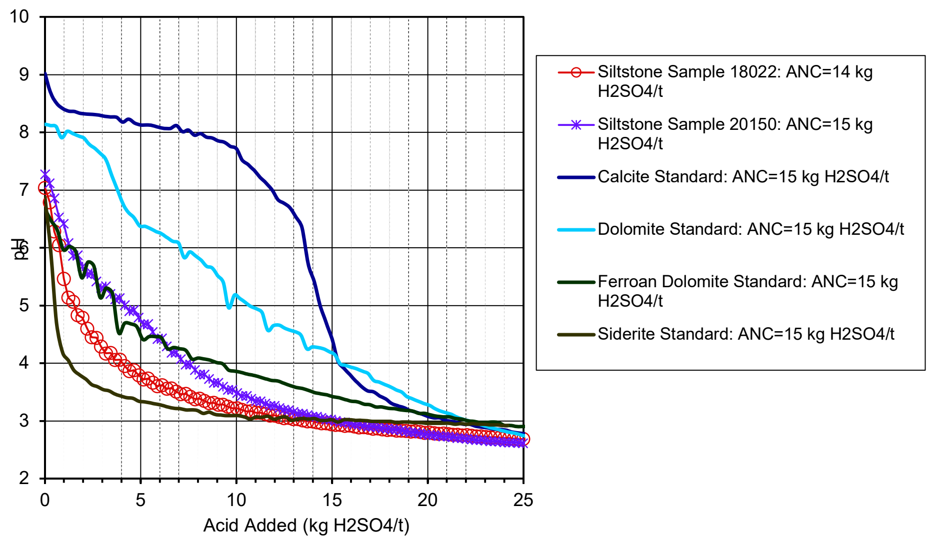


Figure C2: ABCC profile for samples with an ANC value close to 15 kg H_2SO_4/t. Carbonate standard curves are included for reference.

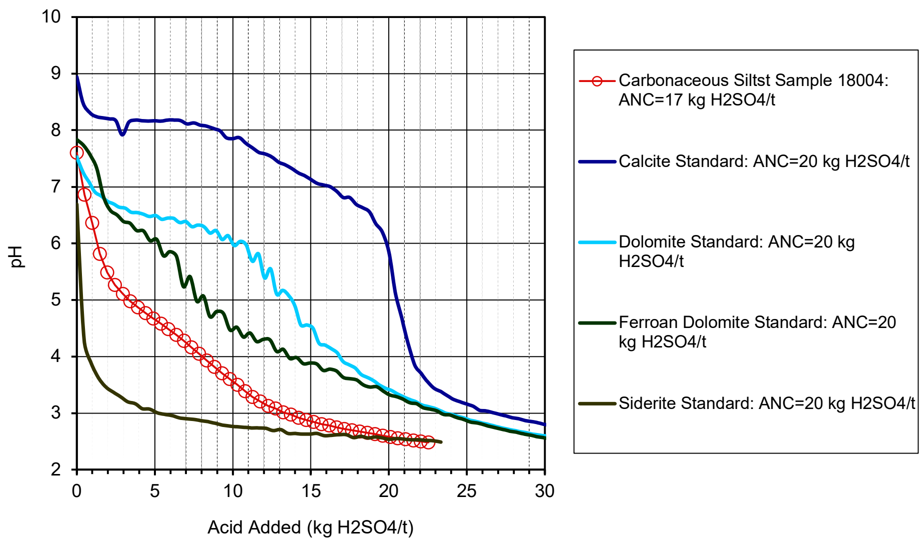


Figure C3: ABCC profile for sample 18004 with an ANC value close to 20 kg H_2SO_4/t. Carbonate standard curves are included for reference.

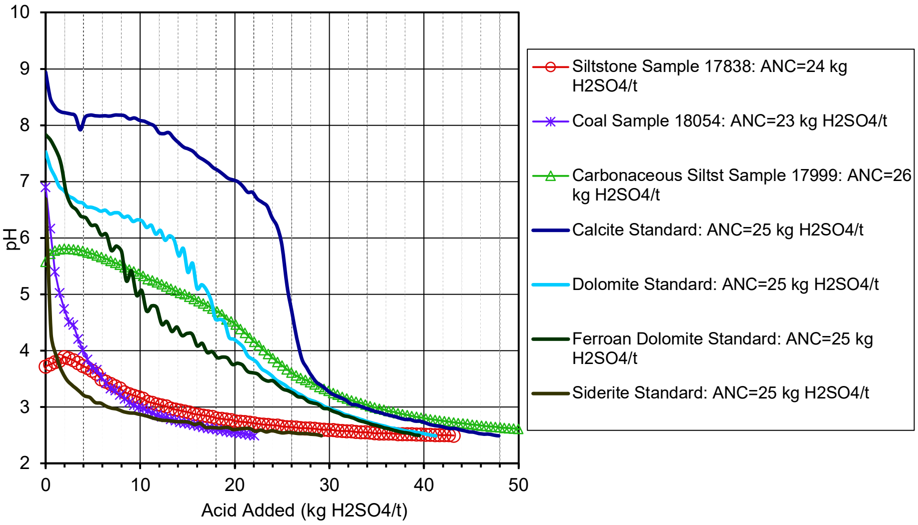


Figure C4: ABCC profile for samples with an ANC value close to 25 kg H_2SO_4/t. Carbonate standard curves are included for reference.

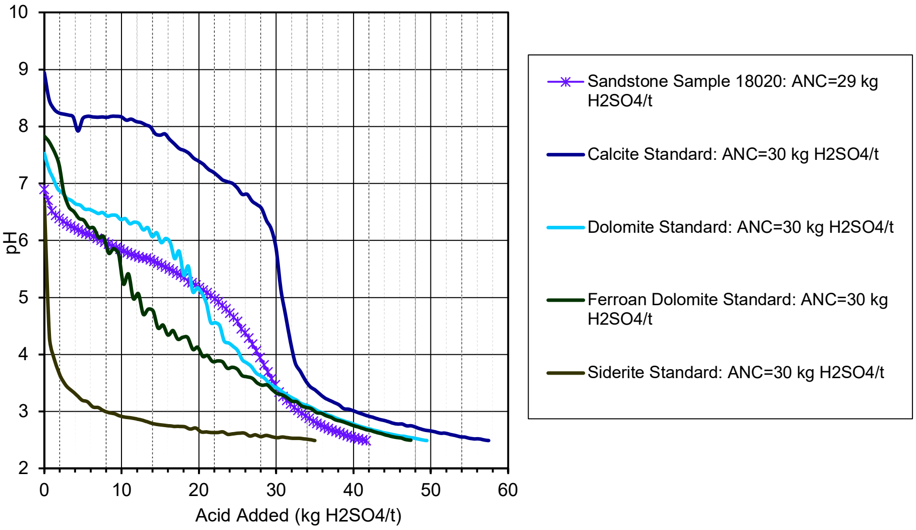


Figure C5: ABCC profile for samples with an ANC value close to 30 kg H_2SO_4/t. Carbonate standard curves are included for reference.

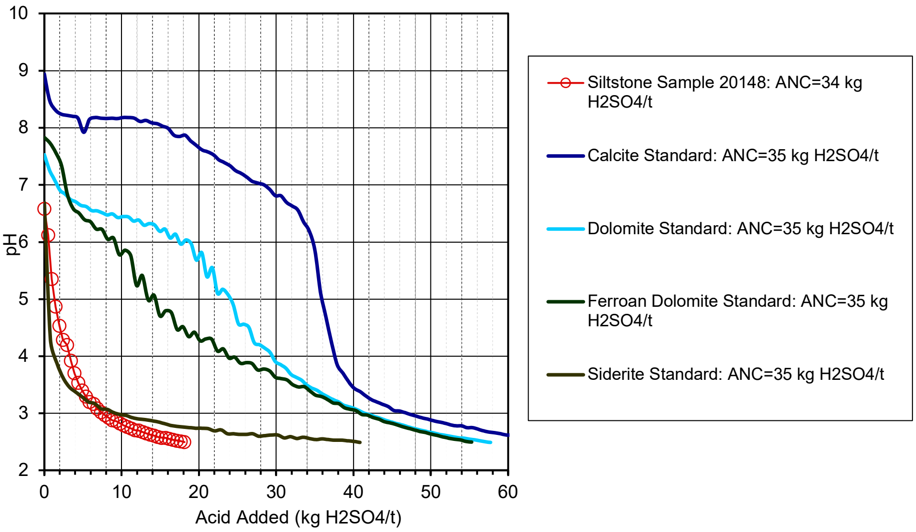


Figure C6: ABCC profile for sample 20148 with an ANC value close to 35 kg H_2SO_4/t. Carbonate standard curves are included for reference.

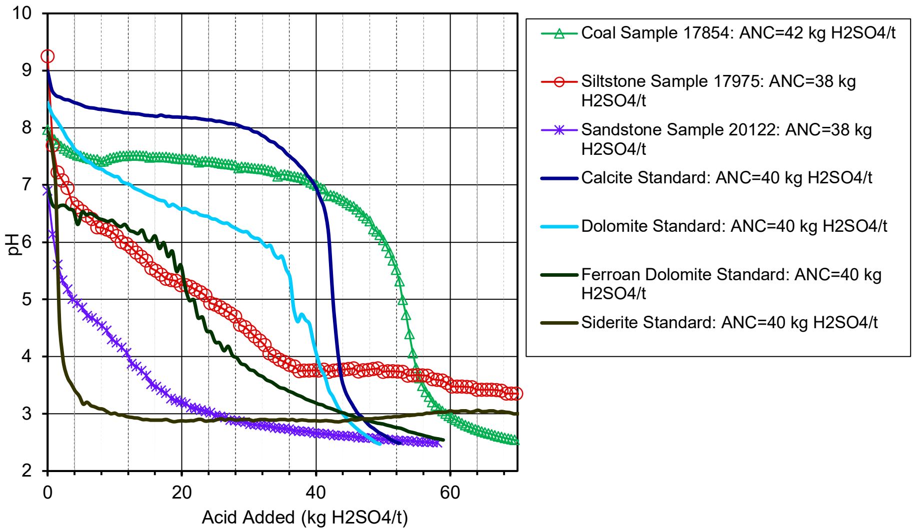


Figure C7: ABCC profile for samples with an ANC value close to 40 kg H_2SO_4/t. Carbonate standard curves are included for reference.

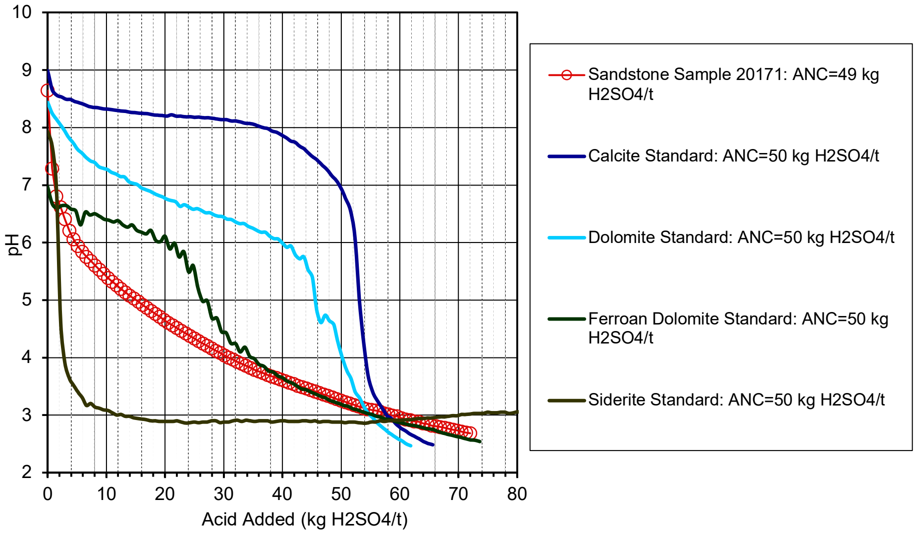


Figure C8: ABCC profile for sample 20171 with an ANC value close to 50 kg H_2SO_4/t. Carbonate standard curves are included for reference.

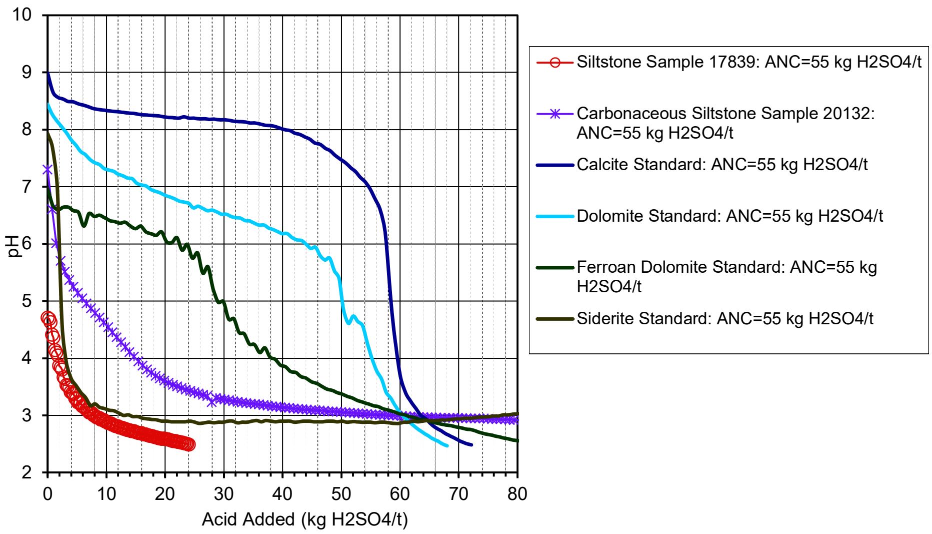


Figure C9: ABCC profile for samples with an ANC value of 55 kg H_2SO_4/t. Carbonate standard curves are included for reference.

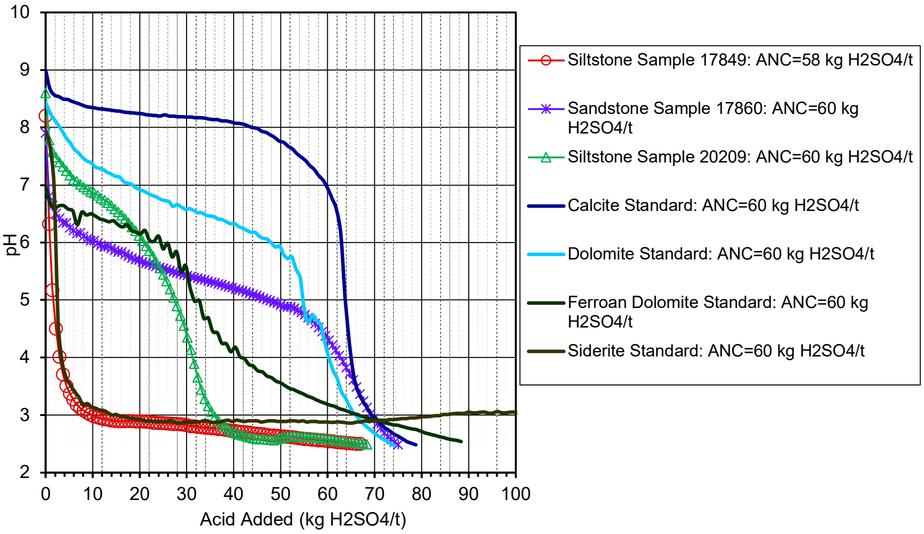


Figure C10: ABCC profile for samples with an ANC value close to 60 kg H_2SO_4/t. Carbonate standard curves are included for reference.

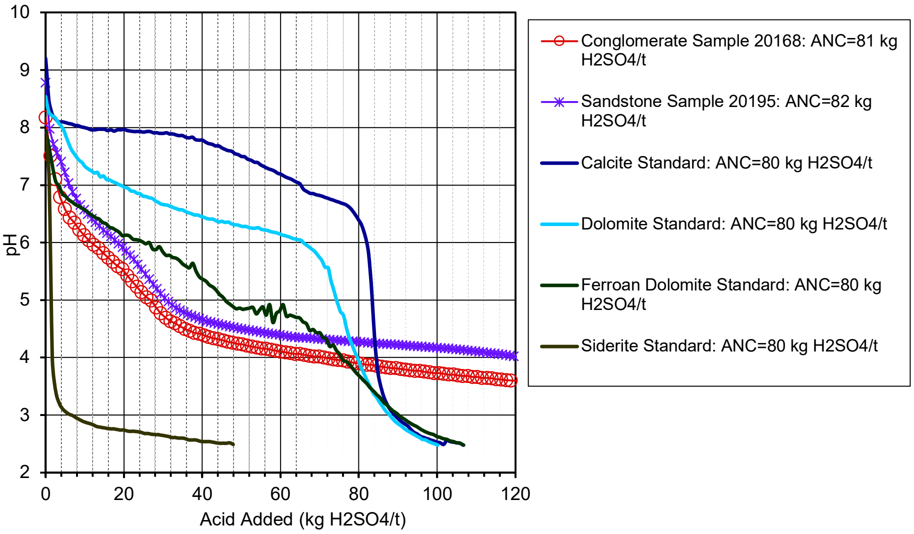


Figure C11: ABCC profile for samples with an ANC value close to 80 kg H_2SO_4/t. Carbonate standard curves are included for reference.

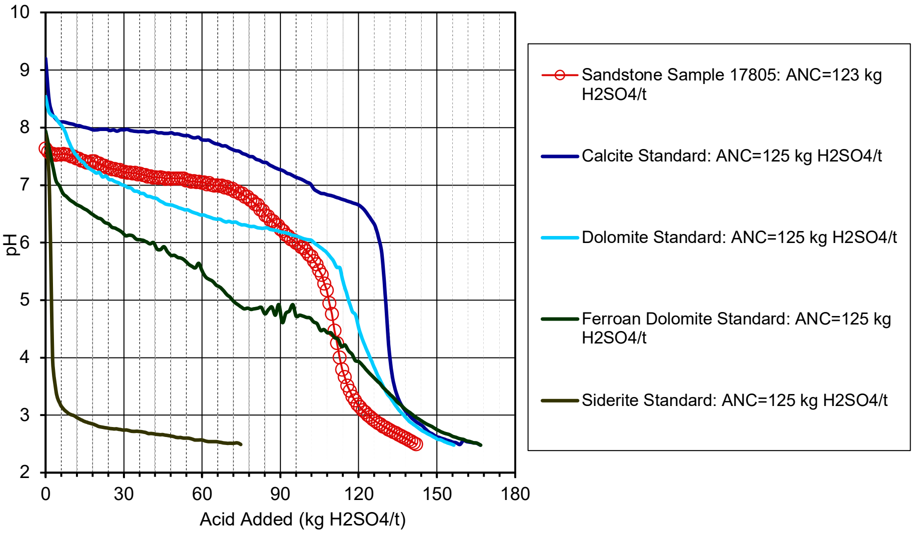


Figure C12: ABCC profile for sample17805 with an ANC value close to 125 kg H_2SO_4/t. Carbonate standard curves are included for reference.

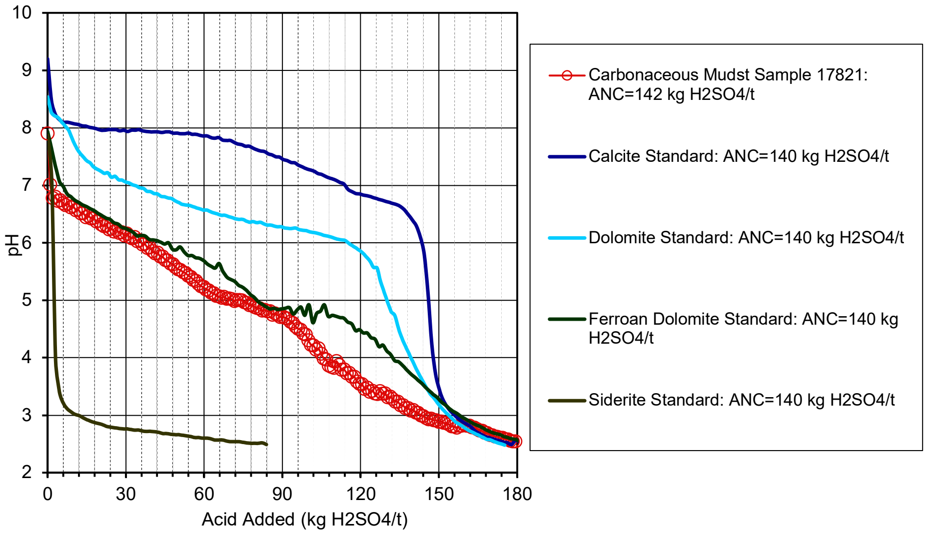


Figure C13: ABCC profile for sample 17821 with an ANC value close to 140 kg H_2SO_4/t. Carbonate standard curves are included for reference.

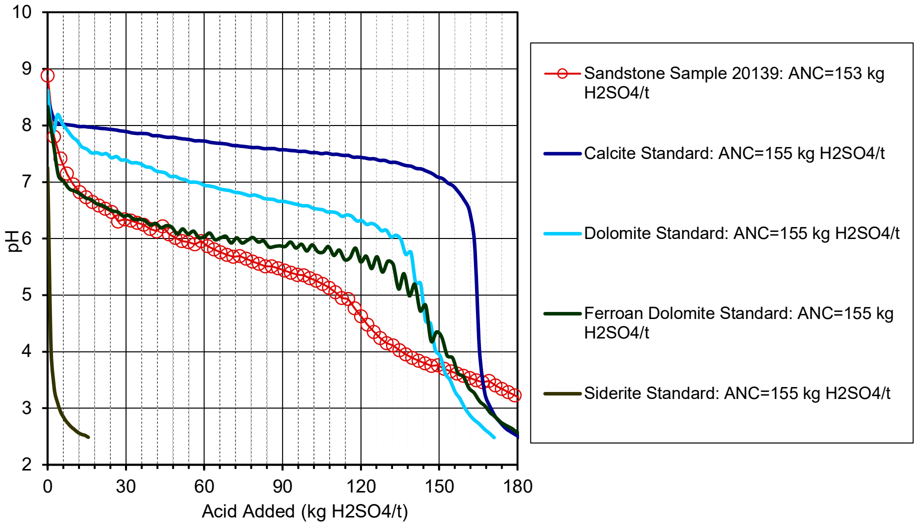


Figure C14: ABCC profile for sample 20139 with an ANC value close to 155 kg H_2SO_4/t. Carbonate standard curves are included for reference.

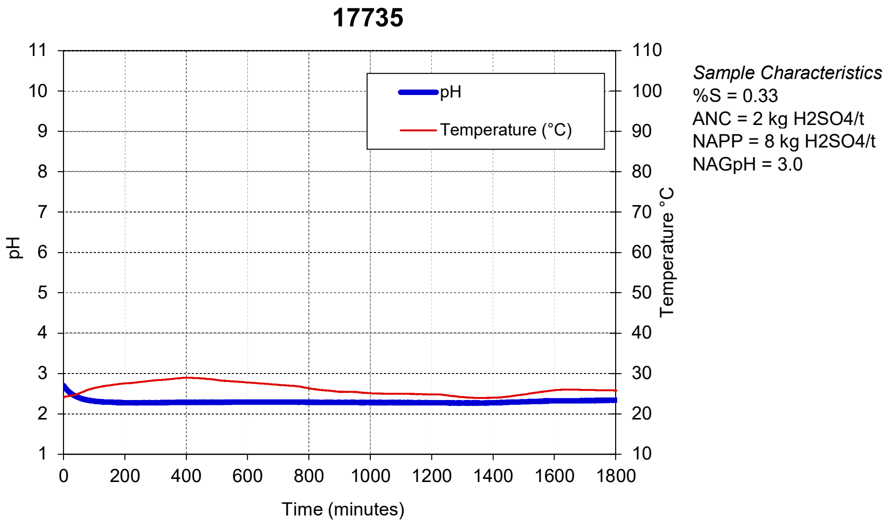


Figure C15: Kinetic NAG graph for Siltstone.

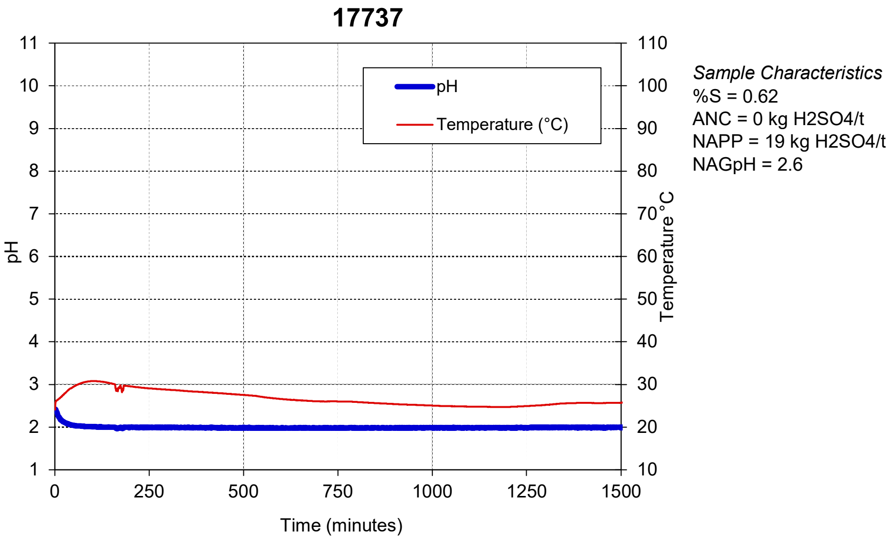


Figure C16: Kinetic NAG graph for Mudstone.

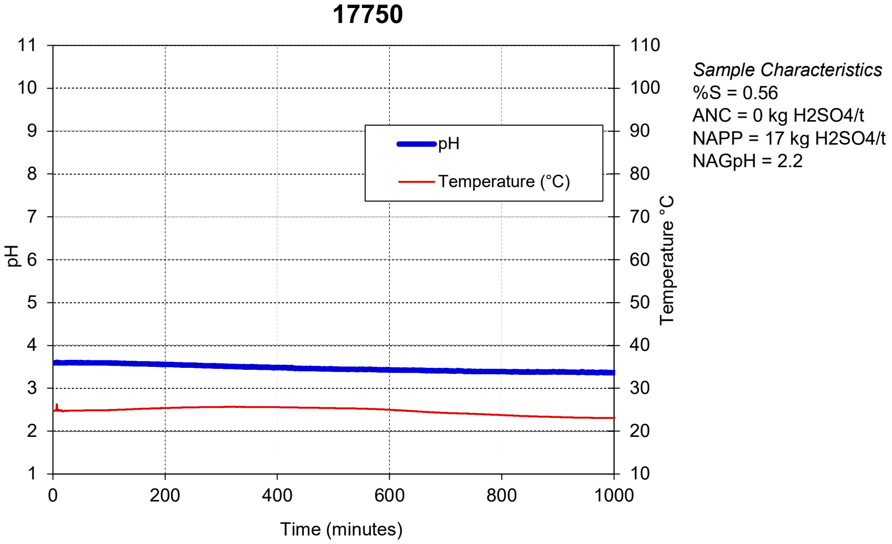
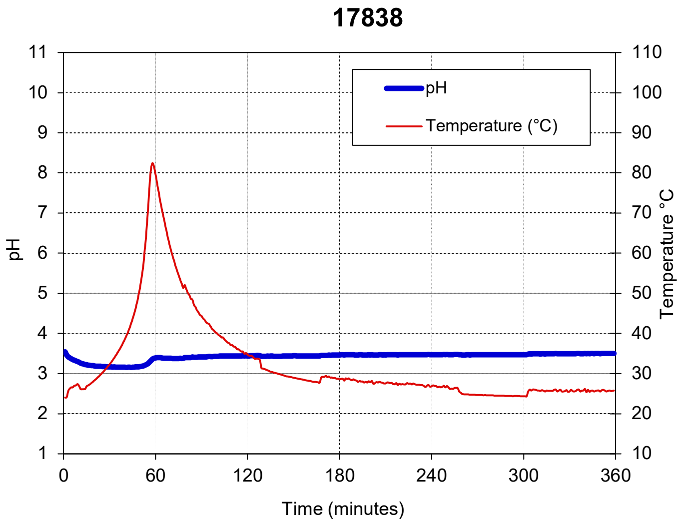
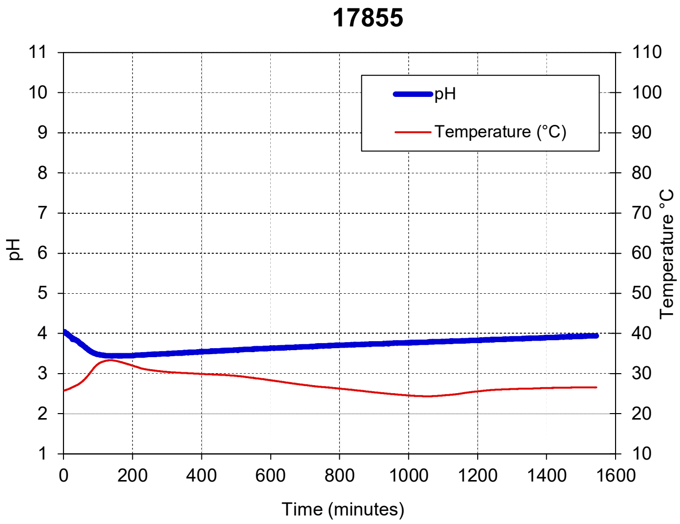


Figure C17: Kinetic NAG graph for Coal.



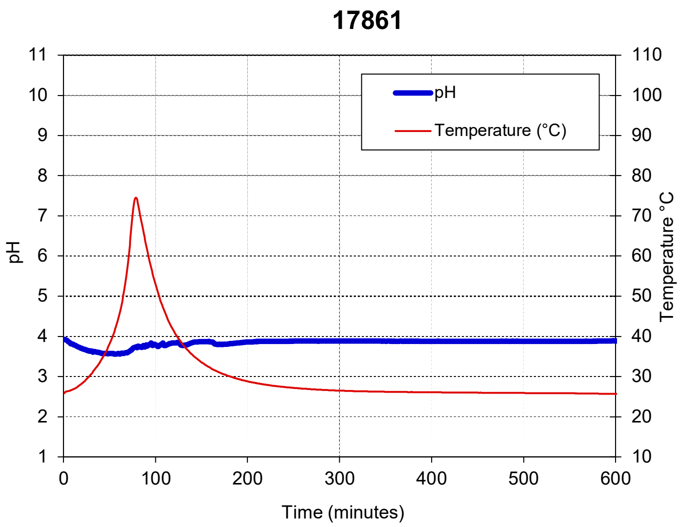
Sample Characteristics
%S = 1.38
ANC = 24 kg H2SO4/t
NAPP = 18 kg H2SO4/t
NAGpH = 3.1

Figure C18: Kinetic NAG graph for Siltstone.



Sample Characteristics
%S = 0.66
ANC = 1 kg H2SO4/t
NAPP = 19 kg H2SO4/t
NAGpH = 3.0

Figure C19: Kinetic NAG graph for Coal.



Sample Characteristics
%S = 0.77
ANC = 1 kg H2SO4/t
NAPP = 23 kg H2SO4/t
NAGpH = 2.8

Figure C20: Kinetic NAG graph for Siltstone.

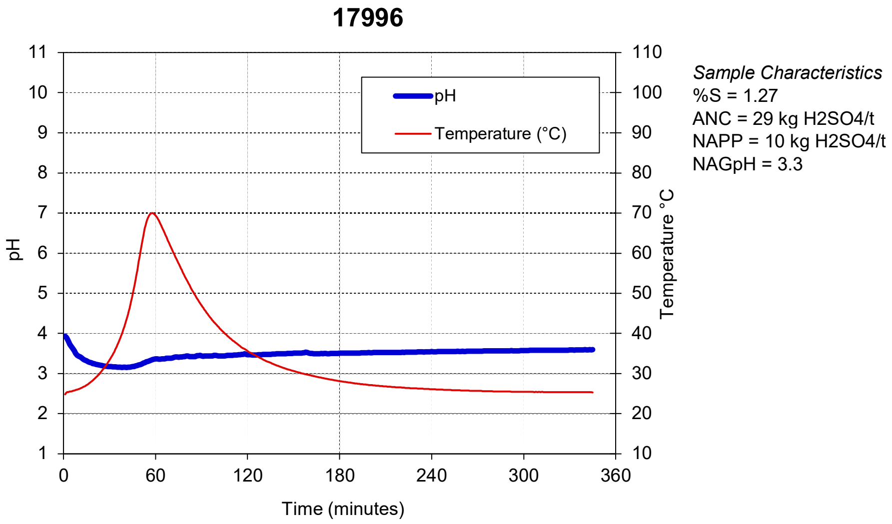


Figure C21: Kinetic NAG graph for Coal.

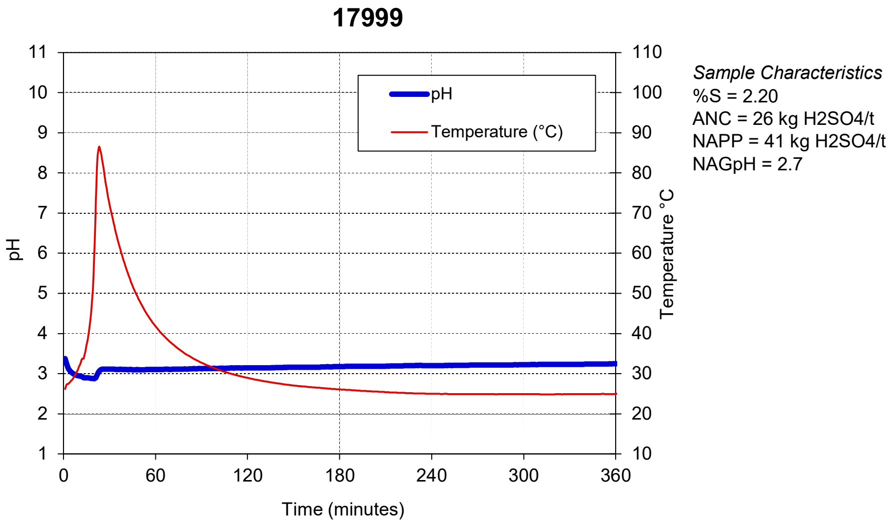


Figure C22: Kinetic NAG graph for Carbonaceous Siltstone.

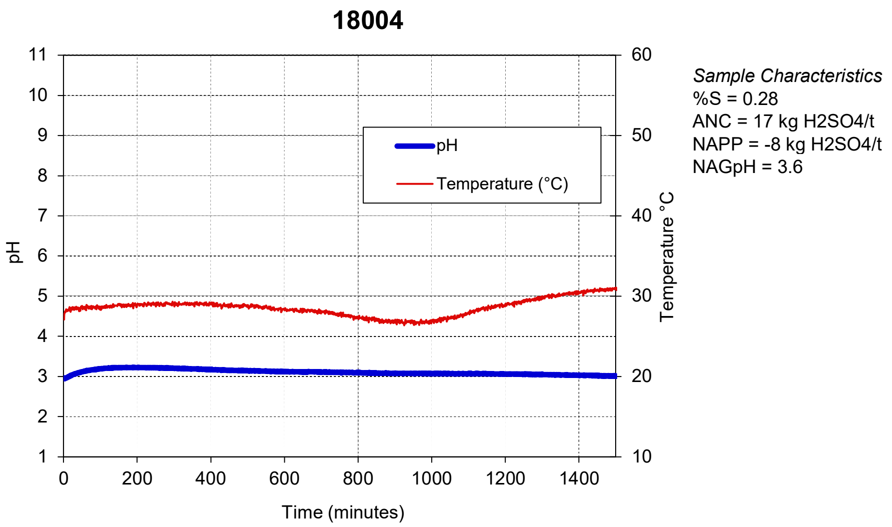


Figure C23: Kinetic NAG graph for Carbonaceous Siltstone.

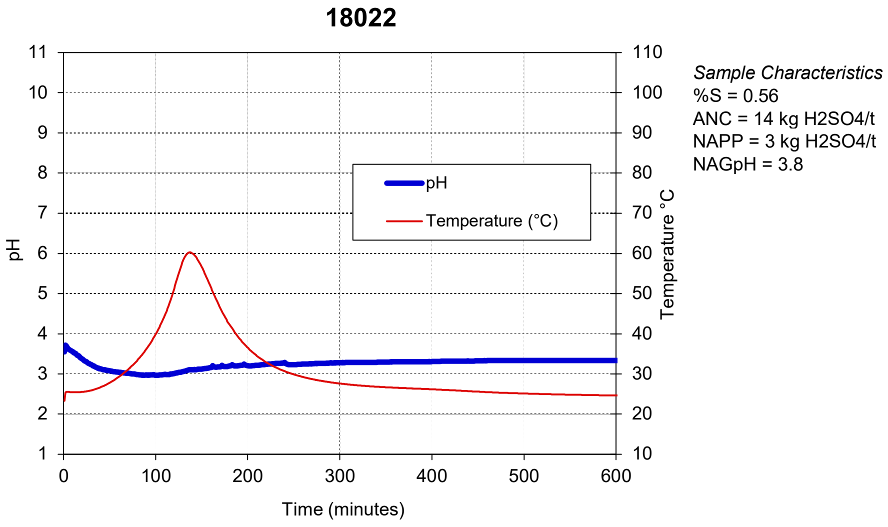


Figure C24: Kinetic NAG graph for Siltstone.

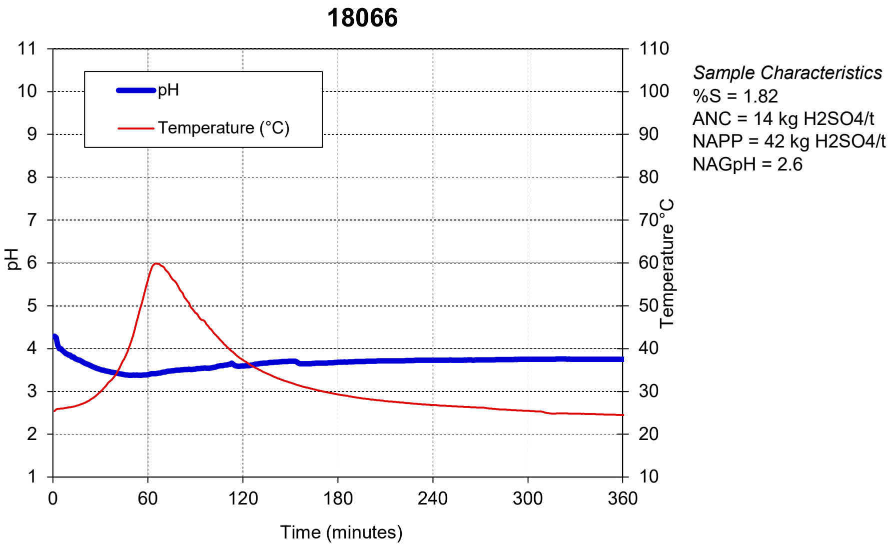


Figure C25: Kinetic NAG graph for Sandstone.

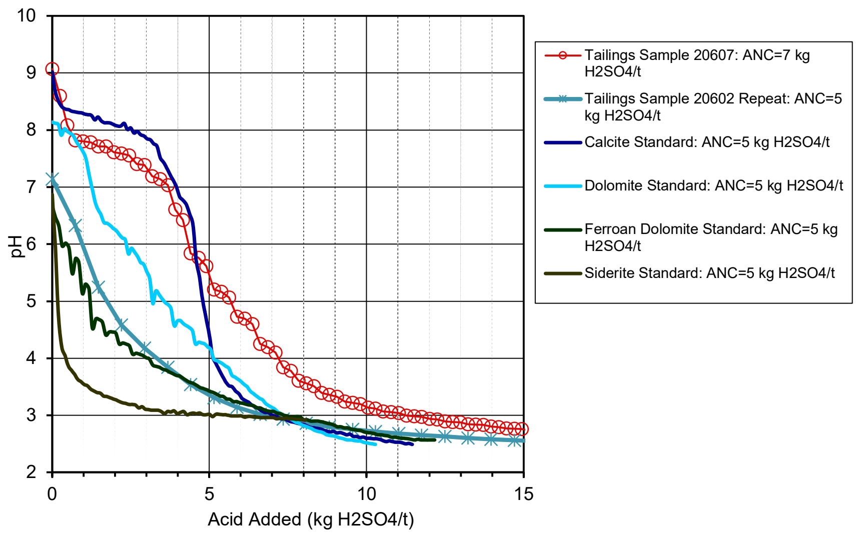


Figure C26: ABCC profile for sample 20607 with an ANC value close to 5 kg H_2SO_4/t. Carbonate standard curves are included for reference.

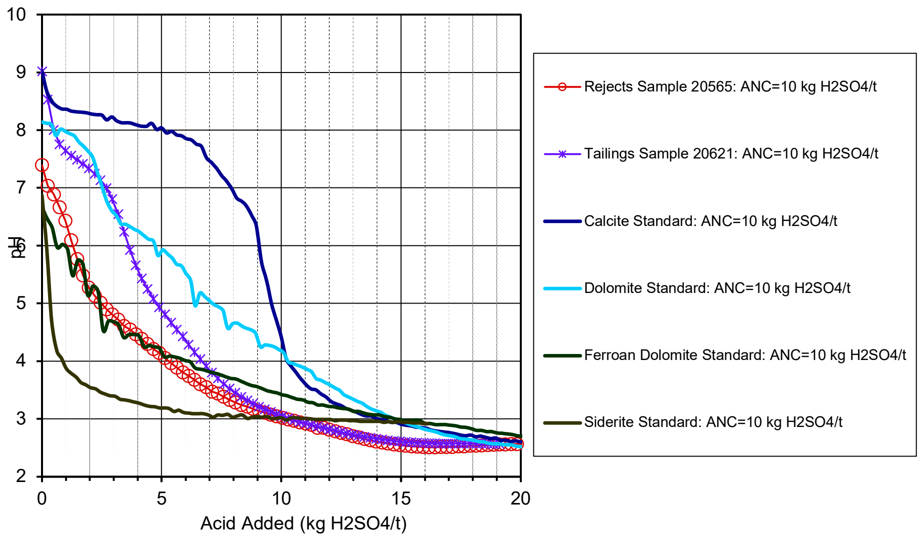


Figure C27: ABCC profile for samples with an ANC value of 10 kg H_2SO_4/t. Carbonate standard curves are included for reference.

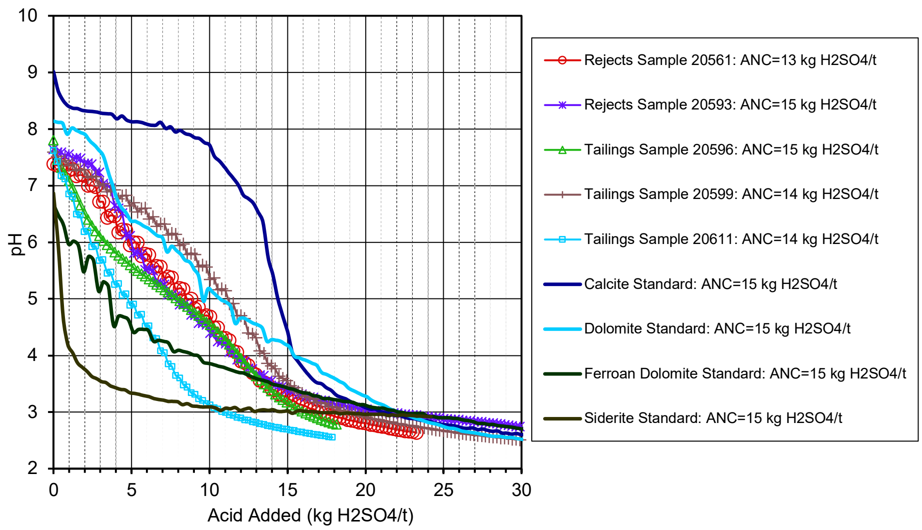


Figure C28: ABCC profile for samples with an ANC value close to 15 kg H_2SO_4/t. Carbonate standard curves are included for reference.

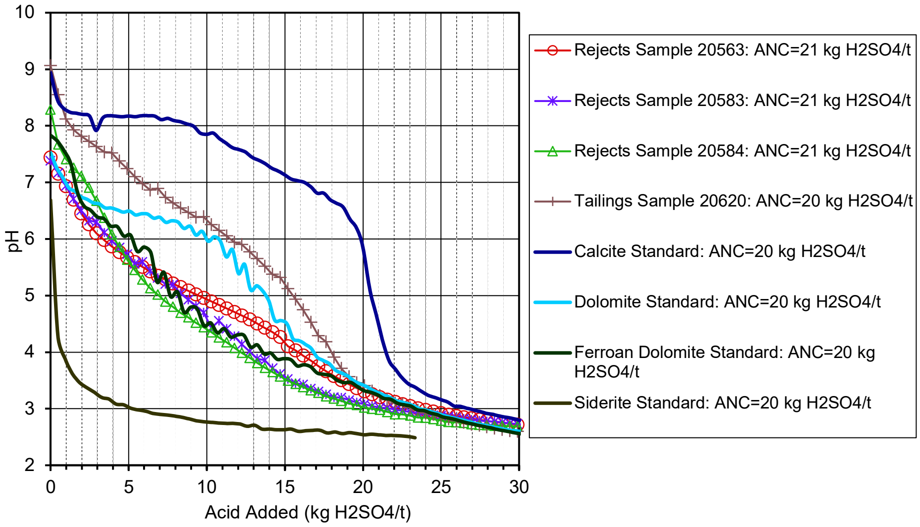


Figure C29: ABCC profile for samples with an ANC value close to 20 kg H_2SO_4/t. Carbonate standard curves are included for reference.

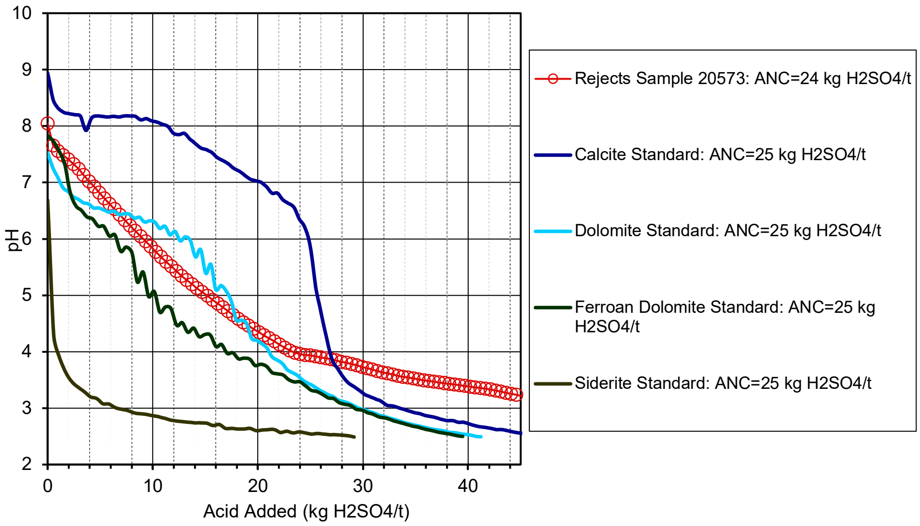


Figure C30: ABCC profile for sample 20573 with an ANC value close to 25 kg H_2SO_4/t. Carbonate standard curves are included for reference.

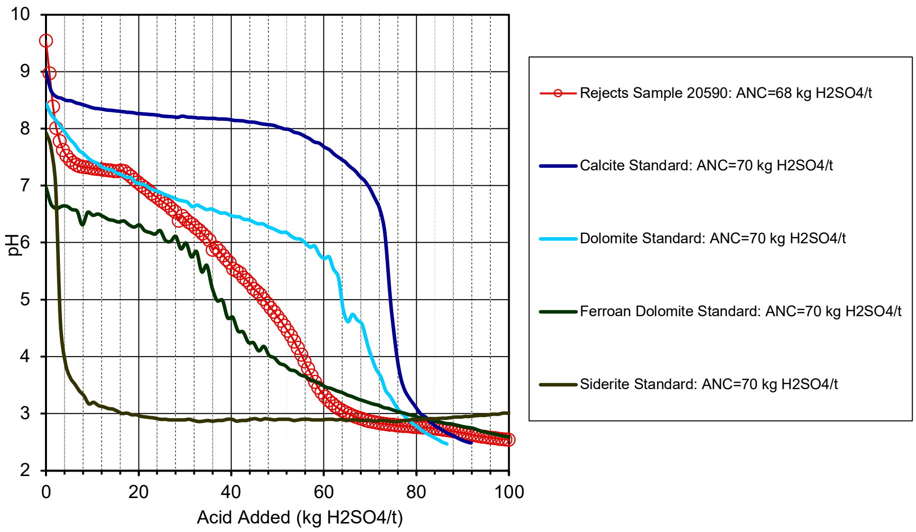


Figure C31: ABCC profile for sample 20590 with an ANC value close to 70 kg H_2SO_4/t. Carbonate standard curves are included for reference.

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