Waste Rock Disposal Plan

Vulcan Coal Mine

Prepared for: **Vitrinite Pty Ltd**

RGS

MINE WASTE AND
WATER MANAGEMENT

Waste Rock Disposal Plan

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This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

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Definitions

Acronym	Definition
Acid and Metalliferous Drainage (AMD)	Any contaminated discharge resulting from mining and associated processing, which is formed through a series of chemical, physical and biological reactions when geological strata is exposed to oxygen and moisture as a result of ground disturbance activities.
ANC	Acid Neutralising Capacity, the capacity of a sample to neutralise acidity expressed as kg H_2SO_4 per tonne of sample.
EA	Environmental Authority
EDMS	Environmental Database Management System
NAF (Barren)	Non-Acid Forming. Geochemical classification criterion for a sample that will not generate acidic conditions. Essentially barren of oxidisable sulfur.
NAPP	Net Acid Producing Potential
PAF	Potentially Acid Forming. Geochemical classification criterion for a sample that has the potential to generate acidic conditions.
ROM	Run of Mine
SSE	Site Senior Executive
Uncertain	Geochemical classification criterion for a sample where the potential to generate acid conditions remains uncertain and may require further analysis.
Waste Rock	Any mining related waste including overburden and interburden material

1 INTRODUCTION

1.1 Purpose

The Vulcan Coal Mine (VCM) is located 34 km northeast of Dysart and approximately 33 km southwest of Moranbah in Queensland's Bowen Basin (**Figure 1.1**). The VCM lies to the immediate west of several established mining operations including BHP's Peak Downs and Saraji mines and will target the Alex and multiple Dysart Lower coal seams.

The VCM is a small-scale mining operation, with the Jupiter hard coking coal target defined and selected for open cut development via a single pit. Coal extraction is planned for approximately 3 years and will extract approximately 6 million tonnes (Mt) of Run of Mine (ROM) hard coking coal at a rate of up to 1.95 Mtpa. This will be followed by completion of rehabilitation activities in year 4. The open cut will extend to a depth of approximately 45 metres(m), following the seam as it dips eastwards. The footprint of the proposed open cut is approximately 136 hectares(ha). Development of the open cut will progress from the southwestern corner, starting in the former bulk sample pit (BSP), in a northerly direction, to the northern boundary of ML700060.

As part of the initial baseline studies ahead of the BSP, two hard coking coal targets, the Jupiter pit to the north and Vulcan to the south were subjected to a geochemical testing program.

Vitrinite has been granted an Environmental Authority (EA0002912) (DES, 2021) for Mining Lease (ML700060) which permits the mining of black coal. **Conditions C8** and **C9** of the EA require the development of a Waste Rock Disposal Plan (WRDP) that must be developed and implemented to include:

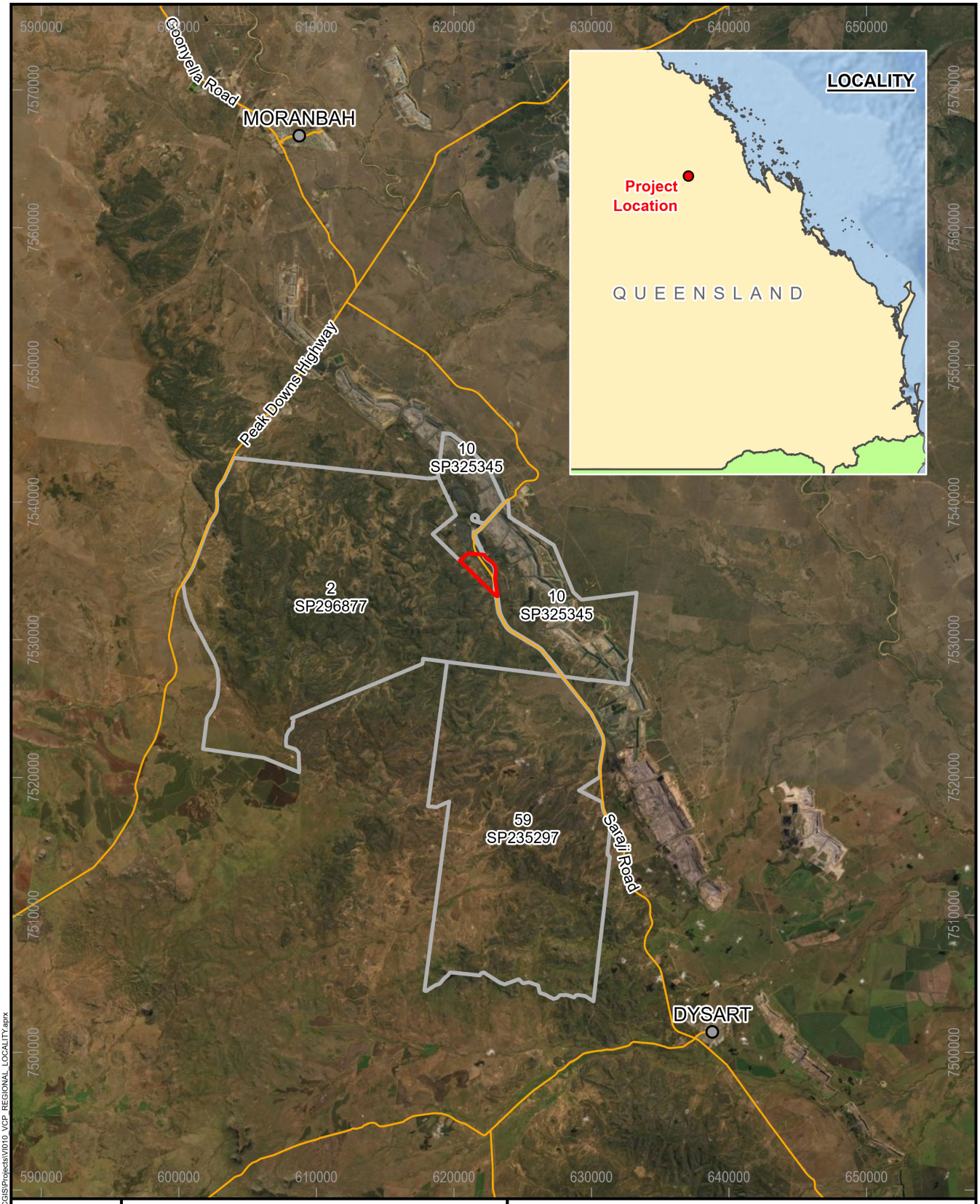
1. effective characterisation of the waste rock and spoil to predict, under the proposed placement and disposal strategy, the quality of runoff and seepage generated concerning potentially environmentally significant effects including salinity, acidity, alkalinity and dissolved metals, metalloids and non-metallic inorganic substances;
2. a program of progressive sampling and characterisation to identify dispersive and non-dispersive waste rock and the salinity, acid and alkali producing potential, metal and acid concentrations of waste rock;
3. a material balance and disposal plan demonstrating how potentially acid forming waste rock will be selectivity placed and/or encapsulated to minimise potential generation of acid mine drainage, where relevant;
4. re-testing of waste rock geochemistry and water quality limits of parameters;
5. where relevant, a sampling program to verify encapsulation and/or placement of potentially acid forming waste rock;
6. data for run-off water quality;
7. how often the performance of the plan will be assessed; and
8. the indicators or other criteria on which the performance of the plan will be assessed.

RGS Environmental Consultants Pty Ltd (RGS) has prepared this WRDP for the proposed VCM activities within ML700060. This WRDP details how Vitrinite will manage its waste rock during VCM operations.

The WRDP aims to ensure waste rock is managed in accordance with Queensland coal mining industry standards and regulatory requirements including the requirements of the EA to align with relevant technical guidelines (CoA, 2016; DEHP, 2013; DME, 1995; and INAP, 2021) and in a manner that minimises any potential environmental and health risks.

1.2 Background

The approved VCM will include both an in-pit waste rock dump (WRD) and an out-of-pit (ex-pit) WRD, along with small scale ancillary infrastructure including a Mine Infrastructure Area (MIA), ROM pad, haul roads and surface water management infrastructure.



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Legend

- Town
- Road
- ML700060 Boundary
- Property Boundary

Source: State of Queensland (Department of Resources), 2021; Vitrinite, 2019; Imagery - Esri, GEBCO, DcLormc, NaturalVuc, Earthstar Geographics. Locator map at different scale.

Vulcan Coal Mine

Regional Location Plan

0 5 10 20

Kilometers

Scale: 1:400,000 (A4)

22/12/2021

Datum: GDA94
Projection: MGA55

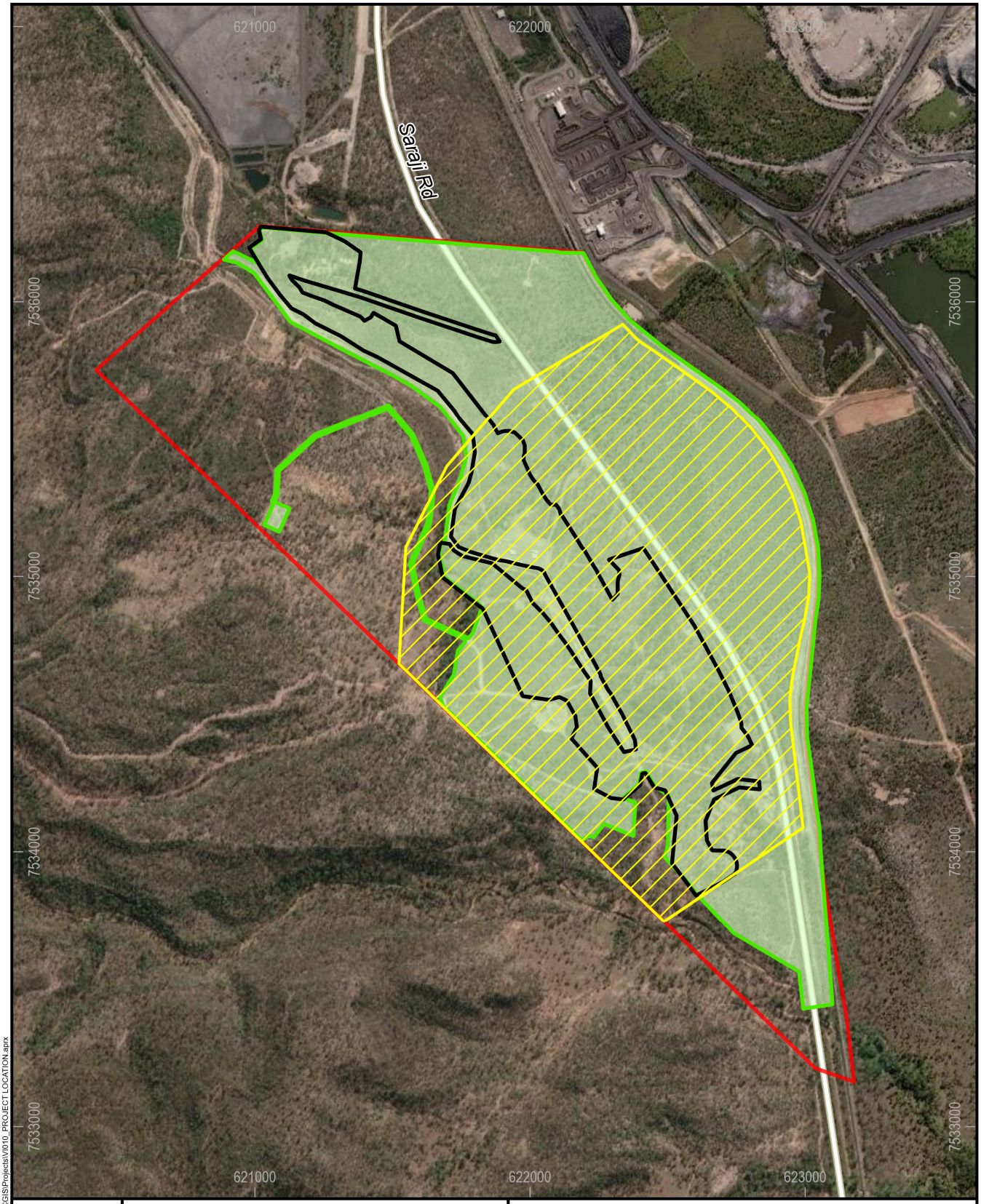
FIGURE 1-1

Under the BSP Vitrinite has approval to extract a bulk sample of up to 600,000 tonnes of high-quality coking coal for testing by a number of international coal consumers. To access the coking coal, an additional 150,000 tonnes of weathered thermal coal lying above the coking coal will be extracted and temporarily encapsulated in the Ex-Pit Waste Rock Dump, with a view to future recovery and market sale.

A new Environmental Authority (EA) was granted by the Department of Environment and Science (EA0002912) for the VCM. This EA allows the extraction of up to 1.95 Million tonnes per annum (Mtpa) of high quality coking coal, with activities commencing under this EA in October 2021. Following the granting of EA0002912 and the commencement of activities on ML700060, the EA for MDL 3039 (EA0002054) will be relinquished. The void created during the BSP will be used as the take off point for the VCM.

Initial waste rock extracted during the early stages of year 1 will be placed in an out-of-pit dump to the west of the open pit. This dump will build off the existing BSP out-of-pit dump and will extend further to the west at a similar geometry. Following this initial out of pit placement, and once sufficient pit space has been established, in-pit placement of waste rock will commence. This will continue for the life of the project as the pit advances north. The in-pit dump will extend approximately 30m above the surrounding ground level, with batters shaped at 15%. A central plateau will drain to the west to minimise the requirement for significant drainage infrastructure along the eastern toe of the dump (where space is limited).

The VCM maximum disturbance limit within ML700060 plotted against the BSP footprint is provided in **Figure 1-2**. The VCM site layout is provided in **Figure 1-3**.



Legend

- Road
- Bulk sample disturbance
- VCM authorised disturbance
- MDL 3039
- ML 700060

Source: State of Queensland (Department of Resources) 2021, Vitrinite 2020, Maxar.

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Vulcan Coal Mine

Authorised Disturbance Areas

0 0.25 0.5 1

Kilometers

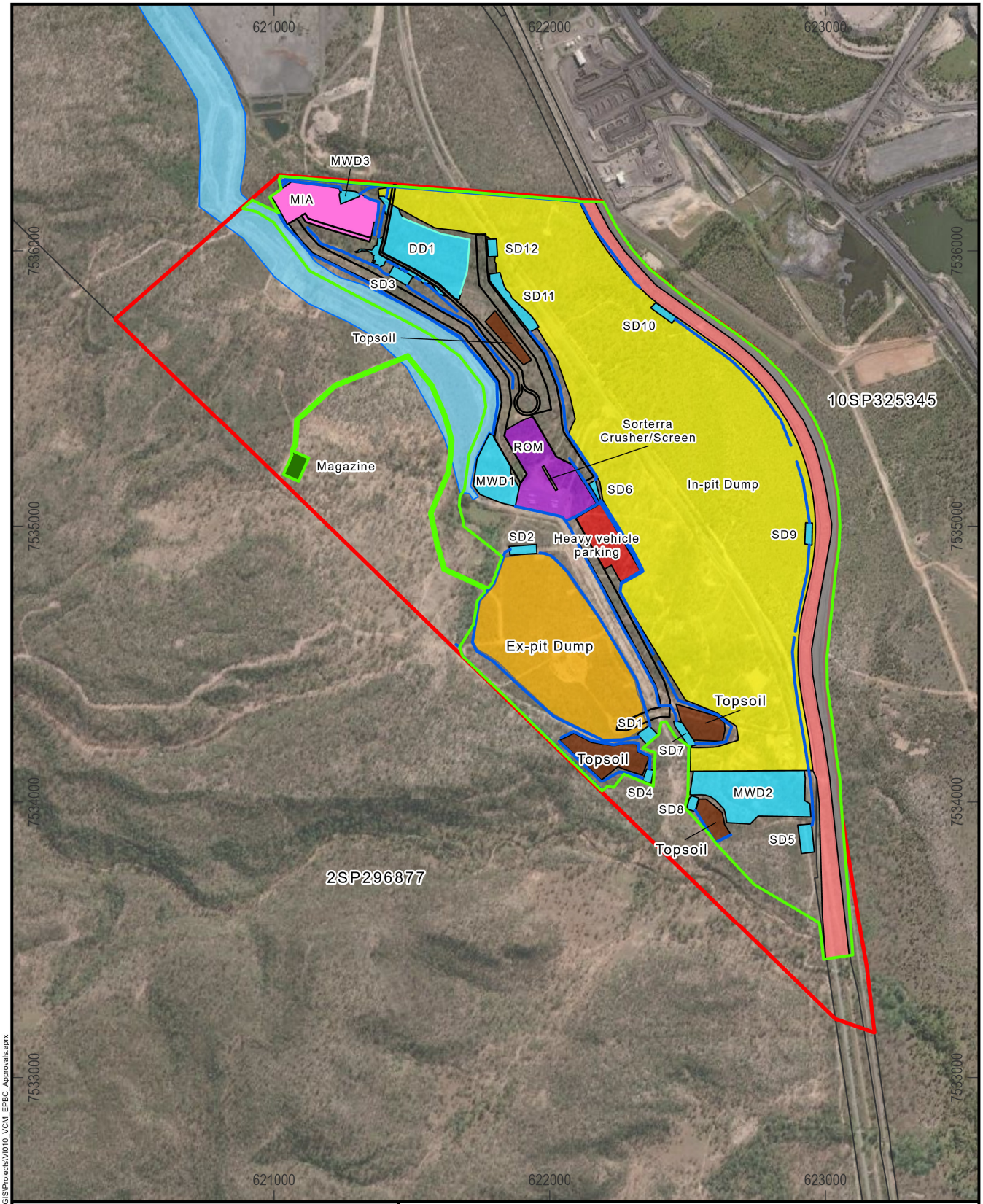
Scale: 1:20,000 (A4)

22/12/2021

Datum: GDA94
Projection: MGA55

FIGURE 1-2

Path: 3:\Projects\VI010_Vulcan_Complex_Project_Jupiter_section\ARCGIS\Projects\VI010_PROJECT LOCATION.aprx



Legend

- Mining lease area
- Cadastral boundary
- VCP Revised Maximum Disturbance Footprint
- Water Pipeline Corridor
- Access road
- Dam Wall
- Drainage line

VCM Stage 2

- In-pit Dump
- Heavy Vehicle Parking
- Magazine
- Stockpile
- MIA
- ROM
- Saraji Road
- Rail
- Dam
- Ex-pit Dump

Source: State of Queensland (Department of Resources) 2021, Vitrinite 2019, Maxar, Earthstar Geographics.

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Vulcan Coal Mine

Site Layout

0 200 400 800

Meters

Scale: 1:20,000 (A4)

22/12/2021

Datum: GDA94
Projection: MGA55

FIGURE 1-3

VITRINITE BRIGHTER COAL

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1.3 Regulation and Permit Conditions

1.3.1 Environmental Authority EA0002912

The VCM will be operated to comply with the conditions of the approved EA and the associated Environmentally Relevant Activities. These are:

- Resource Activity, Schedule 3, 13: Mining Black Coal;
- Ancillary Activity Schedule 2, 16(2); Extracting, other than by dredging, in a year, the following quantity of material, (b) more than 100,000 t but not more than 1,000,000 t;
- Ancillary Activity Schedule 2, 16(3); Screening, in a year, the following quantity of material, (b) more than 100,000 t but not more than 1,000,000 t; and,
- Ancillary Activity Schedule 2, 33: Crushing, grinding, milling or screening more than 5,000 t of material in a year.

This WRDP specifically addresses **Conditions C8** and **C9** of EA0002912 relating to waste rock management on ML700060, as previously described in **Section 1.1**.

Whilst there are a number of additional conditions in EA0002912 that are related to waste rock management, such as erosion and sediment control, dust and particulate matter, groundwater and surface water management, and rehabilitation, these are not a specific focus of this WRDP.

Further information on planning associated with these aspects is contained in the following documents:

- Erosion and Sediment Control Plan (ESCP) for the VCM (WRM, 2021) developed to address **Condition F22** of EA0002912;
- Water Management Plan (WMP) for the VCM (WRM, 2021) developed to address **Condition F19** of EA0002912; and
- VCM Estimated Rehabilitation Cost Supporting Information (METServe, 2021).

1.4 Document Control and Review Process

This WRDP will be reviewed and updated by the Vitrinite Safety, Health, Environment and Training (SHET) Department as required.

Revision 001 of this WRDP is a final document that was certified by Dr. Alan McLeod Robertson, Director of RGS on22 December, 2021. The information in **Table 1-1** documents the version control and sign off by RGS and Vitrinite.

Table 1-1: WRDP Version Control and Approval

Document Control			
Revision	**Signatory**	**Role**	**Company approval (Signed and dated)**
Revision 001	Alan Robertson (RGS)	Document Author	Alan M Robert 22 December 2021
Revision 001	SHET Superintendent (Vitrinite)	Document Owner	

Table 1-2 allows for future amendments to the WRDP to be progressively tracked, over the life of the project, and, if any substantive changes have been made or are proposed to be recorded in the Plan.

It is advisable to document how and why changes are made to the Plan to allow subsequent managers to understand the history of the site and follow the progressive management and operation of the mine areas.

Table 1-2: WRDP Amendment History

Document Control			
Revision	**Signatory**	**Requirement for amendment**	**Reference to amendment**
Revision 001	Alan Robertson (RGS)	Original document	N/A

RGS certifies that this WRDP is feasible and would meet the intent of the conditions of EA0002912 (i.e., the WRDP will enable Vitrinite to continue to progressively characterise, mine and place the mined materials so that their potential to contribute to (or to mitigate) environmental harm can be determined).

This WRDP makes use of existing geochemical characterisation data for materials to be mined at the VCM.

1.5 Integration of the WRDP with other Departments

Effective management of mining waste materials including materials that will be required to initiate and then maintain sustainable vegetation, requires communication between the SHET, geology, mine planning and technical services departments.

Without effective communication and clear workflow designation the WRDP will not meet its objectives. The information in **Table 1-3** shows the potential workflow and communication within and between Vitrinite departments.

Table 1-3: WRDP departmental workflow

Department	Role	Tasks and responsibilities	Connections
SHET Department	Document control	Owner of the WRDP	→ Geology,
		Compilation and updating the WRDP and ensuring that the aim and objectives will be met i.e., auditing process	
		Ensuring the WRDP is integrated with the Plans being managed by other departments eg. the Sediment Control Plan and Water Management Plan.	→ Planning, → Environmental, → Geology, → Tech. Services
		Ensure scheduled waste rock material sampling and analytical programs are planned, ahead of mining, on an as-required basis.	← Planning, ←→ Geology
		Work with the Geology Department to develop the WRDP to obtain any necessary samples from in-fill drilling programs and/or blast hole drilling programs.	←→ Geology
		Document how changes to the WRDP will be tracked over time.	
	Life of mine planning	Rehabilitation will be completed in accordance with the conditions of the EA and the Estimated Rehabilitation Cost (ERC) Supporting Information (METServe, 2021).	← Planning
		The SHET Department must work with other departments and guide them to ensure that the operational mine plans to mine and produce coal align the legislative requirements of the Queensland Government *Mineral and Energy Resources (Financial Provisioning) Bill 2018* and the amendments to the *Environmental Protection Act 1994.*	←→ Planning ←→ Geology
	Material characterisation	Define the material types that will be mined (or processed) and need to be managed and rehabilitated to attain minimal financial liability and relinquishment. In general, all materials from soil to the deepest mined surface should be included in the WRDP.	← Geology
		Document future sampling processes and the physical and geochemical analytical methods that will be adopted in consultation with the Geology Department.	←→ Geology
		Define the geochemical and physical criteria that will be used to classify the samples from drilling and sampling programs in consultation with the Geology Department.	←→ Geology
		Manage the interpretation and classification of the analytical data.	← Geology
	Financial Provisioning	SHET Departments are typically required to manage environmental provisioning for rehabilitation and closure, and this requires reliable outputs from short, medium and long-term mine plans.	← Planning
Geology Department	Drilling and sampling	Utilise the WRDP to develop scheduled exploration and operational drilling and sampling plans.	← Environmental, (←→ Planning)
		Implement the exploration and operation drilling and sampling plans.	
	Update geology models	Compile the material characterisation data into the geology model(s).	← Environmental
		Provide the raw data and interpreted data to the SHET Department.	→ Environmental
		Develop and report annual material balances and provide these to SHET Department.	→ Environmental
		Provide the revised geology model to the mine planning team.	→ Planning
	Issue geology model and material balances	Provide updated material balances for all mined units to the Environment team to verify that the overall aim of the rehabilitation and closure plan can continue to be met e.g. for the active (current iteration) of the mine plan is there enough topsoil, subsoil and other necessary material to achieve complete rehabilitation over the life of mine.	→ Environmental
Mine Planning Department	Life of mine planning	Development and maintenance of schedule in the Operational Mine Plan	←→ Geology, ←→ Environmental
	Scheduling	Utilise revised geology models to develop short, medium, and long-term mine plans including plans for progressive rehabilitation and closure.	← Geology
		Mine planners will need to align with environmental design criteria associated with constructed landforms to ensure that the landforms are rehabilitated to a safe and stable landform that does not cause environmental harm and will conform to the objectives of the *Mineral and Energy Resources (Financial Provisioning) Bill 2018* (the Bill).	→ Environmental
		Mine planners will provide the numerical basis from the Operational Mine Plan to the SHET Department for annual financial reporting (internally and externally).	→ Environmental
		Mine planners will provide the schedules and plan to Technical Services to implement on the ground.	→ Tech. Services
Technical Services	Design and construction	Implementation of approved mine plans in accordance with schedule and approvals.	← Planning, ← Environmental, ← Geology

2 SCOPE, AIM AND OBJECTIVES OF THE WRDP

2.1 Scope

The scope of the WRDP is to manage all mined waste rock units including overburden/interburden, coal, and coal reject streams. Although not explicitly stated in the EA, the WRDP should also include sub-units for topsoil, subsoil and extremely weathered to weathered regolith that are present above the pre-mining groundwater level and that are potentially critical units required for successful rehabilitation.

Effective management leading to successful rehabilitation that will attain regulatory relinquishment or be considered as fit-for-purpose by a subsequent landowner will integrate the mining, placement and rehabilitation of the mined units.

To achieve effective management of the mining waste materials, this WRDP specifically addresses **Conditions C8** and **C9** of EA0002912 (**Section 1.1)** and/or references where more detailed information is available.

2.2 Aim

The aim of the WRDP is to enable mining, coal processing and rehabilitation to be completed economically with minimal adverse environmental and social impacts on the land and water resources, and to lead to successful post-rehabilitation beneficial reuse. To achieve this aim there will be an integrated planning approach coupling the work programs undertaken by SHET, exploration and operational geology and short, medium and long term mine planning departments.

With an integrated, cross-discipline planning approach at the site, implementation of the management aims will be effective and eliminate any subsequent environmental issues.

This WRDP is the central focal point of a broader set of plans and procedures that will be used to achieve the intent of the Plan. The site procedures for some tasks such as future material characterisation would be documented and managed by the custodian of the Plan.

Other tasks such as exploration and operational geological programs, short, medium and long-term mine planning (including landform design), water management, and rehabilitation programs are detailed in other Vitrinite management plans as outlined in **Section 1.3**.

2.3 Objectives

The objectives of the WRDP are to document and map out:

- why the Plan is required and when the Plan will need to be updated;
- how changes to the WRDP will be tracked to enable the reasons for changes to the Plan over the life of mine to be understood;
- who will plan and implement the tasks required to be undertaken by each department;
- how the data collected from departmental tasks such as waste characterisation or developing material balances will be stored and made accessible to other departments who are required to make use of the data;
- how the data are to be used and which other plans the data and the Plan will need to integrate with other Management Plans (e.g., ESCP, Water Management Plan, and Mine Plan); and
- when the tasks in the WRDP are required to be undertaken and what the outputs will be.

2.4 Data Management

The waste rock material characterisation program will compile geochemical and physical data. Typically, this data is provided by a commercial laboratory in pdf and spreadsheets that are then stored on a server. This can lead to the eventual loss of the data. All geochemical, physical and any other relevant data associated with the characterisation of waste rock will be stored in the Geology Department geological database and/or in the environmental database management system (EDMS).

3 GEOLOGY AMD STRATIGRAPHY

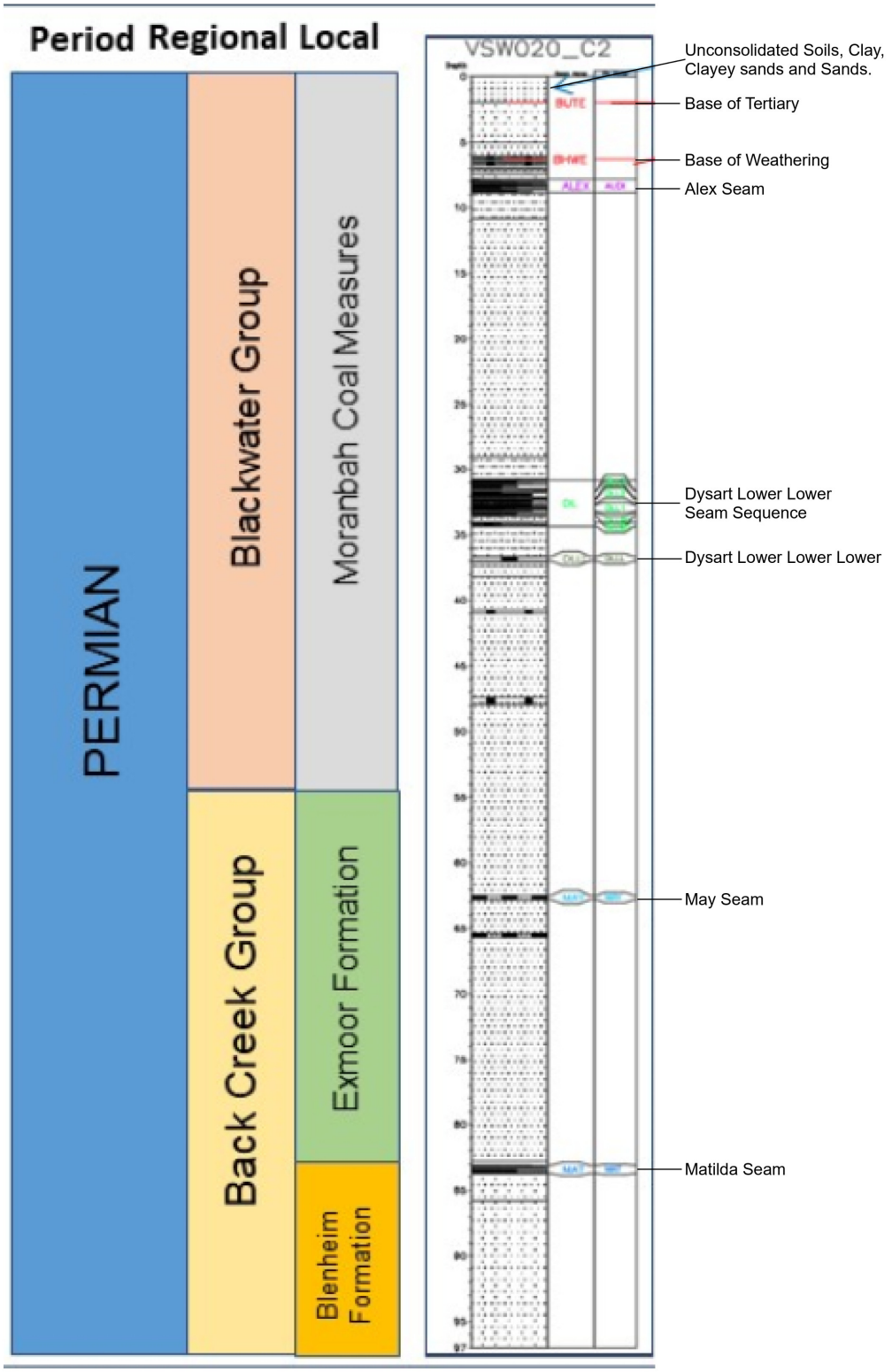
The VCM will target the Alex and multiple Dysart Lower coal seams within the Permian-aged Moranbah Coal Measures. A surficial Tertiary waste rock (overburden) sequence is present in the VCM area, consisting of unconsolidated soils and sands. Underlying this is Permian-aged waste rock (overburden), which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

The Permian waste rock (interburden) materials in the VCM area generally comprise sandstone, siltstone, claystone, and coal, that were deposited in a fluvial floodplain environment within the Bowen Basin. Significant mesa hills formed by highly resistant sandstones have provided target coal seams throughout the centre of the study area. The typical stratigraphic profile encountered at the VCM is provided in **Figure 3-1**.

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

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

The uniform stratigraphy/geology at the VCM is typical of coal mines in this part of the Bowen Basin, where the stratigraphic profile in the lateral direction at an open pit activity is consistent and predictable.



Source: Vitrinite 2019

Vulcan Coal Mine

Typical Stratigraphic Profile

Scale: 1:1 (A4)

22/12/2021

Datum: GDA94
Projection: MGA55

FIGURE 3-1

METSERVE Mining & Energy Technical Services Pty Ltd

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4 WASTE ROCK CHARACTERISTICS

4.1 Sampling and Characterisation

An initial assessment of the geochemical characteristics of the waste rock likely to be generated at the VCM (RGS, 2019) showed that the waste rock does not pose a significant risk of generating acid, saline, or metalliferous drainage (AMD). Subsequent characterisation work confirmed the findings of the initial assessment (RGS, 2020).

The geochemical assessment work completed by RGS in 2019 and 2020 essentially represents a program of **progressive sampling and characterisation** of waste rock (and coal reject) in line with the requirements of **Condition C9** (**clauses (a) and (b)**) of the EA. The work was completed to align with applicable Australian (ACARP, 2008; COA; 2016) and international (INAP, 2021) technical guidelines used in the coal mining industry.

A total of 138 waste rock samples were collected from 21 drill holes at the VCP. Seven of the holes were drilled within the Jupiter target area and 14 within the Vulcan target area. The locations of the Jupiter and Vulcan drill holes with respect to the VCP and VCM areas are shown in **Figure 4-1**. Five of the seven drill holes shown on the figure were used to sample waste rock from within the Jupiter pit shell. Of these five drill hole locations, four are located within the maximum area of disturbance of the VCM (previously shown in **Figure 1-2**).

A program of static and kinetic geochemical tests was used to determine the likely geochemical characteristics of the waste rock materials (RGS, 2019; 2020). The results showed that bulk waste rock materials are likely to have very low sulfur content, excess acid neutralising capacity and are classified as Non-Acid Forming (Barren) based on the geochemistry classification system presented in **Table 4-1** (RGS, 2020; AMIRA, 2002). These materials have a very low risk of acid generation and a high factor of safety with respect to potential for generation of acidity.

Table 4-1: Geochemical classification criteria for waste rock materials

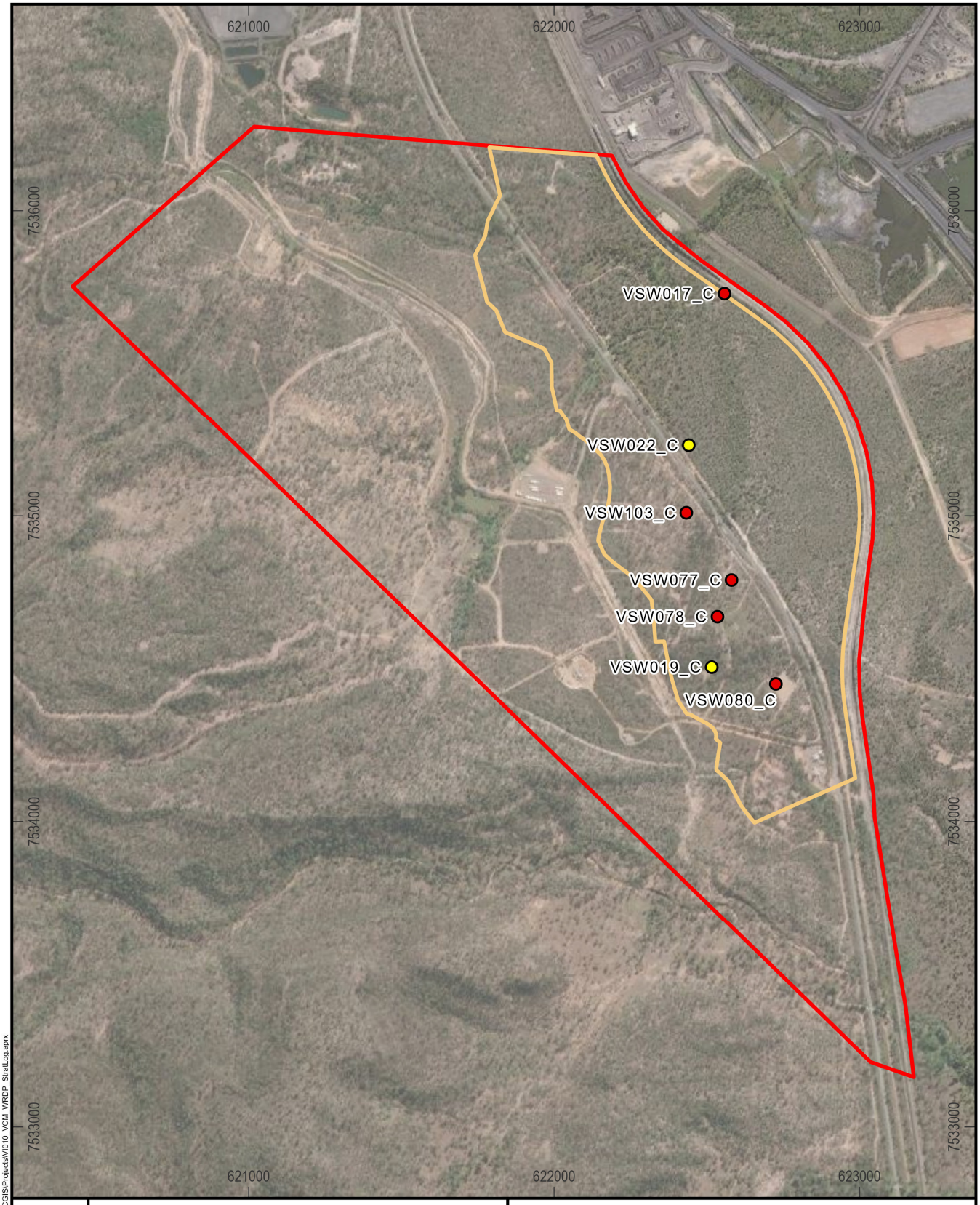
Geochemical Classification	Total or Sulfide Sulfur (%)[1]	NAPP (kg H_2SO_4/t)	ANC: MPA Ratio
Non-Acid Forming (NAF) – Barren[2]	≤ 0.1	-	-
Non-Acid Forming (NAF)	> 0.1	≤ -5	≥ 2
Uncertain	> 0.1	> -5 and ≤ 5	< 2
Potentially Acid Forming (PAF)	> 0.1	> 10	< 2

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

The multi-element concentrations of metal/metalloids in waste rock are low and are not significantly enriched with metals/metalloids compared to median global crustal abundance in unmineralised soils.

Data from the static and kinetic leach test program demonstrates that surface runoff and seepage from bulk waste rock materials will be pH neutral to slightly alkaline with low levels of salinity (and low concentrations of dissolved solids). Acidity levels are expected to be very low with excess alkalinity leading to a positive net alkalinity value.

The total concentration of major ions in the surface water and seepage will be relatively low and dominated by bicarbonate, sodium, chloride and sulfate. The concentration of sulfate in leachate from waste rock is more than an order of magnitude below the receiving water contaminant trigger level described in **Table F2 – Interim contaminant trigger investigation levels** (EA0002912).



Legend

Sample Location

- Jupiter Sample
- Coal Reject Sample
- Jupiter Pit Shell
- ML 700060

Source: Vitrinite 2020, Maxar.

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Mining & Energy Technical Services Pty Ltd

Vulcan Coal Mine

Jupiter Target Sample Locations

0 200 400 800

Meters

Scale: 1:18,000 (A4)

22/12/2021

Datum: GDA94
Projection: MGA55

FIGURE 4-1

Path: 3:\Projects\VI010_Vulcan_Complex_Project_Jupiter_section\ARCGIS\Projects\VI010_VCM_WRDP_StatLog.aprx

The concentration of trace metals/metalloids tested in the water extracts will be low, predominantly below the laboratory limit of reporting and below applied water quality guideline criteria. It is therefore expected that the risk of potential impact on the quality of surface runoff and groundwater from bulk mine waste materials at the VCM will be low. Whilst significantly elevated metal/metalloid concentrations in waste rock contact water are not expected, the suite of metals/metalloids described in **Table E2** of EA0002912 will be included in the groundwater monitoring program at the VCM site.

In common with many mining operations in the Bowen Basin, most waste rock materials represented by the samples tested by RGS are sodic and may be susceptible to dispersion and erosion, although these material characteristics could be improved to some extent by the addition of gypsum or surface rock mulch, if available. If insufficient topsoil/subsoil is available at the VCM WRD, fertiliser addition may also need to be considered for surface mining waste materials for the purpose of providing a reasonable growth medium for revegetation and rehabilitation. Further details of erosion/dispersion and sediment control and rehabilitation are contained in the ESCP.

Based on the geochemical and sodicity data summarised in this section of the WRDP, no selective handling and treatment measures are proposed at the VCM WRD and low permeability capping over the dump is not required.

Additional confirmatory sampling and testing will be completed on bulk mine waste materials when available during the operational phase of the VCM to determine the best management option for progressive rehabilitation of these materials during operations and at mine closure. The re-testing of waste materials and ongoing monitoring of both groundwater and surface water, in line with Schedules E and F of the VCM EA, addresses the requirements of **Condition C9** (**clause (d)**) of EA0002912.

4.2 Material Balance and Disposal Plan

Section 4.1 of this WRDP describes the geochemical characteristics of the bulk waste rock materials that will be generated by the VCM. The bulk waste rock materials are classified as Non-Acid Forming (Barren) and therefore have a very low risk of acid generation and a high factor of safety with respect to potential for generation of acidity.

As described in **Section 4.1** and based on the geochemical and sodicity characteristics of the waste rock materials, no selective handling and treatment measures are proposed at the VCM out-of-pit WRD and low permeability capping over the WRD is not required.

As no potentially acid forming waste rock exists at the VCM, these findings essentially address the requirements of **Condition C9** (**clauses (c) and (e)**) of EA0002912.

4.3 Performance Review/Indicators

The performance of the WRDP will be assessed annually or when any non-compliance incidents occur. This will be achieved by reviewing monitoring data acquired through implementation of the monitoring program for the VCM and any non-compliance incidents associated with emergency and contingency plans described in **Sections 6** and **7** of this WRDP.

Parameters to be monitored as described in relevant sections of EA0002912 include:

- Dust and particulate matter, if required in response to a complaint or request from the administering authority (in accordance with conditions **A15 – A18,** and **Schedule B**);
- Surface water quality (**Schedule F**); and
- Groundwater (**Schedule E**).

The performance review and performance indicators for the WRDP described in this section essentially addresses the requirements of **Condition C6** (**clauses (f), (g)** and **(h)**) of EA0002912.

4.4 Waste Rock Rehabilitation Strategy

The remaining VCM open cut void will be backfilled with stockpiled waste rock, to create a stable final landform over the former open cut footprint. The final landform will utilise the waste material to backfill the void via dozer push. This will be re-contoured at a maximum slope of 15 % with fall to existing water

courses. The location of the in-pit WRD is consistent with the pre-mining topography such that the dump crest will be located in a similar position and at a similar height to the small hill that currently exists in the centre of the proposed pit area.

The re-contoured batters are designed at a maximum slope of 15 % and have been reduced where required to address material balances for cut and fill. The crest of the in-pit dump has been profiled to the west to ensure no pooling of water on this catchment area.

The ex-pit WRD has been designed to a maximum height of RL280. This is consistent with the existing topography within the pit bounds that peaks at RL266. The WRD height ranges from 15 to 30m above ground level. Ex-pit WRD rehabilitation activities will re-contour the WRD to a maximum rehabilitation slope of 15 %. The dump has been designed such that the cut and fill balance allows for an existing levee within the VC footprint to be maintained undisturbed, to avoid impeding the current water flow throughout this area. A standoff of 10 m from the existing levee has also been utilised to ensure separation and elimination of disturbance of this water course. This remains outside the modelled Q1000 flood extent.

5 RISK ASSESSMENT

5.1 Potential Environmental Issues, Impacts and Controls

The potential environmental issues, impacts and controls associated with storage of waste rock materials at the VCM out-of-pit and in-pit WRD areas are described in **Table 5-1**.

There is negligible potential for AMD at the VCM, including from waste rock materials, and no selective handling and treatment measures are proposed. Low permeability capping over the WRD areas is not required.

Because of the sodicity of most waste rock materials, potential dispersion and erosion is considered a risk that will be addressed by following the processes described in this WRDP as well as those contained in the ESCP.

The following hierarchical of control strategies in order of priority can be categorised as:

- prevention of impact;
- minimisation of impact and/or likelihood through rehabilitation trials; and
- interception and control of impact.

The control measures will depend on topography, mining method, material type, soil/rock types, mineralogy, and available amelioration resources, if required (e.g., gypsum, fertilizer and rock mulch). Control measures are documented in **Table 5-1**.

Table 5-1: Potential Environmental Issues, Impacts and Controls

Potential Issue	Potential Impact	Control Measures
AMD	• Contamination of surface water and seepage from WRD areas.	• Waste rock is Non-Acid Forming (Barren) and the risk of AMD from the WRD areas is negligible.
Salinity	• Contamination of surface water and seepage from WRD areas.	• Low salinity levels and low concentrations of dissolved solids are expected to be generated from the WRD areas.
Dust from waste rock materials	• Dust interaction with workforce and the receiving environment.	• Vitrinite will employ all reasonable and feasible avoidance and mitigation measures so that dust and particulate matter emissions generated from waste rock disposal do not cause exceedances of levels described in **Table B1** of the EA. Measures may include dust suppression, monitoring and analysis of dust and particulate emissions and rehabilitation of the WRD areas.
Metals/metalloids leachate	• Leaching of metals/metalloids into surface runoff and groundwater.	• Metals/metalloids are sparingly soluble from waste rock and therefore low concentrations of dissolved metals/metalloids are expected to be generated from the WRD areas.
Dispersion and erosion	• Loss of sediment from WRD areas and potential release to surface run-off	• Progressive recontouring and rehabilitation of the WRD areas to minimise loss of sediment in accordance with the ESCP. • Installation and maintenance of drainage and sediment and erosion control structures to control and treat surface run-off from the WRD areas (see **Figure 1-3**).

6 MONITORING

6.1 Monitoring Programs

Monitoring of solid materials and contact water associated with the WRD areas forms an important part of the on-site management of waste rock materials and will be completed in accordance with EA0002912, the ESCP, the Water Management Plan, and this WRDP.

The monitoring program is primarily aimed at identifying potential impacts to ensure that management practices are appropriate or are modified accordingly. Monitoring will be conducted by trained on site personnel or by specialist consultants as engaged by Vitrinite.

Progressive characterisation of waste rock materials was completed in 2019/2020 and additional sampling and characterisation will be completed if water quality monitoring indicates that the WRD areas are not performing according to predictions.

Leachate from the WRD areas will be included in the site water quality monitoring program and will be monitored in accordance with the relevant conditions of EA0002912 and relevant site plans.

6.2 Monitoring Records

Monitoring records for waste rock materials will be maintained by the Vitrinite Technical Services or SHET Department and will be stored in a geological database and/or an EDMS.

6.3 Integrated Monitoring and Management

Monitoring that may interact with waste rock management includes groundwater, rehabilitation monitoring and general inspections. Items considered may include:

- Water quality – surface water;
- Water quality – groundwater;
- Seepage/leachate production and quality;
- Visual inspections;
- Soil geochemistry; and
- Vegetation coverage and establishment.

All monitoring results will be used to assist with continuous improvement of the waste rock management strategy.

6.4 WRDP Review

The Vitrinite SHET Department is responsible for communicating the outcomes of a review of the WRD performance to site personnel and contractors. An annual review will be undertaken by the SHET Department and/or a suitably qualified specialist consultants. If management practices are not effective, changes to the management will be made and implemented for the VCM, if approved.

The review process will include consideration of monitoring results. Any changes in operational practices will be incorporated into the documentation and communicated to responsible employees and contractors.

Suitable criteria to establish whether waste rock management practices are effective are as follows:

- no complaints in relation to waste rock management;
- full compliance with the requirements of EA0002912, relevant site plans and this WRDP;
- no uncontrolled release of leachate with elevated turbidity; and
- continual improvement in waste rock management practices.

All matters relating to waste rock will be managed by the Technical Services and/or SHET Department.

7 CONTINGENCY AND ENVIRONMENTAL INCIDENT PLANS

7.1 Operational Contingencies

Vitrinite has developed operational contingencies for scenarios that may occur throughout the life of the VCM WRD operation. Each scenario may have more than one contingency of which a portion of the contingencies may be enacted in that event based on the site conditions at the time. The scenarios and contingencies are presented in **Table 7-1**.

Table 7-1: Operational Contingencies

Scenario	Possible Contingencies
Wet-weather preventing access to WRD disposal location	• Temporary storage of waste rock at temporary VCM stockpile area.
Lack of water for dust suppression at WRD	• If dust and particulate matter monitoring indicates a potential issue, review waste rock dumping practices. • Implement changes to waste rock dumping practices (e.g., based on climatic conditions).
Abnormal monitoring results	• Investigation into cause of results and potential mitigation measures required. • Implement mitigation measures.
Elevated sediment loss from WRD	• Review WRD construction methodology and dumping practices. • Review WRD drainage and sediment pond design. • Implement any required mitigation measures.

7.2 Environmental Incident Response

If any Vitrinite personnel suspect that the WRD is not operating as planned, this will be reported to the SHET Department and Site Senior Executive (SSE) (or SSE delegate) as soon as practicable and within 24 hours. Any non-compliance with the conditions of the EA will be investigated and the administering authority notified as required in accordance with **Conditions A11-A15**, **E13-E14**, **F8-F9**, any related operational plans such as the ESCP, Water Management Plan and this WRDP.

During certain climatic events, such as prolonged drought or storm/flood events, release of dust and particulate matter or any uncontrolled release of turbid water containing elevated sediment from sediment dams, that monitoring indicates does not meet EA conditions, will be managed in accordance with the following general principles:

1. **Investigate, Review and Mitigate**
    - Investigate the incident, review monitoring data and implement any required mitigation measures, where possible.
2. **Notify**
    - Notify Supervisor and SHET Department and/or SSE.
    - The Vitrinite SHET Department, in consultation with the SSE, will consider the need to contact downstream landholders, DES and other stakeholders in accordance with the requirements of the EA. The ERMP will also be consulted.
3. **Control the release**
    - Control the release source (e.g., sediment dam). May be completed in conjunction with Principle 1.

The SHET Department will be responsible for commencement of an investigation into any uncontrolled release of dust and particulate matter or turbid water that does not meet EA condition requirements and may include visual inspections and water monitoring. Potential mitigation measures will then be implemented to prevent

further impacts, where practical. The SHET Department will also review this WRDP, related operational plans, site procedures and monitoring records. If required, management plans and site procedures will be amended.

Where an incident occurs that results in an emergency or incident which results in, or may result in, environmental harm or the release of contaminants not in accordance with the EA, the administering authority will be notified in writing within 24 hours (EA **Condition A11**).

Written advice will be provided to the administering authority (EA **Condition A13**), no more than 10 business days following the initial notification of an emergency, incident or information about circumstances which result or may result in environmental harm or the release of contaminants, including the following:

- Results and interpretation of any samples taken and analysed;
- Outcomes of actions taken at the time to prevent or minimise environmental harm; and
- Proposed actions to prevent a recurrence of the emergency or incident.

8 CERTIFICATION

As described in **Section 1.4**, RGS certifies that this WRDP is feasible and would meet the intent of the relevant EA conditions (i.e. the WRDP will enable Vitrinite to continue to mine and place the waste rock materials so that their potential to contribute to (or to mitigate) environmental harm can be determined. The Qualifications of the RGS personnel suitably qualified to certify this WRDP are provided below.

8.1 Suitably Qualified Persons – RGS Company Details

The core business of RGS is to undertake static and kinetic chemical and physical material characterisation studies and produce certified mine material, mine rehabilitation and mine closure plans that include sampling, analytical and monitoring programs.

RGS is an owner-operated leading environmental consulting company that has been operating successfully for the past 14 years. We provide timely and cost-effective solutions to complex environmental management issues from exploration through the planning, operational and closure phases of small to large scale mining projects. RGS has gained an international reputation as a leading provider of environmental management services to the mining and mineral processing industry and takes pride in being flexible, practical and innovative. RGS is committed to delivering on time and within budget; technical excellence; consistent quality; and continual improvement of our service delivery and skills.

RGS personnel have provided services to more than 500 mining and mineral processing projects in Algeria, Argentina, Australia, Bangladesh, Brazil, China, Ghana, India, Indonesia, Laos, Malaysia, Mozambique, New Caledonia, New Zealand, Papua New Guinea, Philippines, Romania, Thailand, Turkey and Vietnam. RGS has worked on more than 100 coal mine projects in Queensland, New South Wales, Western Australia, Africa, New Zealand, Indonesia, Laos and Bangladesh. Our clients range from small to large mining companies including Anglo American, BHP Billiton, CS Energy, Evolution Mining, MMG, Rio Tinto, Stanwell Corporation, Vale and Glencore.

8.2 Suitably Qualified Persons – Relevant Experience

RGS Personnel

Alan Robertson has a PhD in Pure and Applied Chemistry and has over 28 years' experience completing geochemical studies for the mining and mineral processing industry. He has worked on projects for major mining companies (e.g., Anglo American, BHP Billiton, Glencore and Vale) in Australia, Asia, Africa, Europe and South America for both coal and hard rock mines. Alan has expertise in mine waste characterisation, development of AMD management plans, and design of mine waste storage facilities from conception through to closure. Alan is regularly engaged to provide independent environmental advice on mine closure and rehabilitation aspects of mining operations.

Greg Maddocks has a PhD in Geochemical Engineering, over 18 years' mining sector experience and has worked on various open pit and underground mining projects in Australia and South-East Asia. Greg has developed Mining Waste and Rehabilitation Management Plans compliant with the requirements of Australian industry guidelines and standards. Mine closure work ranges from evaluating and selecting optimal water and waste management strategies to developing management plans for tailings and waste rock storage facilities and open pits.

9 LIST OF REFERENCES

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

AS 4969.7 (2008). *Analysis of acid sulfate soil – Dried samples – Methods of test. Method 7: Determination of chromium reducible sulfur (Scr)*. Standards Australia, June.

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

ANZECC and ARMCANZ, (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, ACT. ISBN 09578245 05.

ANZG, (2018). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

Bowen, H.J.M. (1979). *Environmental Chemistry of the Elements,* Academic Press, New York, p61-62.

COA (2016). *Leading Practice Sustainable Development Program for the Mining Industry. Managing Acid and Metalliferous Drainage*. September. Commonwealth of Australia, Canberra ACT.

DEHP (2013). *Application Requirements for Activities with Impacts to Land Guideline.* Queensland Department of Environment and Heritage Protection (DEHP).

DES (2021). Environmental Authority EA0002912 issued to Queensland Coking Coal Pty and QLD Coal Aust No.1 Pty Ltd by the Queensland Department of Environment and Science (DES). 27 September.

DME (1995). *Draft Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland, Technical Guideline – Assessment and Management of Acid Drainage and Saline/Sodic Wastes*. Queensland Department of Minerals and Energy (DME).

INAP (2021). *Global Acid Rock Drainage Guide (GARD Guide)*. Document prepared by Golder Associates on behalf of the International Network on Acid Prevention (INAP). (http://www.inap.com.au/).

METServe (2020). Progressive Rehabilitation and Closure Plan for the Vulcan Complex Project. Report prepared for Vitrinite Pty Ltd by METServe Pty Ltd.

METServe (2021). Vulcan Bulk Sample Project Estimated Rehabilitation Cost (ERC) Supporting Information. Report prepared for Vitrinite Pty Ltd by METServe Pty Ltd. 18 November.

RGS (2019). *Preliminary Geochemistry Results – Jupiter and Vulcan Target Prospects. Vulcan Complex*. Technical Memorandum prepared by RGS Environmental Pty Ltd for Vitrinite Pty Ltd. 18 July.

RGS (2020). *Preliminary Geochemistry Results – Jupiter and Vulcan Target Prospects. Vulcan Complex*. Technical Memorandum prepared by RGS Environmental Pty Ltd for Vitrinite Pty Ltd. 18 July.

WRM (2021). Vulcan Coal Mine. Erosion and Sediment Control Plan. Document 1571-17-B prepared for Vitrinite Pty Ltd owner of QLD Coal Australia No.1 Pty Ltd and Queensland Coking Coal Pty Ltd. December.

WRM (2021). Vulcan Coal Mine. Water Management Plan. Document 1571-17-A1 prepared for Vitrinite Pty Ltd owner of QLD Coal Australia No.1 Pty Ltd and Queensland Coking Coal Pty Ltd. 29 November.

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WATER MANAGEMENT