Vulcan South EA Application

Supporting information and responses to the Department of Environment and Science Information Request relating to surface water

Vitrinite Pty Ltd
1571-20-D2, 14 March 2023

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For and on behalf of WRM Water & Environment Pty Ltd
Level 9, 135 Wickham Tce, Spring Hill
PO Box 10703 Brisbane Adelaide St Qld 4000
Tel 07 3225 0200

Julian Orth

Principal Engineer

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1 Introduction

This report has been prepared in response to an information request by the Department of Environment and Science (DES) for the Vulcan South project (the Project). The Notice of Information Request dated 1 August 2022 was provided in response to the Vulcan South Environmental Authority (EA).

WRM Water & Environment (WRM) previously completed the Vulcan South Surface Water Assessment (SWA) (WRM, 2022), which included an operational water balance model, a flood model and the proposed surface water monitoring program. This report was prepared in response to DES comments and provides further details for the Vulcan South SWA report. This report includes updates to the water management strategy, the surface water monitoring program and the water quality objectives (WQO).

WRM's responses to the DES comments are provided in Appendix A and were formed with direct consultation and approval of Vitrinite following their review.

2 Water management system

2.1 CONCEPTUAL DRAINAGE PLANS

2.1.1 Overview

The proposed strategy for the management of surface water at the Project is based on the separation of water from different sources based on anticipated water quality. Figure 1.3 to Figure 1.13 of the Vulcan South SWA report (WRM, 2022) shows the conceptual drainage plans for the Project during various mining stages. Water management at the Project is reliant on topography, as well as constructed surface water, diverted water and mine water drains. The proposed sediment dams are designed and located to capture surface water runoff via proposed surface water drains to ensure separation from any mine affected water. In the event that surface water within sediment dams is contaminated, this water will be pumped into a mine water dam (MWD).

The waste rock dump has been classified as ‘surface water runoff’ as it will be managed by sediment control structures in accordance with a proposed Erosion and Sediment Control Plan (ESCP) and will not be mixed with tailings, pit or processing water. This is consistent with the definitions provided by DES (2017). A geochemical assessment of the waste rock material has also been undertaken by RGS (2022). The results of the static and kinetic geochemical tests demonstrate that the overwhelming majority of the waste rock materials contain negligible sulphide content, have excess acid neutralising capacity (ANC), and are classified as non-acid forming (NAF). RGS concluded that the samples represent materials with a very low risk of acid generation and a high factor of safety with respect to generating acidic drainage.

Areas proposed to be 'disturbed by mining operations' will be separated from the surface water system using mine water dams which are proposed to capture mine affected runoff via proposed mine water drains. Section 3 of this report provides the review of water quality sample data at monitoring point locations and the proposed receiving waters trigger values in the event that mine affected water potentially contaminates surface runoff water.

2.1.2 Vulcan Main mining area

Figure 2.1 shows the updated conceptual drainage plan for the Stage 2 Vulcan Main mining area (Figure 1.6 of the Vulcan South SWA report), which amended an incorrectly shown surface water catchment boundary.

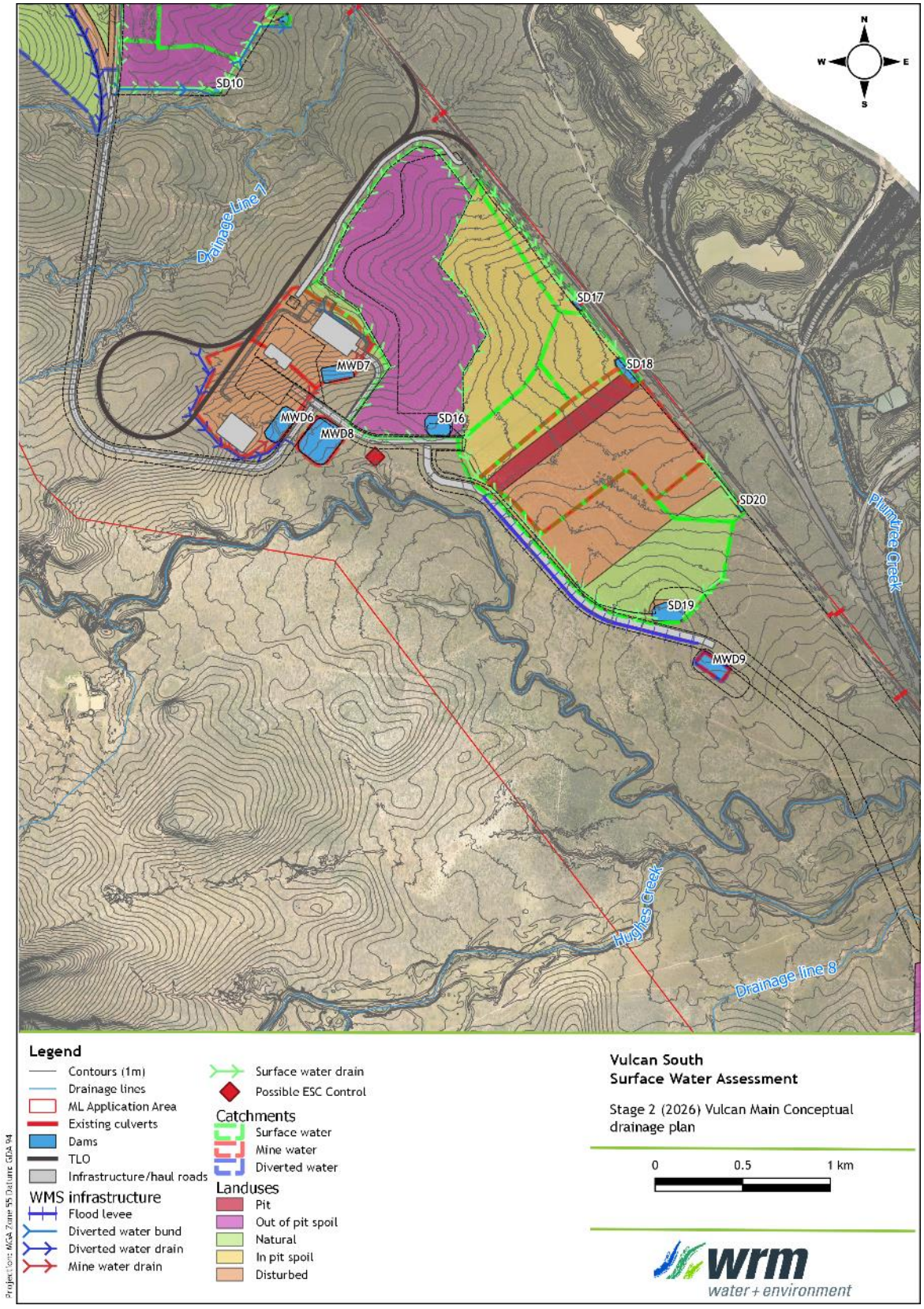

Figure 2.1 – Updated Stage 2 (Year 2026) Vulcan Main mining area conceptual drainage plan

2.1.3 Highwall mining water management strategy

Figure 2.2 shows the proposed mine affected water management strategy for the Project to address DES's comments regarding the management of mine affected water during the highwall mining stages. The active mining area (MAW catchment) is proposed to progressively shift as highwall mining panels are completed and rehabilitated to surface runoff water catchments. The key components of the mine water management strategy throughout the highwall mining stage of the Project include:

- clean water drains/contour banks and rock chutes/drop structures above the plunges will divert natural catchment runoff to the proposed surface water drains/sediment control structures and prevent contamination where active plunges are located;
- bunds along the bench will be built as required. These will direct MAW into the adjacent plunges. Bunds will also divert haul road runoff to the surface water drainage systems;
- direct mine water runoff (via gravity) either directly into a plunge or via a sump that dewaters to the plunge;
- as the highwall miner progresses, a mobile coal stockpile will keep pace within 100 m of the highwall miner before being trucked to the CHPP for processing. Disused coal stockpiles that are greater than 100 m from the highwall miner will be rehabilitated; and
- where plunges are no longer active, rehabilitation will commence to cover the voids at the surface. After covering the voids, surface runoff water would not be classified as MAW, and can be treated through the proposed sediment control structures.

The MAW catchment consists of an approximate area of 3.2 ha based on 318 m in length of highwall mining panels (4 active longwall mining panels + 2 panels with rehabilitation commenced) and a 100 m wide bench (including haul road and batter). This is based on:

- Each longwall mining panel is approximately 53.0 m in length and consists of 10 x 3.5 m wide x 1.5 m high plunges. Each panel will include 9 x 1.5 m wide pillars that will be left between each plunge with a 4.5 m wide pillar every 10 plunges; and
- MAW catchment extends from edge of highwall bench to the clean water contour bank on batter slope above highwall batter/plunges (nominally 100 m width).
- One (1) panel (10 plunges) would store approximately 9.9 ML. This is based on the void capacity of each completed plunge of approximately 990 m^3 assuming plunge dimensions of 1 m high, 3.5 m wide and 300 m deep at 3% gradient;
- Each panel will take approximately 1 to 2 weeks to complete;
- MAW catchment runoff for a 10% AEP 72 hour storm event containment (extreme storm storage [ESS]) = 6.1 ML (rainfall depth = 189 mm, catchment area of 3.2 ha, assumed all rainfall is converted to runoff). This is equivalent to two thirds of the storage capacity of a panel;
- Runoff from MAW catchments would be directed to the designated water storage panel using bunds, drains and pumps (where required). Where possible, there will be an interim panel separating the active panel and the water storage panel to limit the amount of seepage through the coal seam into the seam being actively mined. As mining progresses, the water storage panel plunge openings will be buried, with any water stored in the plunge to remain within the voids. The adjacent panel would then be designated the water storage panel;
- Runoff from areas external to the active mining area including haul roads and batters are considered surface runoff water and not MAW provided the two waters do not mix. Surface runoff water would be managed with erosion and sediment control (ESC) structures and can be released after passing through an ESC structure. Surface runoff water does not require water containment; and

- Mobile coal stockpiles will be located within the MAW catchment within 100 m of the highwall miner. The mobile coal stockpile will keep pace with the highwall miner. Coal will be loaded into trucks and hauled to the VS operations. Abandoned coal stockpile areas that are more than 100 m away from the highwall miner will be cleared of any residual coal material (including fines and rejects). Once the area is cleared of residual coal material and the plunges, runoff will be classified as surface runoff water and can be directed to ESC controls.

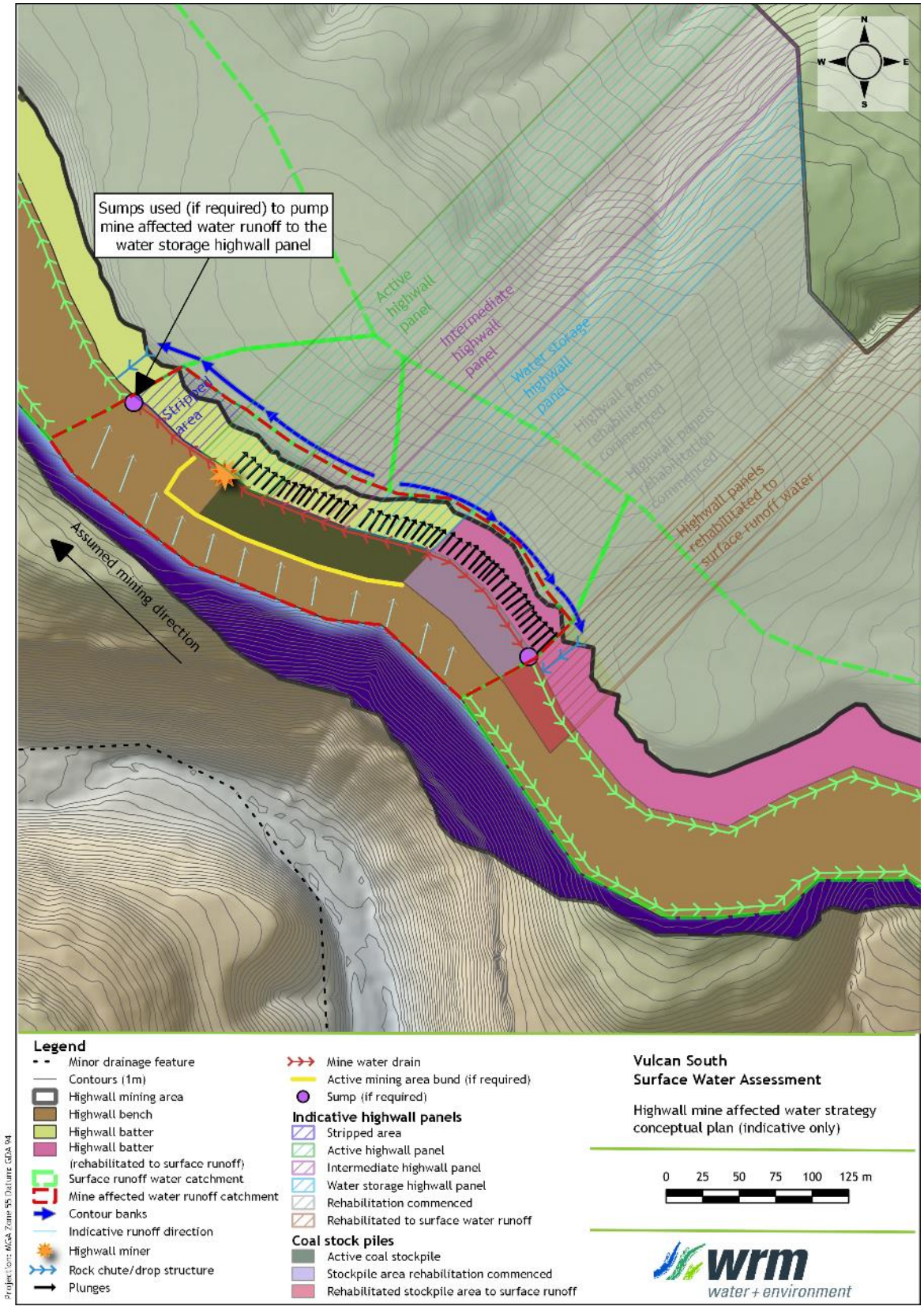

Figure 2.2 – Highwall mine affected water strategy conceptual plan

3 Surface water quality data

3.1 OVERVIEW

Vitrinite has implemented a routine baseline water quality monitoring network since February 2020 within and in the vicinity of the Project to collect baseline (reference) surface water quality along natural drainage lines. A review of the available baseline (reference) surface water quality data has been undertaken to develop locally derived receiving waters trigger values for the Project. The assessment was undertaken in accordance with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality guidelines (ANZG, 2018) for deriving site specific guideline value (SSGVs) for aquatic ecosystems protection from local reference data.

The review has been undertaken using natural surface water quality measurements at relevant baseline (reference) monitoring sites. The available data included monitoring sites on the following drainage lines (see Figure 3.1):

- upstream monitoring points: VSW3, VSW5, VSW11, VESW2, VESW3 and VESW4;
- downstream monitoring points: VSW2, VSW4, VSW7, VSW8, VSW9, VSW10 and VESW1; and
- VSW1 was excluded from the assessment as sampling at this location shows anomalies and could have been potential influenced from external factors or catchments..

The six (6) upstream monitoring points were used for the baseline surface water quality assessment and includes receiving waters locations to the south and north of the Project. These monitoring points have been selected because the catchment characteristics across these drainage lines are similar to those crossing the Project disturbance area and are relevant for setting baseline trigger values for the Vulcan South EA.

Downstream monitoring points will be used to assess the water quality of the receiving waters in the context of the Project. Once the Project commences operations within the downstream monitoring point catchments, these sites will be monitored directly after release events to assess the effect of Project releases.

Prior to operations commencing in the upstream catchment, samples collected at VSW3 and VSW11 are included in the baseline monitoring assessment. Once mining operations commence in the upstream catchment, VSW3 and VSW11 will potentially be affected by the Project disturbance area. Notwithstanding this, VSW3 and VSW11 will be retained as a downstream monitoring points for compliance.

3.1.1 Baseline surface water quality assessment methodology

Vitrinite provided site water quality data collected from February 2020 to October 2022 for this review. Samples were provided at the monitoring sites during ten natural flow events between February 2020 and October 2022.

Locally derived receiving waters trigger values have been proposed for the Project using the 80th percentile of recorded reference site data in accordance with ANZG (2018). The 80th percentile values were compared against the Project Water Quality Objective (WQO) default trigger values provided in Table 3.1 of the SWA report and the DES Model Mine Conditions (MMC) guidelines (DES, 2017). ANZG (2018) states that reference data can be used to derive SSGVs for water quality when natural background concentrations of a toxicant exceed the Project WQO default trigger value.

ANZG (2018) also states that data collected over 2 years of monthly sampling (18 to 24 samples) is regarded as sufficient to indicate ecosystem variability to derive guideline values based on reference site data. To establish local water quality objectives, the Queensland Water Quality Guidelines (QWQG) require that with 3 or more reference sites, 12 samples are collected over at

least 12, but preferably 24 months. Vitrinite has established more than 3 reference sites, which will continue to be either upstream reference sites or reference sites until mining commences.

3.1.2 Comparison of baseline surface water quality data with the Project WQO and MMC default trigger values

The site monitoring data to date has been sampled for at least two (2) and up to ten (10) events across the upstream monitoring site locations. As data collection is limited to periods of flow in an ephemeral system, the samples collected from upstream monitoring sites were combined so that the 80th percentile values could be analysed. In total, 33 samples were taken between February 2020 and October 2022. Table 3.1 shows the 80th percentile values for all parameters measured for the combined upstream monitoring points data set as well as the Project WQO default trigger values and MMC (DES, 2017) default trigger values.

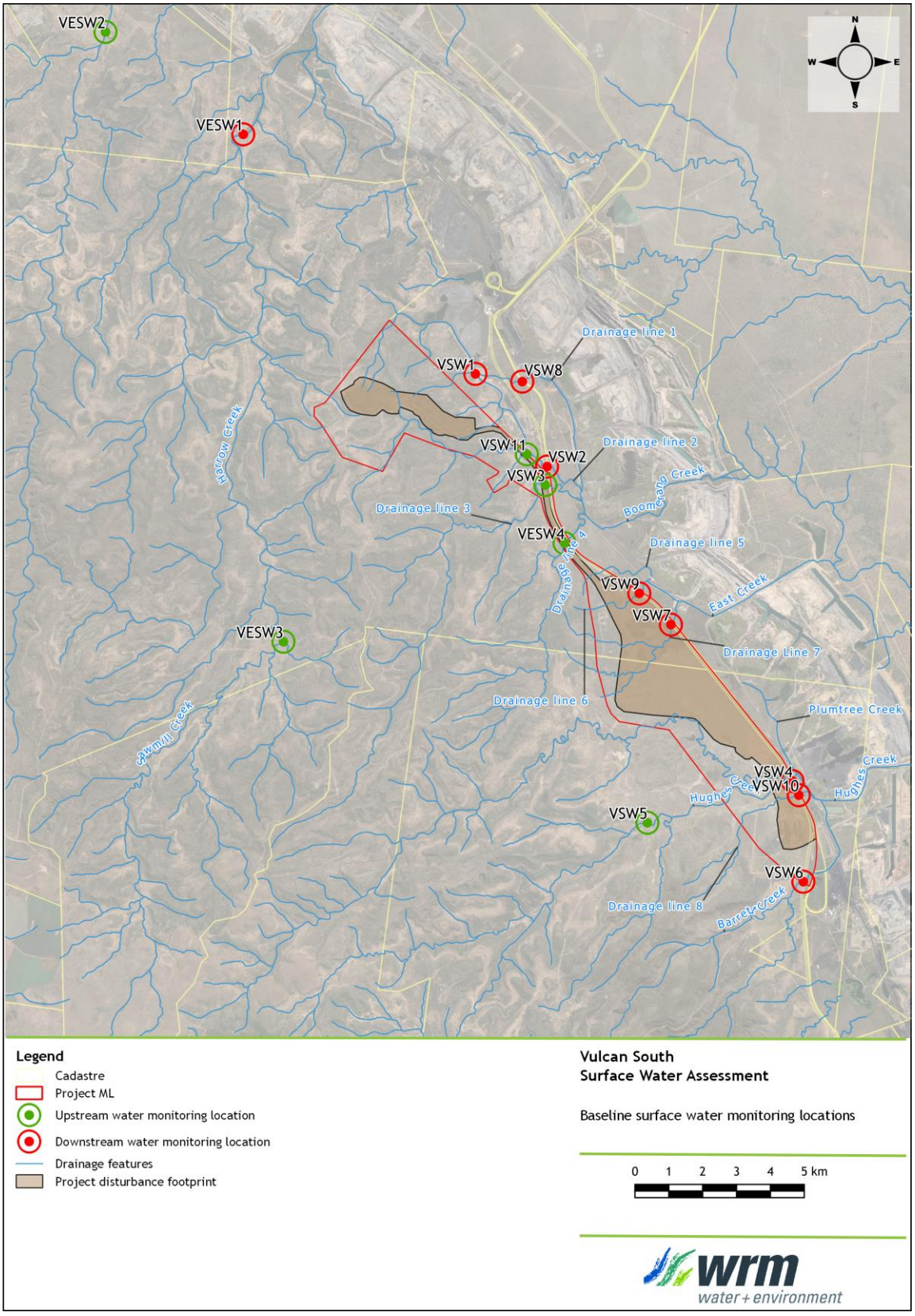

Figure 3.1 – Baseline surface water monitoring locations

Table 3.1 – 80th percentile values for the combined upstream monitoring points data set compared with the receiving water WQO default trigger values and MMC Table F3 trigger values

Parameter	Unit	Upstream monitoring points samples - 80th percentile values	WQO default trigger values (see Table 3.1 of SWA report)	MMC trigger
No. of Samples		33	-	
Physico-chemical parameters				
pH Value	-	7.49	less than 6.5 or greater than 8.5	-
Sodium Adsorption Ratio	-	1.976	-	
Electrical Conductivity	µS/cm	239	> 720 (baseflow) > 250 (high flow)	- -
Total Dissolved Solids (Calc.)	mg/L	155	> 2,000	-
Suspended Solids (SS)	mg/L	**211**	> 55	-
Turbidity	NTU	**464**	> 50	-
Dissolved Oxygen	mg/L	9.56	less than 4	-
Dissolved Metals				
Aluminium	mg/L	0.712	> 0.055	> 0.055
Arsenic	mg/L	< 0.001	> 0.024	> 0.013
Cadmium	mg/L	< 0.0001	> 0.0002	> 0.0002
Chromium	mg/L	< 0.001	> 0.001	> 0.001
Cobalt	mg/L	0.0016	-	> 0.09
Copper	mg/L	0.002	> 0.0014	> 0.002
Lead	mg/L	< 0.001	> 0.0034	> 0.004
Manganese	mg/L	0.0892	> 1.9	> 1.9
Molybdenum	mg/L	< 0.001	> 0.034	> 0.034
Nickel	mg/L	0.003	> 0.011	> 0.011
Selenium	mg/L	< 0.01	> 0.011	> 0.01
Silver	mg/L	< 0.001	-	> 0.001
Uranium	mg/L	< 0.001	> 0.1	> 0.001
Vanadium	mg/L	< 0.01	> 0.5	> 0.01
Zinc	mg/L	0.01	> 0.008	> 0.008
Boron	mg/L	0.056	> 0.37	> 0.37
Iron	mg/L	0.636	-	> 0.3
Mercury	mg/L	< 0.0001	> 0.0006	> 0.0002
Total Metals				
Aluminium	mg/L	12.52	> 5	-
Arsenic	mg/L	0.003	> 0.5	-
Cadmium	mg/L	< 0.0001	> 0.01	-

Parameter	Unit	Upstream monitoring points samples - 80th percentile values	WQO default trigger values (see Table 3.1 of SWA report)	MMC trigger
Chromium	mg/L	0.009	> 1	-
Cobalt	mg/L	0.0076	> 0.1	-
Copper	mg/L	0.012	> 1	-
Lead	mg/L	0.011	> 0.1	-
Manganese	mg/L	0.2816	> 10	-
Molybdenum	mg/L	< 0.001	> 0.05	-
Nickel	mg/L	0.011	> 1	-
Selenium	mg/L	< 0.01	> 0.02	-
Silver	mg/L	< 0.001	-	-
Uranium	mg/L	< 0.001	-	-
Vanadium	mg/L	0.02	-	-
Zinc	mg/L	0.035	> 5	-
Boron	mg/L	0.06	> 5	-
Iron	mg/L	12.5	> 10	-
Mercury	mg/L	< 0.0001	> 0.002	
Major cations and anions				-
Total Hardness as CaCO3	mg/L	38.6	> 150	> 150
Hydroxide Alkalinity as CaCO3	mg/L	< 1.0	-	-
Carbonate Alkalinity as CaCO3	mg/L	< 1.0	-	-
Bicarbonate Alkalinity as CaCO3	mg/L	43.4	-	-
Total Alkalinity as CaCO3	mg/L	43.4	-	-
Sulphate as SO4 - Turbidimetric	mg/L	19.0	> 770	-
Chloride	mg/L	34.6	-	-
Calcium	mg/L	7.6	-	-
Magnesium	mg/L	5.6	-	
Sodium	mg/L	23.6	> 30	-
Potassium	mg/L	7.0	-	-
Fluoride	mg/L	< 0.2	> 2	> 2
Ammonia as N	mg/L	0.396	> 0.02	> 0.9
Nitrite as N	mg/L	< 0.01	-	-
Nitrate as N	mg/L	0.372	> 2.4	> 1.1
Nitrite + Nitrate as N	mg/L	0.476	-	-
Total Kjeldahl Nitrogen as N	mg/L	2.0	-	-
Total Nitrogen as N	mg/L	3.12	-	-

Parameter	Unit	Upstream monitoring points samples - 80th percentile values	WQO default trigger values (see Table 3.1 of SWA report)	MMC trigger
Total Phosphorus as P	mg/L	0.266	-	-
Reactive Phosphorus as P	mg/L	< 0.01	> 0.02	-
Total Anions	meq/L	2.012	-	-
Total Cations	meq/L	2.332	-	-
Ionic Balance	%	7.162	-	-
Hydrocarbons				-
C6 - C10 Fraction	µg/L	< 20	-	> 20
>C10 - C40 Fraction (sum)	µg/L	118	-	> 100
Biological				
Chlorophyll a	mg/m³	5.0	-	-

Notes:
The critical parameter value of the upstream monitoring points samples, WQO default trigger values and the MMC trigger have been shaded in grey.
The ">" symbol indicates an exceedance of a trigger will occur if greater than the trigger value.
The "<" symbol indicates a value that is below the limit of reporting.
Bold/underline indicates the parameter is included as a receiving waters trigger value in the current Vulcan Coal Mine EA. It is proposed to adopt these parameters for the Vulcan South EA.
MMC: Model Mine Conditions ESR/2016/1936 (DES, 2017).
WQO: Relevant Water Quality Objective from Table 3.1 of WRM (2022).

3.2 RECOMMENDED RECEIVING WATERS TRIGGER VALUES

Table 3.2 shows the recommended receiving waters parameters and their trigger values for Vulcan South based on the results presented in Section 3.1. The receiving waters parameters adopted by the current Vulcan Coal Mine EA are proposed for the Vulcan South EA. Updated trigger values for locally derived parameters have been proposed based on the updated review of baseline water quality data. The recommended receiving waters trigger values for all other parameters are based either on the Project WQO, MMC default guideline value or the approved Vulcan Coal Mine EA values.

The summary of the recommended receiving water trigger values to be adopted for the Vulcan South EA include:

- Adopt the 80th percentile values given in Table 3.2 as locally derived trigger values for Filtered Aluminium, total suspended solids, and turbidity. Further monitoring of receiving waters should be continued to update these values;
- Adopt the WQO default trigger values in Table 3.1 of the Vulcan South SWA report (WRM, 2022) for pH, Electrical Conductivity, dissolved oxygen and Filtered Arsenic;
- Adopt the MMC (DES, 2017) default trigger values for Filtered Lead, Filtered Molybdenum, Filtered Selenium, and Filtered Mercury; and
- Adopt the Sulphate trigger value of 770 mg/L based on 95% species protection from Dunlop et al. (2016).

Table 3.2 – Proposed sediment dam release and receiving waters quality trigger values

Parameter	Sediment Dam release point trigger value	Downstream monitoring point trigger value	Source	Frequency
pH (pH units)	6.5 - 8.5	6.5 - 8.5	WQO (aquatic ecosystem)	Upon commencement (the first sample must be taken within 2 hours of commencement of release), daily during release, and within 2 hours after cessation of release.
Electrical Conductivity (µS/cm)	Low Flow[1] <864 Medium Flow[2] <600 High Flow[3] <300	Low Flow[1] <720 Medium Flow[2] <500 High Flow[3] <250	Vulcan Coal Mine EA	
Total suspended solids (mg/L)[4]	253	211	Locally derived	
Turbidity (NTU)[4]	557	464	Locally derived	
Dissolved oxygen	64% - 132% saturation	80% - 110% saturation	WQO (aquatic ecosystem)	
Sulphate (mg/L)	924	770	Dunlop et al. (2016)	
Filtered metals and metalloids				
Filtered Lead (µg/L)	4.8	4.0	MMC (aquatic ecosystem)	Upon commencement (the first sample must be taken within 2 hours of commencement of release), daily during release, and within 2 hours after cessation of release.
Filtered Mercury (µg/L)	0.72	0.6	WQO (aquatic ecosystem)	
Filtered Arsenic (µg/L)	28.8	24.0	WQO (aquatic ecosystem)	
Filtered Aluminium (µg/L)	859	716	Locally derived	
Filtered Molybdenum (µg/L)	40.8	34.0	WQO (aquatic ecosystem)	
Filtered Selenium (µg/L)	13.2	11.0	WQO (aquatic ecosystem)	

1 = Less than 0.5 m^3/s.
2 = (> 0.5 – 5.0 m^3/s).
3 = > 5.0 m^3/s where 10 m^3/s is the maximum release rate in a high flow event.
4 = Interim dam release point trigger values for total suspended solids and turbidity can be exceeded for water discharged from the sediment dam during uncontrolled releases during a heavy rainfall event over and above the sediment dam's design storage capacity.
Note: Above flow rates to be recorded at downstream monitoring points where catchments are disturbed by Project operations.

3.3 RECEIVING WATER QUALITY MONITORING

The DES information request had requested sediment dam release water trigger values for the Project to confirm that surface water runoff is of a suitable water quality to be managed by sediment control structures in accordance with an Erosion and Sediment Control Plan. It is recommended that the Vulcan South EA adopt the values shown in Table 3.2 which are 20% higher than the adopted receiving waters trigger values. It is noted that for most cases, these values would be below the maximum value recorded at the upstream monitoring point locations. This would allow for some dilution with receiving waters upstream of the receiving waters monitoring location. The adopted values can continue to be refined as additional water quality testing is undertaken to better define the surface runoff characteristics from the Project.

It is recommended that water samples be taken at the spillway or pipe outlet during sediment dam release events. It is also recommended that any conditioning of sediment dam water quality be related to the receiving waters water quality sample results. If it is found that sediment dam releases consistently exceed the sediment dam release water trigger values at the same time that the receiving waters water trigger values are exceeded, it is recommended

that an investigation into the exceedances be trigger by EA conditions. Conditions should also require the results of the investigation and associated mitigation and management measures to be reported to the administering authority.

The mitigation measures that are implemented should be undertaken with the aim of preventing these exceedances from reoccurring. This may include investigating the potential source of poorer quality water and/or dewatering runoff from the affected catchment area to the mine water system until the contamination source can be identified and remediated. Exceedance of sediment dam triggers should not trigger the requirement for a sediment dam to be converted to a mine affected water dam.

3.4 DISSOLVED INORGANIC NITROGEN

Dissolved inorganic nitrogen (DIN) loads were assessed using the baseline surface water quality samples to support the aim of reducing end-of-basin fine-sediment and DIN loads. The *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) provides guideline values for DIN based on findings within *Updating nitrate toxicity effects on freshwater aquatic species* (C.W. Hickey, 2013). Table 3.3 provides the Guideline concentration for Nitrate-N, derived using the ANZECC methodology and the updated species database. It should be noted that the guideline values presented are for Nitrate as N values which make up only part of calculated DIN loads.

DIN loads are calculated as the sum of Ammonia as N, Nitrite as N and Nitrate as N. Vitrinite also samples monitoring points located at the sediment dams currently approved for the Vulcan Coal Mine. The sediment dam samples represent the indicative water quality data for any potential releases to receiving waters for the Project. Table 3.4 shows the comparison of 80th percentile values for upstream monitoring point locations and sediment dam DIN loads to the guideline Nitrate as N value.

The comparison shows that the 80th percentile values for the upstream monitoring point and the sediment dam samples, DIN concentrations are below the threshold guideline nitrate concentration value for 95% protection. As such, in the event of an uncontrolled release from sediment dams, DIN concentrations on site are likely to have negligible impact and result in ‘no net decline’ in water quality.

In an event where DIN loads contained in sediment dams on site exceed the guideline value, it is recommended that water is pumped to the mine water dam system and an investigation into the cause for exceedance of the guideline value is undertaken. Any mitigation or management measures as a result of the investigation should be implemented and reported to the administering authority.

Table 3.3 – Guideline derivations for Nitrate-N, grading guidelines are based on species NOEC values and Surveillance guideline threshold effect concentration (TEC) values.

Guideline type	Grading Nitrate concentration (mg NO3-N /L)	Surveillance Nitrate concentration (mg NO3-N /L)	Description of Management Class
Chronic – high conservation value systems (99% protection)	1.0	1.5	Pristine environment with high biodiversity and conservation values.
Chronic – slightly to moderately disturbed systems (95% protection)	**2.4**	**3.5**	**Environments which are subject to a range of disturbances from human activities, but with minor effects**
Chronic – highly disturbed systems (90% protection)	3.8	5.6	Environments which have naturally seasonally elevated concentrations for significant periods of the year (1-3 months).
Chronic – highly disturbed systems (80% protection)	6.9	9.8	Environment which are measurably degraded and which have seasonally elevated concentrations for significant periods of the year (1-3 months).
Acute	20	30	Environments which are significantly degraded. Probable chronic effects on multiple species
Method of comparison	Annual median	Annual 95th percentile	-

Note: Bold indicates default guideline values applicable to most waters (C.W. Hickey, 2013)

Table 3.4 – Comparison of Nitrate as N guideline value to dissolved inorganic nitrogen surface water quality data

Parameter	Unit	80th percentile at upstream monitoring point	80th percentile site samples from sediment dams	Guideline value of Nitrate as N (C.W. Hickey, 2013)
Ammonia as N	mg/L	0.396	0.26	-
Nitrate as N	mg/L	0.372	1.71	2.40
Nitrite plus Nitrate as N	mg/L	0.476	1.71	-
Dissolved inorganic nitrogen	mg/L	1.146	1.82	-

4 References

ANZECC & ARMCANZ, 2000	*'Australian and New Zealand Guidelines for Fresh and Marine Water Quality'*, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (2000).
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
C. W. Hickey, 2013	*'Updating nitrate toxicity effects on freshwater aquatic species'*, C. W. Hickey, National Institute of Water & Atmospheric Research Ltd, prepared for Ministry of Building, Innovation and Employment, January 2013.
DES, 2017	*'Guideline Model Mining Conditions'*, ESR/2016/1936, Version 6.02, Effective 07 March 2017.
Dunlop et al., 2016	*'Toxicity guideline values for sulphate in hard waters'*, Australiasian Bulletin of Ecotoxicology & Environmental Chemistry, Volume 3, 2016, pp. 1-10.
IECA, 2008	*'Best Practice Erosion and Sediment Control Guideline'*, International Erosion Control Association (IECA), November 2008.
RGS, 2022	*'01_2022014_Geochemical Assessment of Waste Rock, Coal Reject and Coal_Rev 01'*, prepared for METServe by RGS Environmental Consultants Pty Ltd, March 2022.
WRM, 2022	*'Vulcan South Surface Water Assessment'*, report prepared for Vitrinite Pty Ltd by WRM Water & Environment, May 2022.

Appendix A - WRM responses to DES information request

Table A.1: WRM responses to DES information request relating to Surface Water Management

Item	Relevant document section	Comment	Requirement	Response
1.8	**Section 5.3 Water management strategy overview**	Appendix A, section 5.3 contends that 'surface water' (i.e. non-mine affected water [MAW]) should include surface water run-off that has come into contact with areas disturbed by mining operations including out-of-pit waste rock emplacements. Additionally, it is argued that whilst this surface water may have a high sediment load, it will remain compliant with water quality objectives (WQOs). The department notes that the applicant proposes to manage this surface water via sediment removal at sediment dams prior to any release. However, additional evidence is required to support the determination that any surface water released will be compliant with the WQOs for the receiving waters. The applicant must demonstrate that this water can be managed appropriately and will not cause environmental harm to the receiving environment if released. Further, it is unclear how areas disturbed by mining operations could be effectively managed to prevent the contamination of surface water with coal, carbonaceous material or other contaminants. Coal and carbonaceous material would likely be present on haul road surfaces, laydowns and the exposed surfaces of out-of-pit waste rock dump.	(a) Provide additional details, including maps of the 'areas disturbed by mining operations' proposed to produce 'surface water' as opposed to MAW. (b) Provide additional evidence to support the proposed management of 'surface water'. Evidence in the form of water quality monitoring data from the VCP and/or an appropriate analogous site/s is permissible. (c) Provide additional details of the management measures to be employed to prevent the contamination of surface water with coal, carbonaceous material and other contaminants. Where surface water becomes contaminated, provide additional details as to how this is proposed to be managed and monitored	(a) Section 2.1.1 of this report presents the overview of the water management strategy and separation of mine affected water and surface/diverted water catchments and Section 2.1.2 of this report presents the updated catchment and water management strategy for Stage 2 (Year 2026) of the Vulcan Main mining area. Figure 1.3 to Figure 1.13 of the SWA report (WRM, 2022), provide the proposed catchment plans for each stage of the Project. (b) Section 3 of this report provides a review of baseline monitoring data and trigger values to determine recommended receiving water trigger contaminant values for the Project. (c) Section 2.1.1 to 2.1.3 of this report presents the details of the water management strategy for the Project and additional details regarding the proposed MAW management strategy during the highwall mining stages of the Project.
1.9	Section 9.2 Reef discharge standards	Section 2.1.2.2 *Release source – waste water from the relevant activity* of the department's guideline – 'Reef discharge standards for industrial activities' (Version 1.02) [ESR/2021/5627] specifies when section 41AA of the Environmental Protection Regulation 2019 (EP Reg) applies. Assuming that surface water is justifiably determined to contain sediment only, and no coal, carbonaceous material or other contaminants, section 41AA does not apply. The department notes that nitrogen may also be relevant where blasting is carried out. However, regardless of this determination, appropriate erosion and sediment control measures will be conditioned through the pending environmental authority to prevent as much sediment as is practical from entering the Great Barrier Reef catchment waters. The applicant is advised to propose an updated Erosion and Sediment Control Plan (ESCP) that is robust and effective in minimising contributions of total suspended sediment (TSS) and dissolved inorganic nitrogen (DIN) so as to support the aim of reducing end-of-basin fine-sediment and DIN loads.	(a) Confirm potential sources of DIN for the project. (b) Update the contents and requirements of the proposed ESCP.As a minimum, the ESCP should include: (i) an assessment of the size and characteristics of all catchment areas; and (ii) an assessment of relevant properties of soils and waste materials; and (iii) identification of receiving waters environmental values, water quality objectives and management intent; and (iv) specification of minimum design criteria for erosion and sediment control structures to achieve the management intent of receiving waters; and (v) locations and descriptions of all erosion and sediment control measures; and (vi) an audit schedule to ensure erosion and sediment control measures are maintained.	(a) Section 3.4 of this report presents the water quality results from sediment dams and the downstream monitoring points of the VCM project. The results of this assessment shows that DIN values are below the 95% protection values from ANZG (2018). Potential sources of DIN associated with project would include: • naturally occurring within the formation and overburden material; • the pit area where blasting occurs. Runoff from the pit will be managed within the Mine Water System and will not be discharges offsite; and • within the onsite explosives storage facility, which will be stored in sealed containers. Notwithstanding this, significant sources of exposed DIN are not expected to be located within surface water catchments or diverted water catchments. (b) An ESCP/WMP will be developed prior to operations to address DES comments. As per Section 9.2, the ESCP will address: • the fullest separation possible of diverted, surface and mine-affected water runoff; • the diversion of upstream runoff from disturbed areas; • the stabilisation of soils in disturbed areas; and • the installation and maintenance of control measures such as sediment and erosion control devices (e.g., silt fences, swales, settling basins, energy dissipaters and vegetated buffers). The WMP will address: • description of measures that are in place to separate clean water from areas where it may collect fine sediment; • description of treatment measures to remove fine sediment from water before being released (such as settlement ponds); • modelling to demonstrate effectiveness of these measures; and • contingency measures for unforeseen storm events.
1.10	Section 7.3.10 Release Scenarios	Appendix A, section 7.3.10 includes an assessment of the effects of releases from sediment dams on the water quality of receiving waters. However, these scenarios only account for the electrical conductivity and release flow rate from sediment dams. It is unclear why TSS or other relevant WQOs have not been included in the modelled scenarios.	(a) Justify why the 'worst-case' scenario modelling for impacts to receiving waters only includes EC and flow rate; and (b) Pending the response to (a), provide additional modelling that accounts for key contaminants including TSS and heavy metals – selenium, arsenic and molybdenum.	(a) As outlined in EPP (WWB), salinity is used as the adopted indicator of water quality as it is typically the key limiting contaminant of concern for coal mines and is historically of most interest for agricultural and domestic use. (b) Other contaminants have not been modelled, however, if baseline water quality monitoring samples shows that other contaminants within runoff may be of concern, the assessment can be updated to include additional water quality parameters.

Item	Relevant document section	Comment	Requirement	Response
1.13	Section 5 Proposed surface water management strategy and infrastructure	The department notes that MAW will be generated in areas disturbed by highwall mining. With reference to Appendix A, Figures 1.9 and 1.10, it is unclear how MAW will be effectively managed so as to prevent releases to the receiving environment and maintain separation of MAW from other waters such as surface run-off. Specifically, Figures 1.9 and 1.10 do not appear to include mine water infrastructure needed to manage MAW such as mine water dams – or in place of dams – drains, sumps and/or piping for the conveyance of MAW to a suitable storage.	a) Provide additional details as to how surface water is to be managed within the extent of areas disturbed for highwall mining, with specific regard to MAW. Clarification should include conceptual drainage plans for all years of active highwall mining before rehabilitation is completed.	(a) Section 2.1.3 of this report presents the proposed MAW management strategy for the highwall mining trial area. The highwall mining test area will last 1 year and consist of general earthworks associated with benching, battering, haul roads and rehabilitation. Runoff from earthworks associated with these activities will be managed using erosion/sediment control structures. As the highwall miner progresses, the plunges where coal is extracted will be buried, battered and rehabilitated. Hence, the expected active disturbance area of the highwall miner is expected to be up to a 3.2 ha area along the coal face at any given time before completed exposed coal faces are buried and rehabilitation works to surface water runoff is completed. Hence, runoff will have minimum contact with coal surfaces. In addition, the pad will be graded towards the exposed coal face so that surface runoff in the vicinity of the highwall miner will drain into the voids left behind by the highwall miner. Proposed sumps will collect any other mine affected water runoff from contamination of rehabilitated or undisturbed surface water runoff catchments. Where possible, contour banks and drop structures will divert natural catchments around the active mining area. Hence, the environmental risk of mine affected water runoff from the highwall mining test area is considered low and the proposed water management system is considered suitable. Notwithstanding this, erosion and sediment control measures will be monitored in the vicinity of the active highwall mining areas. Mine water dams can be proposed if this is the case, and pumped out to MWDs within the main project area.
1.14	Section 5.5.1 Sediment dam locations and sizing	Appendix A, section 5.5.1 discusses the sizing and placement of sediment dams for surface water management. However, this section also explains that runoff from haul roads and access roads is to be captured by sediment basins, before being either released to the receiving environment or returned to the mine water system. Additional justification is required to support the treatment of surface water collected from haul roads as surface water and not MAW.	(a) Provide additional details of water collected from haul roads, including whether this water will be MAW and if said water will be contaminated by coal, carbonaceous material, hydrocarbons, or other contaminants which are predicted to exceed the identified water quality objectives for release (WQOs). (b) Should the response to (a) confirm that water is determined to be MAW, provide updated and/or additional information pertaining to: (i) the proposed surface water management strategy and infrastructure; (ii) updated conceptual drainage plans; and (iii) any further updates to the supporting information necessary to ensure consistency and accuracy (i.e. water balance modelling or water management system assessment).	(a) As per Section 5.5.1 in WRM (2022), erosion control structures for the haul road will be designed to align with Best Practice Erosion and Sediment Control Guidelines (IECA, 2008) prior to operations/construction when the haul road designs and their catchments are finalised. If it is identified that monitoring of these sediments dams that capture haul road water may exceed any WQO, these can be pumped back to the Mine Affected Water system. Per the VCM EA, haul roads constructed out of coal rejects would be considered a source of MAW. Haul roads will not be constructed using coal rejects in areas that drain to a sediment dam. (b) The highwall mining area MAW strategy will conservatively manage any runoff from the haul road in the vicinity of the active highwall mining area as MAW runoff. The MAW will be managed as discussed in Section 2.1.3 of this report to prevent contamination of surface water runoff catchments.
1.26	Section 7.3.7 Releases/overflows to the receiving waters and Section 9.3.1 Release contaminant trigger investigation levels	Appendix A contemplates the proposed release of 'surface water' via sediment dams. Section 3 of Appendix A identifies the WQO trigger levels for the receiving waters. Further, section 9.3.1 of Appendix A identifies the receiving water contaminant trigger levels. The trigger levels of Table 3.1 and Table 9.3 are compared below.	(a) Provide additional details as to how the proposed levels were formulated. (b) Provide additional details as to how the proposed levels will protect EVs of the receiving waters. (c) Provide additional details as to the formulation of interim trigger levels for TDS and TSS – that will protect the EVs of the receiving waters.	(a) Trigger values presented in Section 3 are default WQOs set based on regional values. Revision will be made to the baseline WQOs using the monitoring point sample data collected over recent flow events. The new WQOs will be set in accordance with the Australian and New Zealand Guidelines for Fresh and Marine Water Quality guidelines (ANZG, 2018) for deriving site-specific guideline value (SSGVs) for aquatic ecosystems protection from local reference data. Since the completion of the VS Surface Water Assessment, the VCM EA has assigned trigger values for dams release points and receiving waters. In addition, locally derived trigger values have been developed based on baseline surface water monitoring data for VCM and VS. On this basis, Table 3.2 will be adopted for the VS for consistency across the sites. (b) Section 3.2 of this report presents the recommended trigger values proposed to identify any potential to affect water quality of receiving waters which are derived from local reference data at upstream (undisturbed/natural catchments) for comparison to reference monitoring points downstream of the Project disturbance area. (c) Section 3.2 of this report presents the trigger values of receiving water quality which were formulated initially by adopting 20% above the recommended trigger values These would be less than the maximum values recorded at reference monitoring locations and these can be re-evaluated if sediment dam releases exceed these triggers.

Parameter	Table 3.1	Table 9.3
pH	6.5 – 8.5	6.5 – 8.0
EC (µS/cm)	720 (base flow) 250 (high flow)	1,500
TDS (mg/L)	< 2,000	?
TSS (mg/L)	< 55	?
Sulphate (SO_4^{2-}) (mg/L)	25	1,000

It is unclear how levels have been formulated to protect environmental values (EVs) and why interim trigger levels have been developed for parameters with the exception of TDS and TSS. Further, it is unclear how impacts to the receiving waters can be managed and minimised without proposed trigger limits for TDS and TSS.

Item	Relevant document section	Comment	Requirement	Response
1.27	Section 9.5 Sediment dam monitoring	Section 9.5 of Appendix A states that sediment dams will be monitored for a suite of water quality parameters. (i.e. pH, EC, major anions [sulphate, chloride and alkalinity], major cations [sodium, calcium, magnesium and potassium], TDS and a broad suite of soluble metals/metalloids). However, it is unclear if parameters will include those which are necessary to determine 'surface water' reporting to sediment dams is not MAW and is otherwise suitable for release. Specifically, parameters to be confirmed include: • Dissolved inorganic nitrogen (DIN); • Turbidity (NTU); • TSS; • Total Petroleum Hydrocarbons (TPH); and • Any other proposed parameters required to verify 'surface water' is not MAW.	(a) Provide additional details as to the parameters to be monitored for at sediment dams.	(a) Section 3.2 and Table 3.2 of this report presents the suite of water quality parameters to be monitored within sediment dams including pH, EC, TSS, NTU, Dissolved Oxygen, Sulphate and various metals including lead, mercury, arsenic, aluminium, molybdenum and selenium. Section 3.4 and Table 3.3 of this report presents the guideline values of DIN, which will also be monitored within sediment dams Mine water dams are proposed to capture mine affected runoff via proposed mine water drains. The proposed sediment dams are to capture surface water runoff via proposed surface water drains to ensure separation from any mine affected water. Per our response to 1.26, It is recommended that the parameters and trigger values in Table 3.2 for dam releases be adopted for the VS for consistency with the Vulcan Coal Mine.