MEMORANDUM

To:	Vulcan Coal Management Pty Ltd
Attention:	Gary Robertson, Andrew Bailie, Aromal Murali, Jamey Mitchelson
Prepared By:	Ty Grantham
Reviewed By:	Tom Sullivan
Date:	15 June 2022
Memo Ref:	BMS-P21017C-VIT-VUL-M-5-V1.0
Subject:	June 2022 Quarterly Geotechnical Inspection – Jupiter and Dyno Pits

1 INTRODUCTION

This memorandum details the outcomes of Blackrock Mining Solutions' (Blackrock) 5th quarterly geotechnical inspection of Jupiter and Dyno Pits at the Vulcan Mine Complex near Dysart in the Bowen Basin. The inspection was carried out by Ty Grantham of Blackrock on 9 June 2022, accompanied by Clayton McLeod, Open Cut Examiner (OCE).

The intent of the inspection was to identify areas of the current exposures within the Jupiter (Strip 5 and the Strip 6 free dig area) and Dyno Pits that are classified as a geotechnical hazard or have the potential to cause geotechnical instability, in accordance with the Geotechnical Principal Hazard Management Plan (GPHMP) and Trigger Action Response Plan (TARP).

The inspection focused on the exposed highwalls, endwalls, and lowwall in Jupiter Pit, as well as the external waste dump areas. Figure 1-1 shows the as-constructed pit configuration as of 9 June 2022.

The mine areas inspected included:

- Strip 5, Blocks 1 and 2 (highwall, endwall, lowwall, and crest area behind the highwall);
- Strip 6 (free dig area);
- Dyno Pit; and
- External waste dump areas.

Figure 1-1: Jupiter Pit – As-Constructed Mine Layout (09/06/2022)

2 FIELD OBSERVATIONS – JUPITER PIT

2.1 Operational Observations

At the time of inspection, coal had been mined to be base of the DLL Seam in Strip 5. The thin DLLL parting had been drilled and was being prepared for loading and blasting, after which the DLLL Seam would be mined.

Truck and shovel operations are currently ongoing in Strip 6, which is essentially a holding pit whilst the Saraji Road re-alignment is completed. It was indicated by Vulcan personnel that the Saraji Road re-alignment was behind schedule, and this had affected the mine plan.

No activities were observed in Dyno Pit, however, topsoil dumping was ongoing in the south of the pit, as it was indicated by the OCE that the backfilled topsoil had been potentially contaminated with hydrocarbons.

Spoil material was actively being dumped onto the western external dump.

All geotechnical hazards were identified, and critical controls assigned as per the OCE's shift report.

The following section describes the observations made during the site inspection conducted on 9 June 2022, with reference to Figure 1-1.

2.2 Strip 5, Blocks 1 and 2

Observations from Strip 5, Blocks 1 and 2 are as follows:

- Strip 5 was generally dry with no signs of water seepage or wet patches observed on the pit slopes. However, a significant rainfall event that had occurred in mid-May was likely to have contributed to slope instability in the pit. Fresh rock bench slope height was approximately 20 to 25 m at the time of the inspection;
- Two joint sets, i.e., J1 and J2, were a prominent feature observed on the highwall. An asymmetrical wedge failure mechanism had occurred approximately in the central portion of the highwall, as shown in Figure 2-1. Cling-on material in front of the main failure plane had prevented this failure mechanism from forming completely. Therefore, there is the potential for further toppling and wedge failures and rockfall to occur. It was indicated that the failures had occurred after the rainfall event;
- A 15 m standoff and additional bund height was implemented to manage the wedge failure and toppling mechanisms, as shown in Figure 2-1;
- The approximate orientation, based on field mapping orientations, are as follows:
  - Joint Set 1 (J1): 85°/050° (approximate dip/azimuth), and
  - Joint Set 2 (J2): 75°/185° (approximate dip/azimuth);
- Other toppling mechanisms were observed along the highwall face involving J1, as shown in Figure 2-2;
- No faults or shear zones were observed or reported on the exposed pit slopes;
- The condition of the Strip 5 highwall was generally reasonable, however, the propensity for slabbing, due to the thinly bedded rock mass, had resulted in localised back-break and crest loss, beyond the pre-split barrel traces;
- No cracking was observed behind the highwall crest; and
- No stability issues were observed along the lowwall, as shown is Figure 2-3.

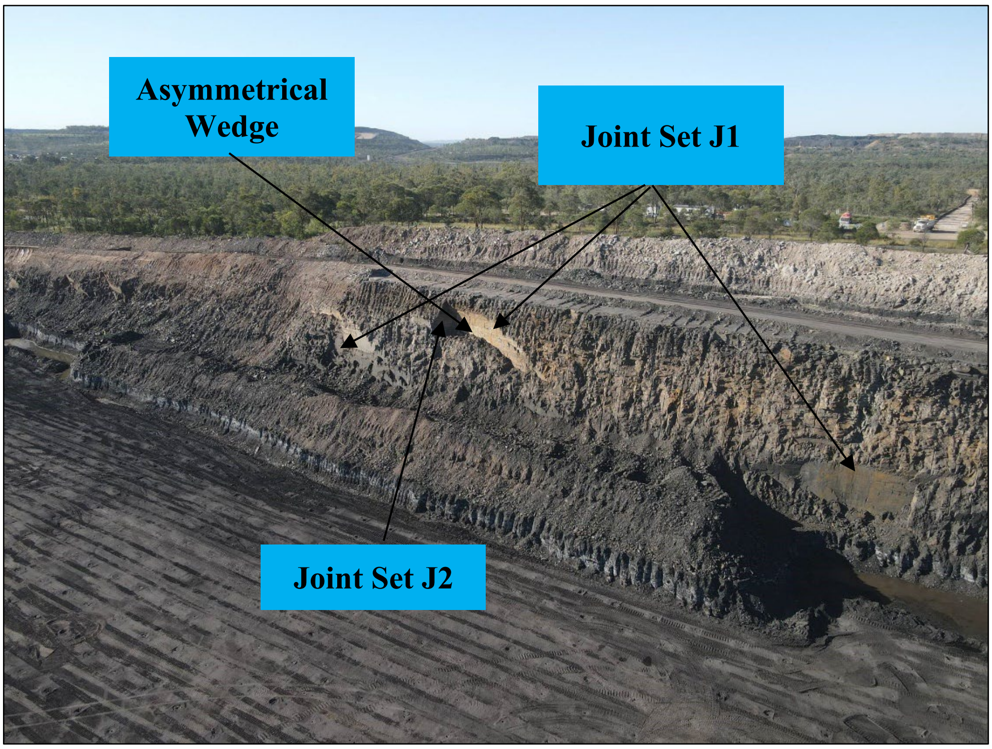

Figure 2-1: Strip 5 (Looking North)

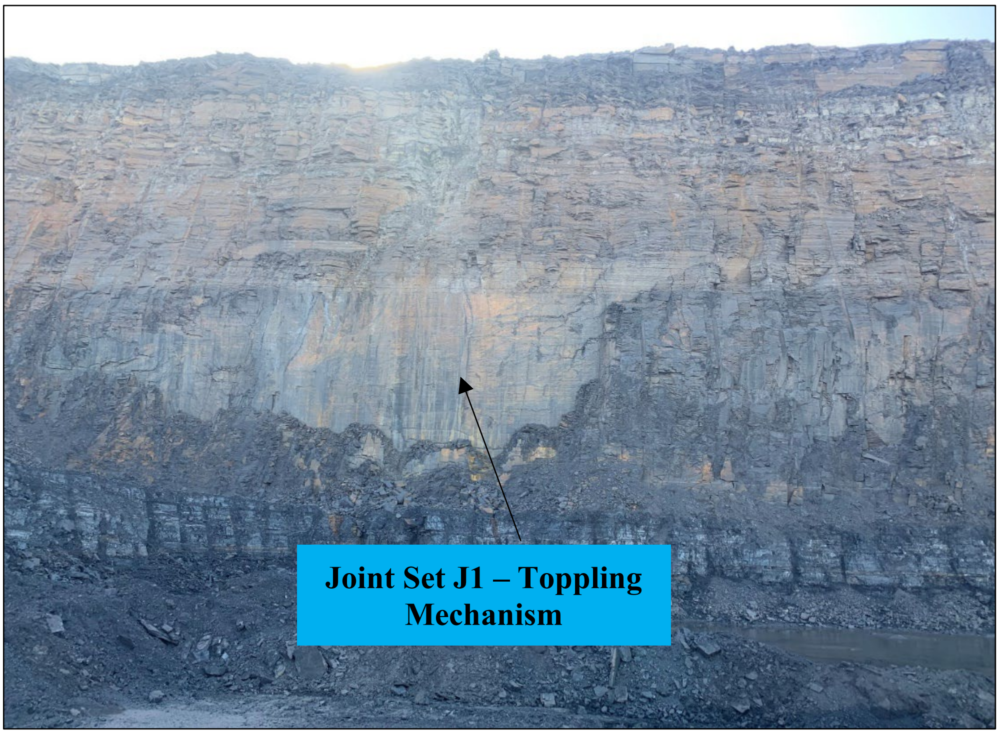

Figure 2-2: Strip 5 Highwall Joint Structure (J1).

Figure 2-3: Strip 5 Lowwall (Looking Northwest)

2.3 Strip 6

Observations from Strip 6 are as follows:

- Generally, no significant slope instability was observed in Strip 6;
- It was noted that the Tertiary horizon thickens in this area, and some possible minor oversteepening of the Tertiary towards the south of the pit had occurred, as shown in Figure 2-4; and
- Surface water was observed in the northern corner of pit.

Figure 2-4: Strip 5 Lowwall (Looking East)

2.4 Dyno Pit

Observations from Strip 6 are as follows:

- A bench-scale slump in the upper Tertiary horizon was observed, as shown in Figure 2-5 and Figure 2-6. It was indicated by the OCE that the failure occurred approximately 48 hours after the significant rainfall event in the region several weeks earlier;
- From the aerial photos, it is likely that drainage behind the crest would not have been suitable to facilitate the flow of water away from the crest during the rainfall event. In this case, ponded water behind the crest and subsequent infiltration would have contributed significantly to the failure. As noted in the OCE report, ponding of water was noted behind the highwall;
- The Tertiary horizon in this part of the mine was approximately 10 m thick, and it was noted from the pit floor observation level that the batter was potentially slightly over steepened; and
- Backfilled topsoil at the southern end of the pit appeared to be stable, as shown in Figure 2-7.

Figure 2-5: Dyno Pit – Highwall Slump – Aerial Photo

Figure 2-6: Dyno Pit – Highwall Slump – Aerial Photo

Figure 2-7: Dyno Pit – Topsoil Backfill

2.5 External Spoil Dumps

There were no geotechnical stability issues observed or noted from the external spoil dumps, as shown in Figure 2-8. It was noted that the upper dump bench was at RL 275 m, which is at the maximum height.

Inspection of the dumped material indicated primarily Category 2 to 2.5 spoil, with some spoil piles up to Category 3 to 4, in accordance with the Simmons & McManus (2004) framework.

It was indicated that some ponding of water was observed after the rainfall event and these areas were pushed down to allow the water to drain.

Figure 2-8: External Spoil Dump

3 CONCLUSIONS

The following observations and conclusions were derived from the 5th quarterly geotechnical inspection of Jupiter Pit on 9 June 2022:

- Strip 5 had been mined down to the DLL Seam. Preparations for blasting the thin stone band to the top of the DLLL Seam were ongoing;
- Joint sets J1 and J2 appear to be pervasive in Strip 5 and have resulted in the formation of an asymmetric wedge failure and numerous toppling configurations:
    - J1 joints are vertical to subvertical and have affected the pre-split blasting, resulting in some potential for rockfalls and toppling on the highwall; and
    - J2 joints appear to intersect the highwall face obliquely and are unlikely to result in adverse planar or toppling kinematic geometries; however, is likely to form wedge failure geometries in combination with J1.
- Antecedent rainfall was likely the driver of the Tertiary horizon failure in Dyno Pit. Additionally, the slope in this upper horizon may have been slightly over-steepened;
- Slopes are generally low height and appear to pose no significant risk of global-scale failure; and
- No slope stability issues were identified of the external waste dump areas.

4 RECOMMENDATIONS

It is recommended that the current strategy of a 10 m exclusion zone from the slope toe line along with regular laser scan surveys are the most effective means of mitigating slope failure risks, particularly for the toppling mechanisms along the Strip 5 highwall. Increasing the exclusion zone up to 15 m for the larger failure mechanisms, such as the larger asymmetrical wedge mechanism (Figure 2-1), is also endorsed if required.

As discussed with Vulcan personnel, the various highwall sections would continue to be monitored regularly with the laser scanner and OCE inspections, in accordance with the GPHMP and the updated TARP.

Going forward, the mine should continue to apply the generally accepted critical controls for managing geotechnical hazards, as follows:

- Excavate to the recommended geotechnical design;
- Restrict access and placement of exclusion zones around the slope faces and known hazard areas;
- Construction of catch bunds along the toe of the slopes, where rock falls and failure mechanisms are anticipated; and
- Monitoring, measuring and interpretation of known hazards.

5 REFERENCES

Blackrock Mining Solutions (Blackrock) (2021). "Memorandum – 4th Quarterly Geotechnical Inspection – Jupiter Pit (February 2022)". Memo Ref: BMS-P21017C-VIT-VUL-M-4-V1.0. Issue Date: 6 March 2022.

Simmons, JV & McManus DA (2004). "Shear Strength Framework for Design of Dumped Spoil Slopes for Open Pit Coal Mines". Proceedings of *Advances in Geotechnical Engineering: The Skempton Conference*, Jardine RJ, Potts, DM & Higgins KG (eds), Vol 2, 981-991, Thomas Telford, 2004.

Ty Grantham
Principal Consultant
BAppSc, MEngSc, CP Geotechnical,
RPEQ #18482
Blackrock Mining Solutions Pty Ltd

M: +61 437 881 075
E: t.grantham@blackrockmining.net