DAWSONWEST

Principal Hazard Management Plan
Geotechnical

Contents

Figures

1. PURPOSE

Geotechnical hazards can pose significant risk to a mining operation as they have the potential to result in multiple fatalities. Following the BBRA, geotechnical hazards in the open pit mining environment are considered to be a Principal Hazard and require proactive geotechnical management systems to reduce the potential risk to an acceptable level.

The PHMP provides guidelines and methods by which geotechnical hazards are to be identified and managed so that risks may be reduced to an acceptable level. The PHMP outlines personnel and operational responsibilities in conjunction with providing guidelines and methods for managing geotechnical hazards associated with the operations.

The hierarchy of control is utilized at Dawson West Coal Mine to manage geotechnical risk. Examples of how the hierarchy of controls may be applied to geotechnical hazards are provided in Figure 1, below. Note that the examples provided in Figure 1 may not be applicable in specific instances and/or other controls may be more appropriate.

Often controls can be placed in multiple sections (e.g. blasting is an elimination and engineering control). These controls are detailed in this document, DWCM-SOP-003a-Ground Control Management and DWCM-SOP- 003b-Ground Control Monitoring.

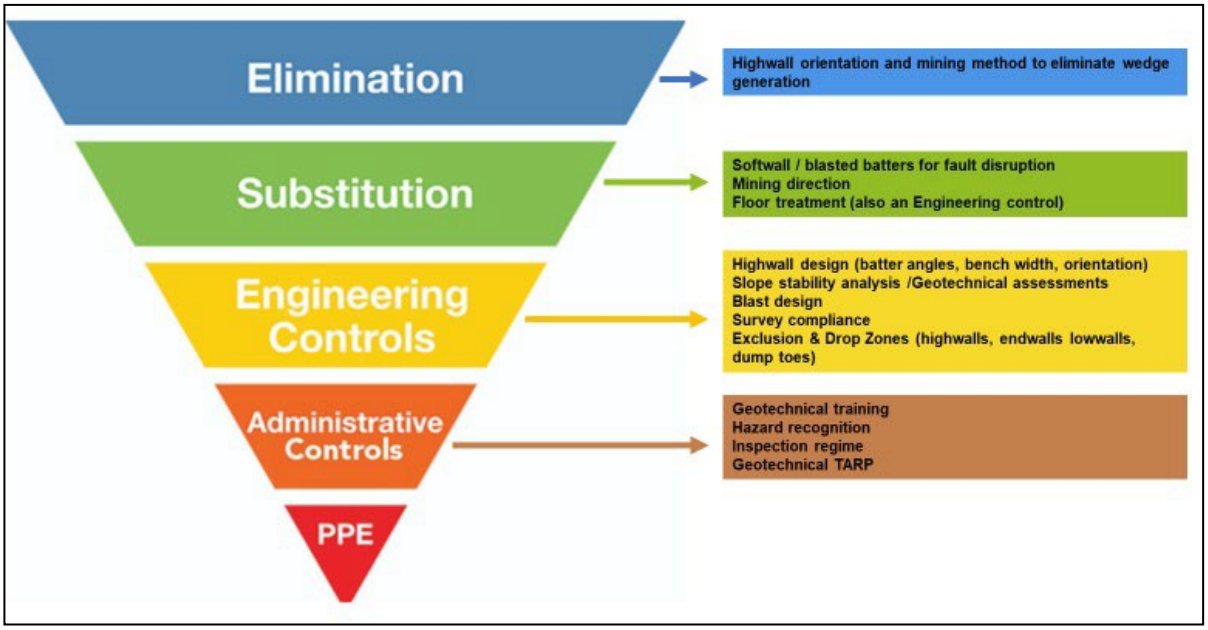

Figure 1: Geotechnical Hierarchy of Control

The Dawson West Coal Mine geotechnical framework is outlined in the below flow diagram. This details the process for managing geotechnical risks on site.

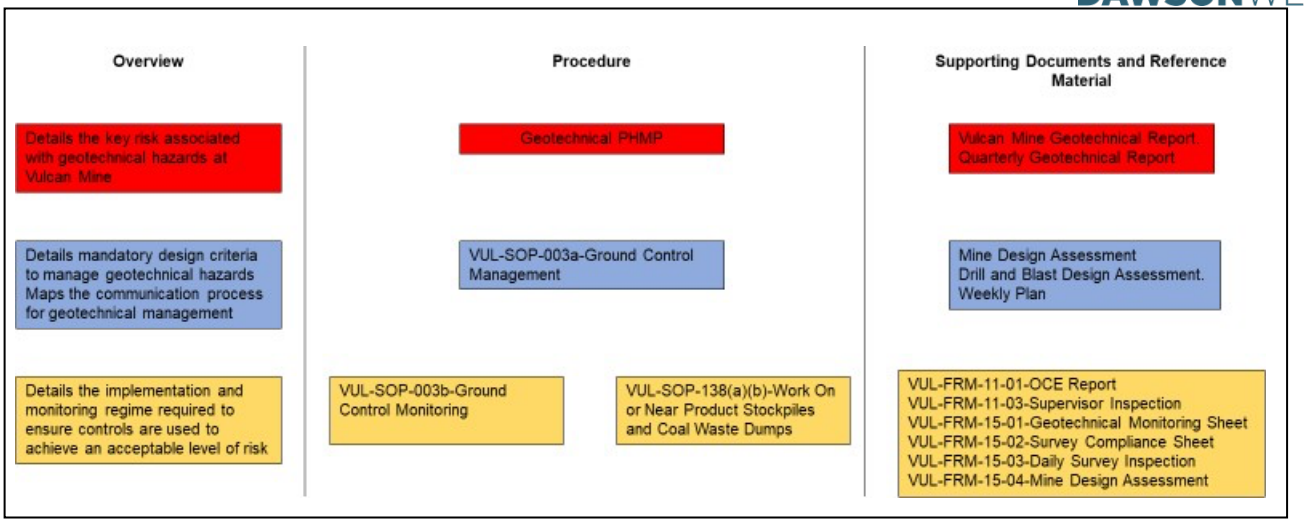

Figure 2: Geotechnical Management Flow Chart

2. CONTEXT

The Dawson West Coal Mine Geotechnical PHMP has been developed to comply with the CMSHA. This document is supported by an operational risk assessment conducted by a cross section of Coal Mine Workers.

The CMSHA states:

s20: Meaning of principal hazard: A principal hazard at a coal mine is a hazard at the coal mine with the potential to cause multiple fatalities.

s63: Principal hazard management plan

(1) A principal hazard management plan must—

(a) identify, Analyse and assess risk associated with principal hazards; and

(b) include standard operating procedures and other measures to control risk.

(2) The site senior executive must give a copy of the principal hazard management plan to a person that employs persons at the coal mine whose work is affected by the plan's requirements.

3. DEFINITIONS

Batter	Inclined component of the highwall or dump slope.
BBRA	Broad Brush Risk Assessment.
Berm	Horizontal Bench established within the highwall or dump slope to catch falling rocks.
Box cut	The initial excavation to develop a new open pit. The excavation may occur in spoil or in rock.
CMSHA	Queensland Coal Mining Safety and Health Act (1999).
CMSHR	Queensland Coal Mining Safety and Health Regulation (2017).
CMW	Coal Mine Worker.
Dump	The cumulative placement of waste rock or overburden to a designed slope profile.
Excavated face	A near vertical face / bench that is created when equipment is used to dig and load coal or waste.
End-wall	The excavated pit walls terminate at the lateral ends of the mining strip.

	An end-wall can comprise spoil or in-situ rock.
FOPS	Falling Object Protection Structure.
Geology Database	Assemblage of geological information derived from exploration drilling, lab testing and field mapping.
Geotechnical Monitoring Database	A stored collection of geotechnical monitoring data including extensometer, piezometer, prism monitoring and radar data.
Highwall	A highwall is the wall of the pit on the advancing side of the excavation i.e., the newly excavated wall.
HME	Heavy Mining Equipment.
JHA	Job Hazard Analysis.
MCM	Moranbah Coal Measures
OCE	Open Cut Examiner.
PHMP	Principal Hazard Management Plan.
RL	Relative/Reduced Level.
Rock Discontinuities	Include joints, fractures, faults and other geological structures.
SHET	Safety, Health, Environment and Training.
SOP	Standard Operating Procedure.
SSE	Site Senior Executive.
SWP	Safe Work Procedure.
TARP	Trigger Action Response Plan.
TOC	Top of Coal.
TSD	Technical Services Department.
TSS	Technical Services Superintendent.

4. DAWSON WEST COAL MINE GEOLOGICAL AND GEOTECHNICAL INFORMATION

A full geotechnical assessment was conducted, and the report findings can be found in Dawson West Complex Geotechnical Assessment (BMS, 2019). The Dawson West Complex will exploit multiple coal seams within the MCM formation in the Bowen Basin. The target seams include the ALEX, DL, and DLLL seams through truck and shovel terrace mining. The strata generally dip towards the northeast at angles between 2° to 5°. The seams appear uninterrupted and continuous in their discrete sub areas (Vitrinite, 2020). The interpreted stratigraphy of the MCM as they occur within the Jupiter Pit area are presented in Figure 3., below.

No igneous intrusions have been encountered within the Dawson West Complex to date in either drilling or field mapping exercises. Pits are currently planned to depths of up to approximately 50 m, which would extend down to the floor of the basal seam.

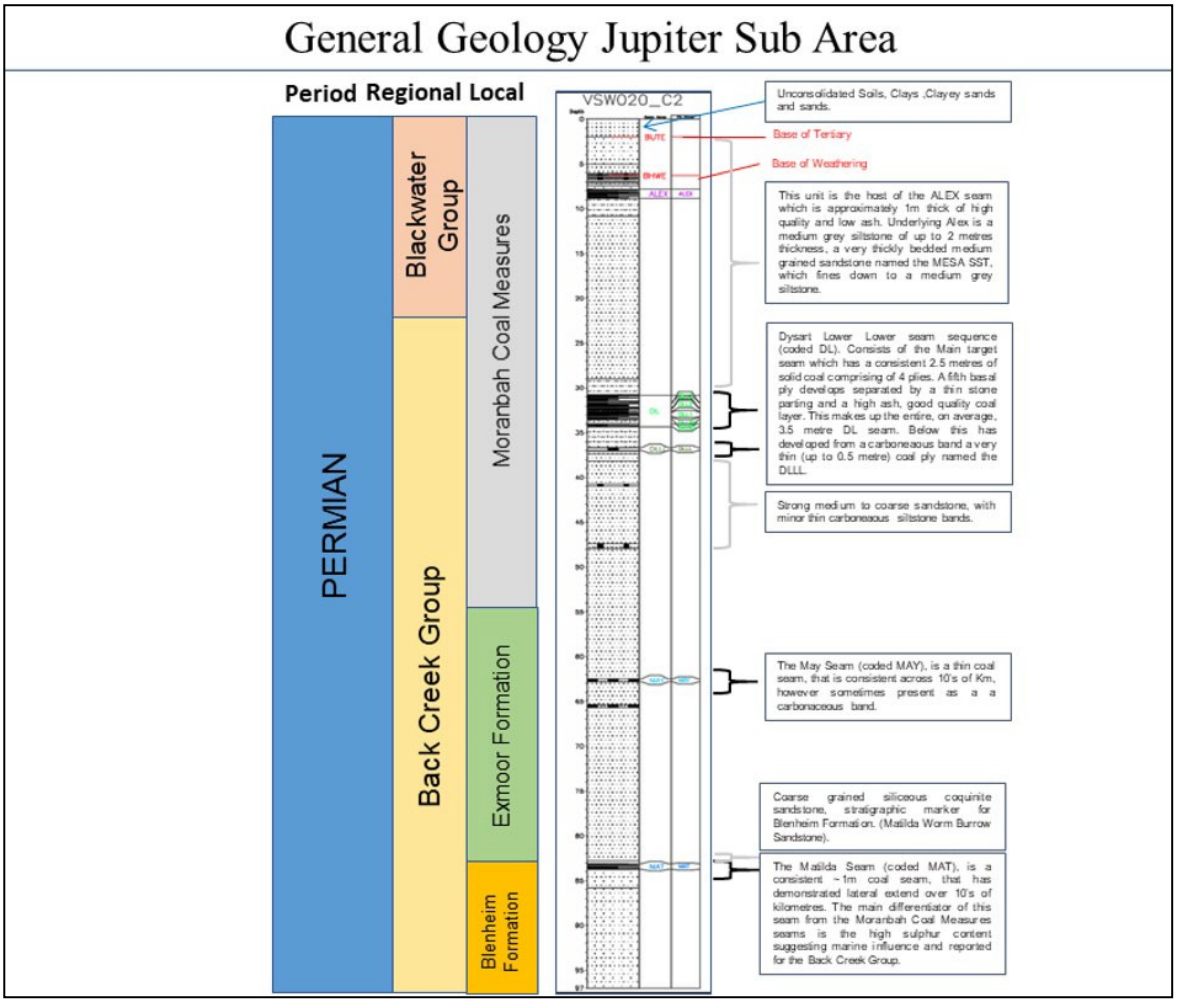

Figure 3: Jupiter Sub Area Representative Stratigraphy

On the basis of boreholes drilled in the area, standing water level typically ranges from between 15 m to 40 m below ground level in the vicinity of the Jupiter Pit (refer Figure 4, below). This is typical for the Bowen Basin (BMS, 2019).

Monitoring Borehole	Sub Area	SWL (m)	SWL (mAHD)	Geotechnical Borehole
VSW017_O	Jupiter	21.00	222.00	VSW121_GT
VSW020_C	Jupiter	15.00	252.00	VSW078_GT

Figure 4: Preliminary data provided by Oasis Hydrogeology Pty Ltd

To assess the geotechnical parameters at Dawson West Coal Mine, geotechnical holes were drilled and analyzed. The locations of these holes are presented Figure 5, below.

Figure 5: Geotechnical Borehole Locations

Laboratory testing was carried out and is presented in Figure 6, below.

Test Type	No. Tests	Standard
Atterberg Limits	8	AS 1289.3.1.1, 3.2.1, 3.3.1 & 3.4.1
Particle Size Distribution	8	AS 1289.3.6.1
Triaxial CU Shear Strength	2	AS 1289.6.4.2
Slake Durability	7	AS 4133.3.4 (2005)
Uniaxial Compressive Strength (UCS)	19	AS 4133.1.1.1, 4.2.2 (2013)

Figure 6: Laboratory Testing Summary

Dawson West Coal Mine conducts quarterly geotechnical inspections which encompass all relevant areas of the mine site. The Dawson West Coal Mine geotechnical engineer analyses all data from site and will issue quarterly reports that are made available to all CMWs. Prior to commencement of mining in new areas, geotechnical assessment is conducted on known geological data. The recommendations from the initial geotechnical assessment are utilised for mine designs and for the development of the design criteria in DWCM-SOP-003a-Ground Control Management. These recommendations form the basis of the monitoring protocol provided in DWCM-SOP- 003b-Ground Control Monitoring and the trigger levels provided in the DWCM-TAR-003-Geotechnical Failure.

During mining, geotechnical hazards arise that will require additional assessment. Trigger levels as per DWCM-TAR-003-Geotechnical Failure will detail the response required for relevant CMWs. The monitoring protocol will be initiated, and the geotechnical engineer will conduct analysis of the data. These analyses utilise software modelling and include, but are not limited to:

- stereonet analysis;
- slope stability analysis;
- rockfall analysis; and
- laboratory analysis.

4.1. Specific Risk Events Identified

The specific hazards identified are:

- High-wall or End-wall failure onto pedestrians.
- High-wall or End-wall failure onto mobile equipment.
- Low-wall or dump/spoil failure onto pedestrians.
- Low-wall or dump/spoil failure onto mobile equipment.
- Stockpile failure onto mobile equipment.
- Reject dump failure onto pedestrians.
- Reject dump failure onto mobile equipment.

4.2. Geotechnical Training

All relevant CMWs undergo geotechnical awareness training. This training will detail common failure mechanisms and identification triggers. This training is refreshed at a frequency of no less than every five years.

5. ROLES AND RESPONSIBILITIES

The geotechnical risk management process assigns responsibilities and obligations to the various roles across a mine site. The legislation also requires that people likely to be affected by a geotechnical hazard are consulted during the risk management process.

The following roles and geotechnical responsibilities are outlined to ensure the PHMP is effective.

All personnel should adhere to the following mandatory rules:

- all ground control activities must comply with site procedures;
- all personnel have a duty of care with ground control requirements;
- all personnel must report any geotechnical hazard;
- all personnel must follow any relevant safe working procedures; and
- Any departure from the designed excavation mine plan must be approved by the TSS.

Position	Responsibilities	Reporting To
Site Senior Executive	• Ensure the PHMP is developed in accordance with the legislation. • Provide adequate resources (competent people and necessary equipment) to ensure the requirements of this PHMP are achieved and are effective. • Seek periodic advice as required by this PHMP from people competent in providing such advice. • Authorise this PHMP. • Shall be familiar with and promote the use of the TARP. • Ensure geotechnical inspections are being conducted and identified issues are being actioned and completed. • Check the PHMP has been implemented and used via internal and external audits. • Provide for scheduled review of the PHMP or authorise TARP reviews as required. • Ensure and verify that the content of this PHMP has been communicated to all CMWs. • Ensure and verify that suitably competent persons are involved in assessing / inspecting geotechnical hazards. • Following the removal of persons from an area due to a TARP trigger, ensure the level of risk is reduced to an acceptable level before allowing operations to resume in this area. • Review the risk and determine if there are any additional controls or risk assessments are required.	Coal Mine Operator
Geotechnical Engineer	• Carry out assessment of all known geological data prior to commencement of mining. • Carry out quarterly inspections of all active mining areas and other areas as required. • Provide recommendations for geotechnically stable slopes (e.g., high-walls, end-walls, low-walls, dumps/spoil, reject storage). • Provide assessment on site geotechnical hazards with available site data during the course of excavation. • Assist with the update of the PHMP so it remains relevant to the project conditions. • Be familiar with and promote the TARP system. • Become involved and provide geotechnical advice when the TARP triggers require. • Assess geotechnical data and provide advice regarding data trends.	Site Senior Executive

Position	Responsibilities	Reporting To

Technical Services Superintendent	• Carry out mine inspections as required, including pit wall crests, stockpile areas and dumps.
	• Ensure all high-wall, end-wall, low-wall and dump designs are compliant with the relevant pit design parameters and/or specialist geotechnical advice.
	• Ensure designs make allowance for suitable drainage on spoil dumps, high-walls and low-walls to minimise geotechnical risk.
	• Ensure that DWCM-FRM-15-04-Mine Design Assessment is completed by engineers prior to any design being implemented into the mine plan.
	• Arrange for a competent geotechnical engineer to conduct:
	  ○ ongoing quarterly geotechnical inspections of all active mining areas, and other areas as required;
	  ○ a detailed assessment of failed areas, or sections of the pit which have been identified as having the potential to fail; and
	  ○ inspection of geological data prior to commencement of new mining areas, monitor compliance against design in active mining areas and investigate/rectify any variances. Changes should be documented, and risk assessed outside standard geotechnical parameters.
	• Collate, store and maintain all site geotechnical documents, technical reports and data, including reports by a competent geotechnical engineer.
	• Ensure that the location of geotechnical hazards and incidents are recorded, documented and communicated on mine plans appropriately.
	• Arrange for the monitoring of movement in excavated rock walls, low-walls, spoil toe on coal floors, dumps and groundwater levels where applicable.
	• Arrange for conducting test holes in coal floors to assess for shears and required floor remediation where required.
	• Generate a running survey layer to record floor treatment that has been carried out in pits.
	• Ensure the geotechnical engineer has adequate resources and support when working in conjunction with the technical services team.
	• Ensure periodic reviews of the site PHMP.
	• Ensure survey the location of geotechnical hazards, monitoring systems or features as requested.
	• Ensure survey and record the RL or location of water in sumps or pits.
	• Ensure that survey pick-ups for geotechnical monitoring are undertaken as required.
		Site Senior Executive

Position	Responsibilities	Reporting To
Technical Services Department/ Mine Geologist	• Be familiar with and promote the TARP system. • Undertake analysis of pit wall geological mapping to record the location of faults. • Maintain up-to-date copies of geotechnical data relevant to the site. • Liaise with the geotechnical engineer as required. • Monitor areas of geotechnical instability. • Deployment and maintenance of ground monitoring system. • Data review from ground monitoring system. • Geotechnical weekly inspections and data collection for review and sign-off.	Site Senior Executive
Site Superintendent	• Be familiar with current geotechnical hazards. • Ensure personnel are trained and assessed in the relevant hazard controls in the PHMP. • Be familiar with, promote and adhere to the TARP system. • Communicate the shift TARP level after consultation with the OCE to their area supervisors. • Communicate the results of Risk Assessments to all workers. • Ensure any geotechnical hazards are discussed as part of prestart meetings. • In the event of change in geotechnical conditions, liaise with the OCE to alter and communicate the new TARP level. • Advise the TSS of any new geotechnical issues.	Site Senior Executive
HSET Superintendent	• Shall be familiar with and promote the TARP system. • Ensure all relevant persons working on the mine have completed all relevant site inductions (including Geotechnical Awareness Training). • Ensure this PHMP and training is available to all CMWs. • Coordinate reviews of the Risk Register and update as appropriate.	Site Senior Executive

Position	Responsibilities	Reporting To
Open Cut Examiner	• Carry out mine inspections including pit wall crests and dumps. • Communicate geotechnical hazards to CMWs. • Complete and distribute OCE report highlighting any geotechnical hazards. • Carry out handover to oncoming OCE. • Monitor compliance e.g., adherence to exclusion zones, correct dump procedures. • Receive and manage geotechnical hazard information received from CMWs. • Initiate actions to isolate and/or remove people and equipment from immediate, geotechnical risk areas. • Ensure adequate lighting at all excavated faces and spoil dumps. • Implement the DWCM-TAR-003-Geotechnical Failure system and monitoring controls as set out in this PHMP. • Approving access or work within restricted areas such as adjacent to pit walls or crest.	Site Senior Executive
Supervisor	• Be familiar with, promote and apply the TARP system. • Inspect the mine excavation and related parts of near-mine excavation. • Ensure and inspect that pit walls are excavated to the design and scaled back to a stable slope. • Inspect and ensure drainage is established to minimise water ingress into the pit or dumps. • Inspect and ensure dumps are to design and dumping controls are in place. • Operating areas, according to inspection outcomes, risk assessments, and TARP conditions. • Convey TARP levels to the CMWs. • In the event of change in geotechnical conditions, liaise with the OCE and communicate the new TARP level. • When immediate danger exists, initiate withdrawal of workers from the area and communicate the danger to OCE and all other workers.	Site Superintendent

Position	Responsibilities	Reporting To
All Coal Mine Workers	• Review and/or be briefed on the OCE Shift Report in relation to geotechnical hazards prior to entering any area in the pit. Seek clarification if unsure of current conditions or controls. • Carry out appropriate pre-task planning prior to commencing any task in the pit accounting for geotechnical hazards in respective work areas near walls, dumps, spoil areas, reject dumps, stockpiles. • Adhere to mine procedures regarding exclusion zones, dump operations, stockpile management and around restricted areas of the pit. • Immediately report any geotechnical hazards or possible geotechnical hazards around pit walls or on dumps to the OCE/supervisor responsible for the area. • Being familiar with TARP procedures and following the TARP level as required. • Reporting geotechnical hazards to their supervisor. • When immediate danger exists, initiating withdrawal from the area and communicating the danger to all other workers. • Observing all hazardous areas and drop zones and directions issued and seeking approval from the OCE prior to accessing a restricted area.	Supervisor

6. IDENTIFYING GEOTECHNICAL HAZARDS

Geotechnical hazards include any unstable ground within the mining area likely to cause injury or harm and damage. There are multiple contributors toward geotechnical instability and many of these exist inherently within the rock mass and are not normally able to be removed or altered. Therefore, the identification of a hazard or a high-risk environment is the first and most essential part of the risk reduction process. Further information can be found in DWCM-SOP-003a-Ground Control Management and DWCM-SOP- 003b-Ground Control Monitoring.

The following processes are used to identify geotechnical hazards:

- current knowledge of actual mine stability performance;
- the geological database and models;
- systematic review of mine plans by the geotechnical engineer and Technical Services Department;
- history of past instabilities;
- advice and experience from the workforce;
- advice from Geotechnical Engineer;
- shared learnings from other sites and industry collaboration;
- geotechnical investigation and reporting schedule;
- OCE inspections and report;
- geotechnical hazard mapping and risk register; and
- regular geotechnical inspections and monitoring system.

7. HISTORICAL INFORMATION

A record of geotechnical hazards shall be documented by the TSD. This information will be utilised as reference for future mine planning designs.

7.1. Geotechnical Investigation and Reporting Schedule

Geotechnical investigation is a precursor for hazard identification. This aids in developing a geotechnical model and providing appropriate mine design parameters for the project.

Reporting follows a set format at various times to record and provide information about geotechnical issues. These include:

- As needed monitoring and analysis detailing specific issues.
- Monthly Geotechnical inspection from TSS.
- Quarterly geotechnical reporting by the geotechnical engineer.

7.2. Geotechnical Hazard Mapping and Risk Register

Geotechnical hazard mapping will be communicated to all CMW upon identification. This will be conducted and communicated as identified and subsequently included in the weekly planning process. All data associated with the hazard will be stored by the TSD to ensure that this information can be recalled and included in mine planning processes.

7.3. Inspections and Monitoring

Geotechnical inspections are important and will be undertaken by the various job roles with the appropriate level of detail to identify, record and communicate the identification of geotechnical hazards.

Geotechnical inspections shall be conducted according to the job role and TARP level.

Geotechnical hazards shall be identified and monitored on an on-going basis in accordance with the inspection schedule that includes at a minimum:

- Shift inspections and report by the OCE.
- Monthly inspections by the TSS and SSE.
- Quarterly inspections by the Geotechnical Engineer.
- Geotechnical monitoring data, graphs and reports should be recorded for future reference. The monitoring data is to be reviewed by the Geotechnical Engineer.

8. MANAGING GEOTECHNICAL HAZARDS

Management of geotechnical hazards shall be undertaken in accordance with DWCM-SOP-003a-Ground Control Management.

The following processes and systems shall be developed and implemented to manage geotechnical hazards in mining operations:

- Communication.
- Geotechnical analysis and design.
- Mine design and approval.
- Mine design performance monitoring.
- Geotechnical hazard awareness training.

8.1. Trigger Action Response Plan (TARP)

DWCM-TAR-003-Geotechnical Failure (TARP) has been implemented.

8.2. Geotechnical Analysis

Throughout the mine operating phase, new geotechnical data will be collected comprising rock defects, rock strength, geotechnical failure investigations, and groundwater data to update the geotechnical database and revise the geotechnical parameters where required.

8.3. Mine Design

The Mine Design Plan and mine planning processes shall consider geotechnical hazards and the recommended geotechnical design parameters during all relevant mine processes. All mine designs will be subject to the review and approval of the TSS utilising DWCM-FRM-15-04-Mine Design Assessment. This is detailed in DWCM-SOP-003a-Ground Control Management.

8.4. Mine Planning

The actions arising from geotechnical inspections shall be included into mine planning to ensure implementation and communication of appropriate risk management controls.

8.5. Restricted or Hazardous Areas

The current TARP level will determine the ability to access pit slopes, dump or stockpile tip-heads. Areas of the open pit workings can be potentially hazardous to personnel on foot, in a light vehicle, or a heavy vehicle without FOPS.

8.6. Exclusion and Drop zones

A nominal exclusion zone of 10 m exists from the toe of the highwall, endwall and lowwall. Personnel shall not access exclusion zones without completing a risk assessment and approval of the OCE.

The exclusion zone for active work areas can be delineated via the use of a grader rill and/or safety cones.

HME required to work within, or pass through, the exclusion zone shall:

- be fitted with FOPS;
- be operated with the operator's cabin positioned farthest from the slope wherever possible; and
- be operated with machinery tracks or wheels perpendicular to the slope to allow pullback, if required.

An exclusion zone exists below an active dump face. This shall be demarcated and bunded to prevent access to the advancing dump face.

8.7. Tailings Dam and Other Rejects Storage Facilities

Dawson West Coal Mine does not contain a tailings dam. Coarse rejects from the crusher / screen will be treated as overburden waste and managed in accordance with the waste dump specifications detailed in DWCM-SOP- 003a-Ground Control Management.

8.8. Geotechnical Training

All relevant CMWs shall receive TARP and geotechnical awareness training and assessment, to ensure they are competent.

9. MINE CLOSURE

Mine closure plans will require a geotechnical component to ensure the final void, dumps and associated dams or drains are stable structures. This may require geotechnical investigation, analysis and design as inputs into mine closure and environmental management. The Dawson West Coal Mine final landform design is governed by the DWCM-SOP-003a-Ground Control Management.

10. CHANGE MANAGEMENT

Proposed changes must be reviewed as part of the change management process before the change is implemented. This applies to:

- any change that may affect geotechnical risks; and
- any modification to this PHMP.

11. REFERENCES

- BMS (2019), *Dawson West Complex Geotechnical Assessment*, Report No. 20191029_VR, Blackrock Mining Solutions Pty Ltd, 29 October 2019.
- BMS (2020), *Jupiter Final Landform Slope Stability Assessment Memorandum*, Memo Ref. BMS-20200304-VIT, Blackrock Mining Solutions Pty Ltd, 4 March 2020.
- Coal Mining Safety and Health Act 1999 (Qld).
- Coal Mining Safety and Health Regulation 2017 (Qld).
- DNRME Safety Alert 145 Highwall failures.
- DNRME Significant Incident 53 Collapse of pit wall.
- DNRME Significant Incident 58 Falling rock from endwall causes personal injury.
- Vitrinite (2020), *Dawson West Complex JORC Resource Final,* Vitrinite Pty Ltd, 2020.

12. REVIEW

This document shall be reviewed at mnimum every two years, or as follows:

- as soon as practicable after the commencement of;
- when there has been a significant event to which this document was relevant (e.g., following a significant geotechnical incident);
- following a change in relevant legislation, codes and standards;
- evidence of geotechnical risks that are not or have not been satisfactorily managed by the PHMP
- when there is a change of method and/or technology and/or legal or other requirement that may affect the accuracy of this document;
- every year; and
- as a result of relevant audit findings.

13. DOCUMENT CONTROL

Version	Date	Description	Document Controller
01	11/07/2022	Creation of Document	James Pallas