6

ATTACHMENT 6

Tips, Dams and Voids: Principal Hazard Management Plan (PHMP)

CANTERBURY COAL MINE

TIPS, DAMS AND VOIDS

PRINCIPAL HAZARD MANAGEMENT PLAN

CAN-TEC-PHMP-003

BATHURST
RESOURCES LIMITED

DOCUMENT OWNER: Mine Engineer

APPROVED BY: Site Senior Executive

Signature: ..... Date: 23/04/2015

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Table of Contents

Figures

Tables

Attachments

1.0 Purpose

This Principal Hazard Management Plan (PHMP) has been developed to provide instruction on the requirements to manage Tips, Dams and Voids at Canterbury Coal mine. This PHMP will be referred to throughout this document as the Tips, Dams and Voids Principal Hazard Management Plan (TDVPHMP).

A principal hazard, as defined by the Health and Safety in Employment (Mining Operations and Quarrying Operations) Regulations 2013 (HSE Regs), is a hazard with the potential to cause multiple fatalities or re-occurring single fatalities.

2.0 Scope

This TDVPHMP is authorised by the Site Senior Executive and is applicable to all Canterbury Coal mine employees and contractors working on the Mining Permit within development, construction, operations, decommissioning and closure phases.

The TDVPHMP forms part of the Canterbury Coal Health, Safety, Environment and Community Management System (HSECMS), which meets the requirements of the HSE Regs - *Part 2 Health and Safety Management System.*

3.0 Objectives

The objective of the TDVPHMP is to formalise the systems, standards, procedures and methods in use, or to be introduced at the Canterbury Coal mine to ensure effective management and control of hazards relating to Tips, Dams and Voids by defining the base standards utilised at the mine in the control of these hazards.

3.1 Health and Safety in Employment Regulations

This document addresses the requirements relating to Tips, Dams and Voids under the HSE Regs (**Table 1**).

Table 1: Requirements of Regulation 81, 82, 83 and 122 of the HSE Regs and where addressed in this document

Regulation 81 – PHMP for Tips, Dams and Voids	Section Addressed
81 Principal hazard management plans for tips, ponds, and voids The principal hazard management plan in relation to tips, ponds, and voids must, at a minimum, provide for the following:	
(a) the procedures and processes to ensure the safe design, construction, and maintenance of any tips, ponds, or voids at the mining operation:	Section 5.3.1
(b) a geotechnical assessment to be carried out commensurate with the type and scale of tipping operations and having regard to;	
(i) the underlying geotechnical structure at the location of a tip; and (ii) the properties of the material being tipped; and (iii) the creation of any ponds or voids:	Section 5.3.1
(c) road design and traffic movement connected with tipping operations:	Section 5.3.2
(d) the tipping rules relating to the use of tips:	Section 5.4.4
(e) records to be kept of the materials that have been tipped:	Section 5.3
(f) an inspection and monitoring regime.	Section 7.0
82 Risk reassessment in relation to tips, ponds, and voids In addition to the requirements of regulation 55, the Site Senior Executive must ensure that a reassessment of the stability of the tip, pond, or void is carried out by a competent person—	
(a) at least once every 2 years after the date the principal hazard management plan is approved by the site senior executive; and (b) if a tip, pond, or void as constructed deviates from the geotechnical design; and (c) if a new tip, pond, or void is created.	Section 5.1, 5.3.1 and 15.0
83 Inspection of tips If the principal hazard management plan for tips, ponds, and voids requires regular inspections to be carried out, the principal hazard management plan must specify:	
(a) the nature and interval of inspections; and (b) the appointment of a competent person to supervise the conduct of tipping operations, including a requirement that this person supervise every inspection of a tip at the mining operation.	Section 7.0
122 Defects discovered during inspection of tips (1) The mine operator must ensure that any person who carries out an inspection of a tip at the mining operation—	
(a) makes a written record of all defects discovered during the inspection; and (b) informs the mine manager of the defects that require immediate rectification.	Section 7.2

Regulation 81 – PHMP for Tips, Dams and Voids	Section Addressed
(2) The mine operator must ensure that a written record is made of the action taken to remedy any defect in a tip discovered during an inspection of the tip. (3) The mine operator must ensure that the records required by subclauses (1)(a) and (2) are kept as part of the health and safety management system.	

4.0 References

- Health and Safety in Employment Act 1992 (the Act);
- Health and Safety in Employment (Mining Operations and Quarrying Operations) Regulations 2013;
- CAN-HST-BBRA-001 Principal Hazard Broad Brush Risk Assessment (September 2014);
- CAN-TEC-PHMP-003.01 Canterbury Coal mine Tips, Ponds and Voids Principal Hazard Management Plan Risk Assessment;
- CAN-TEC–PHMP-002 Ground and Strata Instability Principal Hazard Management Plan;
- CAN-HST-PCP-002 Emergency Management Principal Control Plan;
- CAN-HST-STD-004.07 Canterbury Coal mine Training Needs Analysis;
- CAN-HST-STD-006.01 Daily Shift Report Form;
- CAN-HST-STD-008.02 Canterbury Coal mine Audit Schedule;
- CAN-MIN-SOP-002 Dump Truck Operations;
- CAN-MIN-SOP-006 Mobile Lighting Plants;
- CAN-HSE-SOP-017.02 Working Around Water Assessment;
- BRL-HST-STD-001 Risk Management Standard;
- BRL-HST-STD-002 Incident Reporting and Notification Standard;
- BRL-HST-STD-003 Document Control Standard;

- BRL-HST-STD-004 Training Standard;
- BRL-HST-STD-006 Workplace Inspection Standard;
- BRL-HST-STD-007 Non-Conformance and Corrective Action Standard;
- BRL-TEC-STD-032 Spontaneous Combustion Standard;
- Bathurst Resources Limited 2015, Canterbury Coal Mine – Open Cut Geotechnical Review;
- Health and Safety at Opencast Mines, Alluvial Mines and Quarries, Best Practice Guidelines – In Draft (November 2014); and
- Minerals Industry Risk Management Model (MIRM) – Database developed for the minerals industry presenting best practice information about managing safety and health risks. Access via http://www.mirmgate.com/.

5.0 Management Approach

5.1 Risk Assessment

A Risk Assessment has been undertaken using a semi-quantitative methodology as outlined in the ***BRL-HST-STD-001 Risk Management Standard*****,** to apply a facilitated team-based approach to risk identification, risk analysis and risk evaluation. This risk assessment technique assessed the level of risk in accordance with defined consequence and likelihood factors to determine and ensure risks are effectively controlled to as low as reasonably practicable (ALARP). The risk assessment provides an understanding of the potential impacts of Tips, Dams and Voids and determines the primary controls that alone, or in conjunction with other controls, significantly reduces the likelihood and/or impact to an acceptable level.

The effectiveness of the controls shall be monitored by:

- Operator checks and inspections of their work environment prior to and during the shift;
- Safety observations and compliance inspections by leaders; and
- HSEC Audits of the workplace against this TDVPHMP.

In addition, and in accordance with Regulation 82: *Risk reassessment in relation to tips, ponds and voids*:

The SSE must ensure that a reassessment of the stability of the tips, ponds, and voids is carried out by a competent person -

(a) At least once every 2 years after the date the principal hazard management plan is approved by the SSE;

(b) If a tip, pond or void as constructed deviates from the geotechnical design; and

(c) if a new tip, pond, or void is created.

5.2 General

Only trained, competent and authorised operators are to operate equipment at Canterbury Coal mine.

During night operations, lighting must be provided to adequately illuminate work areas and immediate approaches to tip heads and tips, having regard to shadow, contrast and glare and to assist with void detection (***CAN-MIN-SOP-006 Mobile Lighting Plants***). Excessive glare and deep shadows can be minimised by placing the lighting source on higher ground or on benches above the work area where possible.

5.2.1 *Pedestrian Safety*

To minimise the risk to pedestrians when on a tip or stockpile, the following controls shall apply:

- Access limited to authorised personnel only – only those persons who have a definite operational purpose shall be permitted to walk onto any tip, stockpile or reject tip;
- The dozer operator is in charge of the tip or stockpile whilst it is operational. Positive Communication and acknowledgement with the dozer operator of intent is required prior to entering the stockpile area. Where the dozer is not present, other equipment operators working on/near the tip or stockpile shall be contacted. Radio contact must be maintained at all times and where possible visual contact;
- Appropriate signage and barricades shall be installed to warn of hazards;
- Where pedestrians or maintenance personnel are required to work on the tip or stockpile whilst other mobile equipment is operating, mobile equipment and

pedestrians shall be separated by a barricading bund of appropriate width and height with a minimum height of half the wheel height of the largest piece of equipment operating in the area;

- Pedestrians leaving the tip or stockpile must notify the dozer operator and if not present, any other mobile equipment operator on the stockpile; and
- A pedestrian or light vehicle must make positive communications with the dozer operator in charge of a truck circuit before entering a tip or stockpile.

5.2.2 *Signage and Barricading*

Signage (**Figure 1**) and barricades (maybe in form of bollards or traffic cones) shall be in place on all approaches and access points to reduce the risk of harm to people.

This will be achieved by preventing the unauthorised access of pedestrians and vehicles onto:

- Tips;
- Stockpiles;
- Dams; and
- Hazardous historic mine workings.

Where safety bunds are established as barricading, these shall be maintained at a minimum of half the wheel height of the largest piece of equipment and dependent on the competency of the material being used.

Figure 1: Example of signage restricting unauthorised access to stockpile area

5.2.3 *Inspection and Supervision*

Regulation 83 Inspection of Tips: If the principal hazard management plan for tips, ponds (dams), and voids requires regular inspections to be carried out, the principal hazard management plan must specify:

(a) The nature and interval of inspections; and

(b) The appointment of a competent person to supervise the conduct of tipping operations, including a requirement that this person supervise every inspection of a tip at the mining operation.

At the commencement of each shift the mining Supervisor shall inspect all work areas prior to the commencement of work. Further inspections shall occur throughout the shift to identify any changed conditions or developing hazards in accordance with the ***BRL-HSE-STD-006 Workplace Inspections Standard***.

The Supervisor shall record the results of inspections including any identified hazards or defects on the ***BRL-HST-STD-006.01 Daily Shift Report Form*** including any action taken to remedy. Where a hazard poses an unacceptable level of risk, the operations must cease until the hazard has been rectified or the area made safe prior to any work re-commencing.

Operators shall report any adverse changes to conditions as observed throughout the shift to the Supervisor.

Supervisors of Tips, Stockpiles, Dams and Voids within the active mining area will inspect the work area at least daily and complete a Daily Shift Report Form for the area and document any abnormalities with the shift handover notes for communication to the next crew.

If work has stopped for any period of time due to weather, another inspection by the Supervisor of the working pit may be required prior to restarting work. This inspection must also be documented.

5.2.4 *Equipment Maintenance and Breakdown*

In the event of a breakdown on a stockpile or tip, the equipment operator shall immediately notify the Supervisor. The operator shall standby for instruction from the Supervisor. When it is necessary for equipment maintenance to be completed on a tip or stockpile, maintenance activities shall not commence until truck tipping and dozer activities have

ceased and the maintenance work area has been effectively demarcated and isolated from traffic hazards. The maintenance area shall be barricaded by solid bunds and delineation such as traffic cones and/or reflective tape to ensure the maintenance exclusion zone is not breached by equipment or other personnel.

5.3 Tips

A geotechnical stability assessment and design has been undertaken for all dumps proposed in the current mine plant (Bathurst Resources Limited 2015).

The existing Tips at Canterbury Coal mine have been demonstrated as stable throughout the Greendale Earthquake. This has provided field testing and justification of the stability of the design.

Material placement and final location is recorded in Tips by collecting the hours plant operate on the different material types and the location within the Tip this material is dumped. This information is collected on plant operator timesheets. Tips are surveyed at least twice yearly and compared against the mine plan and geotechnical design characteristics by the Mine Engineer.

5.3.1 *Design Philosophy*

Tips at Canterbury Coal mine are designed and constructed by adhering to a process of:

- Geotechnical investigation/assessment and bund design prior to commencing tipping (includes necessary exclusion zones at base of the slope);
- Material characterisation;
- Slope stability analysis incorporating safety factoring;
- Designed by competent and experienced personnel to undertake design;
- Maintaining a safety bench below the current lift of a minimum of 5 m in width where the area is accessible;
- Adequate lift heights, compaction to control stability;
- Designed installed drainage;
- Active monitoring and investigation of any know failures; and
- Earthquake hazard assessment.

As per the HSE Regs:

> "*The stability of the tip shall be reassessed at least every two years or sooner if considered necessary and when the tip design deviates from the geotechnical design or a new tip is created."*

Work areas must be designed and maintained to provide adequate drainage and minimise the accumulation of water or ponding.

5.3.2 *Process Control*

The following controls will be developed and implemented to ensure the design is deployed as intended:

- Tip plans are approved for construction by the Mine Manager;
- Guidance on spoil placement and spoiling sequence is issued by the Mine Engineer;
- SOPs and PHMPs are in place that set out road construction, traffic management, bunding and tipping rules;
- Pre-shift tip inspections are undertaken by the Shift Supervisor;
- Dozer and dump truck operators are aware of tip design, operating and maintenance standards and hazards; and
- Water management and drainage is installed as necessary to drain the tip surface and toe.

5.3.3 *Mixed Coal Measures Backfill Waste Materials*

Mixed backfill waste materials are primarily comprised of excavated coal measures overburden and inter-burden rocks. A review of representative site topographical survey data indicates in pit backfill slopes composed of dry end tipped coal measure waste typically form a slope ranging from 35 to 39 degrees, with an with an average residual internal angle of repose of 37 degrees. The range of slope angles observed is a result of the variability of the overburden particle size grading. Assumed geomechanical properties for Broken River coal measure waste materials are summarised (**Table 2**). Material properties for mixed coal measure waste materials and the Canterbury Coal mine site are consistent with similar material types observed from elsewhere in New Zealand.

A consent is in place for the disposal backfill ash material in the tips at the mine. This is dumped and spread throughout the tips and disposal has been considered in the geotechnical assessment and mine design.

Table 2: Summary of the Broken River coal measure waste geomechanical material parameters

Material Property	Broken River Coal Measures (CM)	
Material Description	Mixed angular overburden and inter-burden waste composed of coal measure MUDSTONE/SILTSTONE/Laminated fine SANDSTONE	
Bulk Density	1.77 t/m^3 (17.4 kN/m^3)	(Assuming 120% swell of in-situ coal measures)
Phi	37 (degrees)	(From detailed site survey)
Cohesion	0 (kPa)	(Residual)

5.4 Tips/ELF and Stockpile Design Parameters

The proposed slope design parameters for the free draining Tips or Engineered Landforms (ELF) areas are outlined (**Table 3**). The overall slope angle of 22° for final landform constructed from mixed overburden waste materials has been observed from areas below the current site office. To date these slopes have been observed to perform in a satisfactory manner. It is assumed that this material has been placed in successive compacted lifts, no more than 1 m thick and has been rolled by careful sequencing of loaded trucks to achieve adequate compaction (Bell 2007). Surface water control had also been implemented to mitigate ponding of surface water and saturation of waste materials.

Table 3: Recommended slope angles for Tips/ELF slopes constructed from overburden and inter-burden waste

Design Sector	Configuration	Bench Height (m)	Bench Width (m)	Batter Slope Angle
Mixed overburden and inter-burden waste rock	Benched	10	5	27° (2:1 grade)
	Continuous Slope	-	-	22° (2.5:1 grade)

5.4.1 *Temporary and In-Pit Tip Considerations*

The current tip is and in-pit tip where backfill is being dumped into a previously mined out void. End tipping such as that currently being undertaken into the northern mined out void, should only be undertaken where stability of the temporary landform can be ensured.

Minimum key considerations of a geotechnical nature for construction of in-pit backfill are summarised as:

- Loose dumped fill will readily stand at up to 37°, however under heavy rain or snow melt, due to the high fines content, these temporary faces rapidly rill and erode and it is therefore advisable to create temporary batters around 30°;
- Waste can be placed onto in-situ coal measure or rock materials where bedding dip and structure is favourably oriented to ensure stability;
- Ensure the base of the waste dump is not sitting on soft or low shear strength materials, ensure the base and toe of the fill is stable;
- Restricted lift limits to a maximum of 20 m in height;
- Active tipping area is to be a minimum of 3 % slope toward the back of the tip edge for the last 20 m so that trucks are backing uphill;
- Ensure the placed waste fill remains dry and the fill is not end tipped into standing water;
- Surface water control is implemented to ensure the top of the fill surface is graded and sealed to prevent water ingress and saturation of waste materials. Runoff should be directed away from the fill to areas where excess water will not cause erosion or slope instability.
- In-pit backfill is to be constructed from weak rock fill materials of siltstone/mudstone with minor sands. If wet or soft materials are to be disposed then they should be placed into an area which does not potentially compromise stability. These materials should also be mixed with drier material to ensure appropriate densification.

5.4.2 *Ex-Pit Dumping Considerations*

Due to the high fines and clay content, combined with rainfall, coal measure waste materials can retain water in excess of the optimal water content for compaction and be difficult to compact into waste overburden iandforms. Reduced compaction also greatly reduces trafficability as these materials differentially settle and become soft under multiple truck passes. When well compacted these materials can either prevent water infiltration or act as a barrier and aid retention of ground water within the tips. As a saturated material this will

have significantly reduced shear strength. To maximise stability of the dump, overburden waste material should be dumped uniformly along the entire face.

Bell (2007) summarises pertinent protocols for development of Tips at Canterbury Coal mine. Additional measures pertaining to effective site water management are also listed. Key considerations of a geotechnical nature for construction of the ensuing ex-pit tip (for consideration in future mine plans) include:

- Overburden Tips are an engineered facility designed to receive excavated materials from stripping and ash within the mine footprint only;
- Topsoil and weathered soil/rock beneath any designated Tip placement area is to be removed and stockpiled separately for rehabilitation work;
- The cleared slope is to be benched so as to key in the compacted waste materials with in-situ rock;
- Where Acid Mine Drainage (AMD) is not an issue, coarse rock fill should be placed as drainage course at the base of the Tip to maintain drainage and to ensure base stability;
- Overburden waste composed predominantly of mudstone with minor sands, is to be paddock-dumped in layers not exceeding 1 m and compacted by at least six passes of a tracked or rubber-tyre machine;
- As each section of the overburden dump reaches design height, it is to be capped with at least 500 mm of subsoil and topsoil to facilitate revegetation;
- The surface of the Tip must be graded at all times to prevent water ponding. Runoff should be directed to areas where excess water will not cause excessive erosion or slope instability. All surface cracks or depressions where water can enter the waste stockpile should be graded and sealed to prevent water ingress;
- There will be no end-tipping of materials during ex-pit Tip construction due to the extra handling to collect and compact that material, and the risk of wet slurries moving rapidly down the unfinished slope; and
- Where wet materials have to be disposed of in the overburden dump, a compacted mudrock wall is to be formed to enclose the wet material, which will then be mixed with drier material to ensure densification.

5.4.3 *Hazards*

Hazards to look for on tips are:

- **Tip cracks** – There are basically two types of cracks in tips:
    - Settlement cracks are small cracks that develop at different areas of the tip due to natural or equipment compaction; and
    - Failure cracks which are large cracks that indicate the potential for a tip failure. Failure cracks are normally lower on the tip edge side.
- **Safety bund slumping** – This is also a function of settlement but in most instances the material near its angle of repose (particularly if wet) will cause the slumping. If a muddy clay material is being tipped over the edge of a tip it most likely will collect near the top of the tip until it has built up enough weight to roll to the bottom of the tip. If enough of this material builds up at the bottom or along the face of a tip and the tip material changes to rock or dry dirt, the clay will cause this material to build up until the weight causes enough pressure for it to flow towards the bottom of the tip.
- **Tip bulging** - Bulging in the face or bottom of a tip occurs when compression of certain materials like wet clays occurs and cause deformation. This may cause shear planes to develop and when the material becomes too heavy, the tip may fail. Failure cracks and bulging generally occur together and should be promptly identified and dealt with.

With good tip management, failures can be identified and quickly corrected thus preventing an injury or equipment damage. The dozer operator is the key to a successful tip.

5.4.4 *Rear Tipping*

Dump truck tipping operations shall be carried out in accordance with:

- ***CAN-MIN-SOP-002 Dump Truck Operations.***

5.4.5 *Working below a Tip Head*

The wall (batter) of a tip shall, as far as practicable, be maintained in a secure condition.

This will be achieved by:

- Ensuring the tip batter is not too steep for the stability of the material being placed;

- Benching or battering the tip; and
- Establishing a water management system (e.g. diversions, pumps etc.) at the top and toe of the tip and on each bench.

As a minimum, a 15 m Drop Zone shall be established and delineated on the ground under tip heads. All unauthorised personnel shall remain outside the Drop Zone.

Where personnel are required to enter within the 15 m Drop Zone to carry out their duties (e.g. Supervisor inspections, Pump crew, Drill and Blast Personnel, Mine Planning etc.), the following shall apply:

- A Job Safety Environmental Analysis (JSEA) must be completed for the particular activity;
- Visual inspection of area prior to entry is required to visually assess the stability;
- No vehicles or equipment should be parked within the 15 m Drop Zone;
- Equipment without ROPS and FOPS are to stay outside the Drop Zone;
- Use of spotters who are familiar with the task and the work environment;
- Notify the Tip Dozer Operator prior to entering the area if an active tip is above and ensure that signs and barricades are in place at the top of the Tip head notifying of personnel working below;
- Consider moving the active tip face away from above the Drop Zone whilst working within the Drop Zone; and
- Minimise time spent under the Drop Zone.

5.5 ROM and Stockpiles

The Canterbury Run of Mine (ROM) consists of ROM and product coal stockpiles less than 10 m in height.

5.5.1 *Tipping on the ROM*

The dozer/loader operator remains in control of the stockpile at all times and will direct truck operators where to tip. Dumping sequence and planning will be done under the instruction of the mining Supervisor and/or Superintendent. Trucks entering a stockpile area where the

dozer/loader is operating shall establish and maintain positive communications with the dozer/loader operator. Trucks must maintain a separation distance of at least one truck width to all other mobile equipment. Truck trays must be lowered prior to truck moving off.

5.5.2 *Bunding Standards*

Coal is inherently less consolidated than overburden bunds, so it is necessary to have a specific bunding standard for the ROM.

Overburden and Coal Bunds - The minimum height of a standard overburden bund shall be at least half the height of the wheel of the largest truck using the area. These bunds will be constructed no steeper than angle of repose.

Coal and ash stockpiles at Canterbury Coal mine are kept to less than 10 m in height and there are no reject stockpiles/tips at the site.

To ensure that a stockpile does not present the risk of collapse onto personnel and equipment underneath, the stockpile working face will be battered back to a stable slope angle by the loader operator prior to leaving the work area.

Where stockpiles are to be worked in the dark, appropriate lighting will be provided.

5.6 Spontaneous Combustion

Spontaneous combustion (spon-com) is a process where coal of particular characteristics reacts when exposed to air (oxygen), causing it to heat and cause an outbreak of fire.

5.6.1 *Spontaneous Combustion from Coal Stockpiles*

Coal and reject stockpiles may have the potential to ignite through spon-com or from fires from surrounding vegetated areas. Canterbury coal has been characterised as having a high propensity for spon-com (***BRL-TEC-STD-032 Spontaneous Combustion Standard***). Given the potential health and safety risks, financial loss and management costs associated with burning mined coal, controls have been implemented to minimise the risk of spon-com, coal loss or injury including:

- Stockpiles shall be designed to assist prevention of incidence of spon-com (low profile with long axis parallel to the prevailing wind direction where possible);
- Adequate drainage will be provided;

- Competent personnel to undertake scheduled inspections (may include temperature monitoring) to identify any evidence of spon-com;
- Regular temperature monitoring for coal stockpiles kept for a period of greater than six weeks as per the ***BRL-HST-STD-032 Spontaneous Combustion Standard***;
- Oldest coal removed first where possible;
- Any incidence of spon-com in Stockpiles is managed as per ***BRL-HST-STD-032 Spontaneous Combustion Standard***; and
- Any detection of spon-com is a HSE Mining Regs Schedule 8 Notifiable Accident and must be reported using the ***BRL-HST-STD-002 BRL Incident Reporting and Notification Standard***.

5.6.2 *Abandoned Historic Workings - Spontaneous Combustion and Gas Hazard*

Coal fires resulting from spon-com within old underground mines have been known to occur in the Historic Mine Workings outcropping in the highwalls at Canterbury Coal mine. These spon-com events are typically caused by un-compacted coal being exposed to air flow over a period of time. There are currently no known active fires in historic underground workings of the Canterbury Coal mine or Malvern Hills area.

It is known that the Malvern Hills Coalfield has low coal seam methane content due to the shallow seams and numerous breakthroughs to the surface as a result of the underlying geology. The historic Canterbury Coal Mines were recorded as “non-gassy” and were worked originally using open flame lamps. No records of mine explosions have been identified for the Malvern Hills Coalfield, despite extensive research into the subject being undertaken by BRL.

Spon-com however, requires monitoring and management at Canterbury Coal mine and this monitoring and management will be undertaken as per the ***BRL-HST-STD-002 BRL Incident Reporting and Notification Standard***.

5.7 Water Bodies

Water bodies and associated infrastructure including pump installations on the mine site require regular maintenance. These water bodies carry an inherent risk to mine workers

including drowning, hypothermia, being swept off flood ways by running water or loss of and/or damage to equipment.

Water bodies at Canterbury Coal mine may include:

- Dams;
- Creeks;
- Sumps;
- Pits;
- Drains;
- Ponds; and
- Waterways (natural or manmade).

All personnel and contractors at Canterbury Coal mine will complete the ***CAN-HST-SOP-017.02 Working Around Water Assessment*** within the site induction. Persons shall not attempt to cross flooded water ways which are flowing and deeper than 30 cm.

Any inspections or monitoring, or maintenance of equipment in close proximity to any body of water should only be carried out in daylight hours. Any person carrying out an inspection MUST advise their Supervisor of the following:

- The purpose of the inspection or visit to the dam;
- Length of time the task will take;
- Complete a Take 5 prior to commencing the inspection;
- Carry a two way radio with them tuned to the mine channel;
- Maintain regular contact with Supervisor during the inspection; and
- Notify Supervisor once they have completed inspection.

Where an inspection is to be carried out using a boat, a JSEA shall be completed and a minimum of two competent swimmers used to complete the task. Life jackets shall be worn and life saving devices shall be on hand whenever working on or near water (within falling distance).

Good lighting will be carried and installed for the purpose of inspections or working near water in hours of darkness.

Where areas are accessible to light vehicles or other mobile equipment safety bunds shall be constructed and maintained to at least half the wheel height of the largest equipment operating in the area to protect against fall of equipment over hazardous edges. Designated parking areas will be constructed for the safe parking of equipment around bodies of water.

The following controls shall be implemented to eliminate/mitigate the risk of injury to persons or damage to equipment as a result of risks associated with water bodies:

- Completion of a geotechnical assessment of dam sites and materials in the planning stage;
- QA/QC program including appropriate supervision during the construction of a water body;
- Appropriate bunding around Dams and Sumps;
- Where required, walkways, handrails and railings constructed to AS/NZ standards;
- Pit dewatering rates calculated to minimise pit flooding;
- Regular inspections by competent person;
- Designated access and egress from water bodies for inspection and monitoring personnel;
- Life jackets worn by personnel when working around water;
- Life preserver rings installed adjacent to Dams and Sumps;
- Warning signage;
- Restrictions on site access and movement on site during periods of heavy rainfall;
- ***CAN-HST-SOP-017.02 Working Around Water Assessment*** in the site induction;
- Height indicators on crossings and flood ways where required; and
- ***CAN-MIN-TARP Adverse Weather*** within the ***CAN-HSE-PCP-002 Emergency Management Principal Control Plan (EMPCP).***

6.0 Voids

Voids may exist due to:

- Open pits;
- Water sumps excavated below ground level;
- Presence of a sink hole (wash out);
- Presence of an open drill hole;
- Subsidence, weathering, wind and water; and
- Presence of known/unknown underground working areas.

To mitigate/eliminate the risk of injury to a person or damage to equipment due to undetected or unprotected voids the following controls shall be implemented:

- Restricted access to areas identified as high risk;
- Safety bunding shall be constructed to at least half the wheel height of the largest equipment operating in the area to protect against fall of equipment over hazardous edges*;*
- Inspection and monitoring of work areas prior to commencement of work to determine existence of sink holes, subsidence, spon-com and old workings interaction;
- Adequate drainage;
- Capped drill holes;
- Protective canopy fitted on mobile plant;
- Scaling down of high walls; and
- Maintaining conformity to the mining and hazard plans;

6.1 Encountering Voids Whilst Mining

Open pit mining in areas of historic underground workings presents potential hazards that must be managed by incorporation into the mine design and during the mining process.

Hazards associated with working around and mining through historic underground workings is included in the ***CAN-TEC-PHMP-002 Ground or Strata Instability PHMP***.

7.0 Monitoring and Inspection

7.1 Long Term Stability Monitoring

A network of long term deformation survey marks were installed 1st July 2013 by BTW South Survey across the Canterbury Coal mine site (**Figure 2**). The aim of these surveys marks is to monitor long term stability of the high wall located in the Footwall geotechnical domain and the overburden Tip/ELF. These marks are located above the crest of the current Footwall (DEF01 - DEF07) and along the base of the present overburden Tip/ELF (DEF07, DEF09, DEF10). An additional deformation survey mark is also positioned at the site of the old mine office, 60 m southeast of the present overburden placement area. Survey data is acquired using a static GPS with readings likely to have an estimated error ± 0.015 m (Mike Borthwick, LandPro Ltd, pers. com.).

Figure 2: Canterbury Coal mine long term deformation survey markers installed 1st July 2013 to record potential ground deformation within the footwall (DEF01-06), overburden tips/ELF area (DEF07-10) and site office

Design review and validation of the geotechnical model during mining will occur by monitoring the Footwall and Hanging Wall response during overburden and coal removal, and installation of surface drainage.

Based on the size and extraction rate of the current opencut mine ongoing data collection is required to enable performance monitoring and review of the slope design. This should include:

- Daily walk over visual inspections by site operational staff;
- Pit geotechnical mapping and field observations at intervals of no less than six months;

- Topographic surveys of Slope Movement Monitoring Points at intervals of no less than two monthly;
- Additional survey monitoring for settlement or slope movement (if required). This could include survey prisms, survey reflectors, extensometers, tilt meters, tell tales, etc.; and
- Regular monitoring groundwater piezometers once installed (piezometers to be installed into the Footwall).

7.2 Inspections

Scheduled mine pit and tip inspections are outlined (**Table 4**).

Table 4: Schedule of Geotechnical Inspections and Design Review

Facility	By	Frequency
Water Storage Facilities		
Mining area water storage facilities geotechnical audit and risk assessment	Mine Geologist	Twice annually
Mining Area		
Mining Pit, Footwall and Hanging Wall, Tips and other as per Daily Prestart Inspection	Shift Supervisor	Daily and After Storms
Open pit geotechnical inspection and mapping	BRL Geologist	Every two months
Overburden storage geotechnical inspection	BRL Geologist	Every two months
Topographic surveys of Slope Movement Monitoring Points and Tips constructed since last survey	Mine Surveyor	Every two months
Regular monitoring groundwater piezometers once installed (piezometers to be installed into the Footwall).	BRL Geologist	Twice Annually
Design		
Open pit slope status review	BRL Geologist/ Mine Engineer	Twice Annually
Slope design review	BRL Geologist/ Mine Engineer	Annually
Site slope risk review	BRL Geologist/ Mine Engineer	Twice Annually

At the commencement of each shift the Supervisor shall inspect all work areas prior to the commencement of work. Further inspections shall occur throughout the shift to identify any

changed conditions or developing hazards as per the ***BRL-HST-STD-006.01 Daily Shift Report*** and the ***BRL-HST-STD-006 Workplace Inspections***.

Where a hazard poses an unacceptable level of risk, the mine manager must be informed and operations ceased in the affected area until the hazard has been rectified or the area made safe prior.

Daily inspections (or more frequently after rainfall (> 10 mm in a 24 hr period)) performed by the Shift Supervisor to identify:

- Development of tension cracks and subsidence in Tip crests, berms, dumping area and haul roads, as indicators of possible impending failures;
- Deterioration in the condition of slopes due to weathering, erosion, undercutting or loosening;
- Movement status and update the risk rating of any existing failures; and
- Identification of loose rocks or material which would be potentially hazardous.

Operators shall report any adverse changes to the work area conditions and any hazards or potential hazards to the Supervisor immediately.

Routine inspections of all pit walls will be undertaken by geotechnical personnel. These inspections will include:

- Every two months inspections carried out by the Mine Geologist of the pit perimeter, including all accessible benches to check for the development of tension cracks or other adverse instability indicators; and
- Every two months inspections (or more frequently if ground conditions dictate) by the Mine Geologist, focusing on the geotechnical conditions encountered within the Tip areas, compared with those planned in the design, including new or potential failure zones and hydrogeological observations.

A Geotechnical Summary Report shall be published on a regular basis and presented at the Canterbury PSI meeting along with any Geotechnical Incident Reports from the previous period. When generated, this report incorporates all the periods data into an up to date report.

The reporting period will be two monthly when the TARP is in green, not less than weekly if the TARP is in an orange and daily when in red.

TARPs (**Section 11**) are used to manage issues with Tips identified through inspections and observations.

8.0 Emergency Response

Where the rescue of an operator is required from an engulfed dozer or loader, the Emergency Management Plan shall be initiated.

The First Response Team (FRT) must consider:

- The urgency of the situation, fire, and the potential for further engulfment or the trapped machine or rescuers;
- The potential for further movement of the equipment;
- The stability of the tip or stockpile to further movement;
- Mobile equipment suitable for dozer rescue must be available, such as a dozer, excavator, truck, elevated work platform (EWP), etc.;
- Need to suitably prepare a stabilised pad area on the stockpile surface for rescue operations;
- Operators must be rescued from equipment before attempting to recover the equipment;
- Once the operator is rescued safely, a recovery plan must be devised based on a Risk Assessment; and
- Once the rescue operation is complete, an incident report must be filed and investigation completed if required in accordance with ***BRL-HST-STD-002 Incident Reporting and Notification Standard.***

9.0 Closure

As per the requirements of the HSE Regs, all plans, drawings, records and reports associated with the mine are to be submitted to the Inspector within three months of abandonment or before parting with the whole of the premises on which Tips are situated.

10.0 Resources Required

The Senior Site Executive (SSE) shall ensure that adequate resources are made available to maintain compliance with this TDVPHMP.

11.0 Trigger Action Response Plans (TARPs)

This TDVPHMP has identified Trigger Action Response Plans to provide a step-by-step approach for the rectification of issues as they become apparent. These include:

- ***CAN-MIN-TARP-Tiphead Failure (Attachment 1)***;
- ***CAN-MIN-TARP-Ground or Strata Instability*** within the Ground or Strata Instability Principal Hazard Management Plan; and
- ***CAN-MIN-TARP Adverse Weather*** within the Emergency Management Principal Control Plan (EMPCP).

12.0 Communication

All persons affected by the requirements of the TDVPHMP shall have access to a copy of this document and associated documents via the mine's Document Control System. Communication of any related information to the mine workers will be undertaken using one or more of the following methods:

- Induction training;
- Start of shift briefings;

- Toolbox talks;
- Memoranda;
- Letters;
- Notice boards;
- Emails; and
- Verbal (training sessions).

All communication of related information shall be recorded and filed within the mine's record.

13.0 Roles, Responsibilities and Training

13.1 Roles and Responsibilities

Implicit in the effective management of this Principal Hazard, is the comprehensive allocation of responsibilities to key individuals. Details of roles and responsibilities associated with this management plan are provided (**Table 5**).

Table 5: Responsible Personnel and Tasks

Position	Accountable Task
Senior Site Executive	• Ensure adequate resources are available for the implementation of this plan. • Ensure this plan is audited for effectiveness. • Ensure this plan is reviewed and updated.
Mine Manager	• Provide adequate resources for the implementation of this TDVPHMP. • Ensure the controls herein are implemented, maintained and effective. • Ensure persons (including contractors) working at the operation who are affected by the requirements of this TDVPHMP have been given a copy of the TDVPHMP and are aware of the requirements.
Managers Superintendents Geologists Engineers and Surveyors	• Be responsible for supporting the implementation of the requirements of this TDVPHMP and communicating any issues to the mine management team. • Actively promoting reporting of potential situations which could result in an incident. • Coordinate and participate in the on-going review of this TDVPHMP as required. • Undertake stakeholder engagement and education.

Position	Accountable Task
Supervisors	• Responsible for ensuring the instruction of workers, implementation of this TDVPHMP, including monitoring the effectiveness. • Ensure persons working at the operation under their responsibility (including contractors) are affected by the requirements of this TDVPHMP, have been given a copy of the TDVPHMP and are aware of the requirements. • Shift Supervisors are to be trained and competent in the inspection of tips and are to undertake such inspections and implement or escalate any corrective action.
Contractors	• Ensuring all their employees are fully trained and aware of relevant requirements. • Ensure compliance with all Canterbury Coal mine procedures and engage in safe work practices.
All personnel	• Comply with the requirements of the TDVPHMP.

13.2 Training Requirements

Training and awareness at Canterbury Coal mine shall be carried out in accordance with the ***BRL-HST-STD-004 Training Standard*** and the ***CAN-HSE-STD-004.07 Training Needs Analysis***.

14.0 Corrective Action

Any corrective action identified as a result of an incident or an audit shall be entered into the corrective action data base and reviewed to ensure closeout of identified actions. Refer to ***BRL-HST-STD-007 Non-Conformance and Corrective Action Standard.***

15.0 Review

Review will be triggered either by a due date of every two years, or an event triggered review or a request by the regulator.

The review process shall critically evaluate the system documentation including its procedures, documentation requirements and record keeping requirements. The review process requires the involvement of a cross section of the workforce from all levels of the

organisation who are impacted by the requirements of this TDVPHMP or who provide relevant content expertise.

The document owner, being the Mining Engineer or nominated delegate, is responsible for ensuring the time based review is carried out.

The event-triggered review shall be carried out when a significant incident occurs that could be directly or indirectly linked to this system. There may also be a review required when there is a substantial change in methodology or technology. Where a significant incident is Canterbury Coal mine based, the document owner shall instigate the same format of review team as detailed above.

Where the Regulator has requested a review, the review will be carried out as per the directive from the Regulator.

Where the significant incident is BRL or Industry based, the document owner shall ensure the document is reviewed for compliance with the incident recommendations and where not, raise corrective actions to address any changes required.

16.0 Audit

The mine will audit against this procedure to ensure the procedure is implemented, effective and addresses all regulatory requirements. Audits shall be conducted as per the ***CAN-HST-STD-008.02 Audit Schedule***.

17.0 Document Control and Record Management

17.1 Document Control

Document control will be in accordance with the ***BRL-HST-STD-003 Document Control Standard.***

17.2 Record Management

This document is issued, revised and amended under authorisation of the SSE.

Documents will be stored electronically with access available to all mine workers. The signed hard copy will be maintained in the mine library.

Reasons for making changes to the TDVPHMP will be documented and recorded in the document properties table. A copy of the original document and subsequent versions will be kept for the Project records and marked as obsolete. Each new/updated version will be issued with a version number and date to eliminate obsolete documentation being used.

18.0 Glossary of Terms and Abbreviations

ALARP	As Low as Reasonably Practicable.
BBRA	Broad Brush Risk Assessment.
BRL	Bathurst Resources Limited.
Consequence	The outcome of a risk if it occurs.
Control	The means used to manage risk.
Emergency	A situation that is developing, or has developed suddenly and unexpectedly and poses a threat to Life, Property or the Environment.
EMPCP	Emergency Management Principal Control Plan.
Hazard	A source of or a situation with the potential to cause loss.
HSECMS	Health Safety Environment and Community Management System
Incident	An unplanned event or occurrence.
Likelihood	The chance that a particular risk will occur. Sometimes referred to as probability.
PHMP	Principal Hazard Management Plan.
Principal Hazard	A hazard with the potential to cause multiple fatalities.
Risk	A measure of Consequence and Likelihood for an unwanted event developing from a hazard.
Risk Assessment	The process of risk identification and risk evaluation.
Risk Identification	A structured process to identify unwanted events which could develop from hazards.
Shall	Mandatory
Standard	An acceptable measure of performance or quality that determines the minimum criteria required to ensure a safe and healthy work environment.
Should	Understood to be non-mandatory, advising or recommended
SSE	Site Senior Executive.
TARP	Trigger Action Response Plan – Pre-determined actions to be taken in the event of an alarm or trigger level being reached.

Attachment 1: TARP for Tip Head Failure at Canterbury Coal Mine

Action	Normal State	Level 2 Response	Level 3 Response
TRIGGERS	**This is the normal state and no responses are required.** • No visible effects	**This is NOT the normal state and a risk is identified.** There are signs of dump failure: • Increased water seepage from face • Obvious signs of failures developing within face. • Build-up of bulging at toe of dumps • Further deterioration in condition of existing features.	**Imminent slope failure or failure has occurred.** This is a highly abnormal state with highly elevated risk. An evacuation response is required due to: • Significant slumping of material; and/or • Precursors to major slumping that has the ability to affect mine infrastructure.
RESPONSE	Regular monitoring and inspection in accordance with the TDVPHMP and supporting SOPs.	• Alert the ***BRL Geologist*** for recommendations on increased monitoring and inspection frequency. • Identify specific structural features and monitor condition. • Increased standoff distances for mobile equipment and personnel. • Submit a Hazard Report and develop a JSEA for continuing work in the area. • ***Mine Manager and BRL Geologist*** to review unstable area and monitoring records and implement contingency measures. • Geotechnical Summary Report completed and distributed at least weekly. • Reporting as required. • Refer to TDVPHMP and supporting SOPs.	• **Cease operations in affected area**. • Notify ***Mine Manager*** immediately. • Withdraw all personnel from potential collapse of unstable areas. • Cordon off area as identified in the JSEA. • Issue a Safety Alert. • Provide updated monitoring results to all relevant personnel. • ***Mine Manager*** to advise scale of safety and geotechnical reporting. • ***Mine Manager*** to approve remedial works where appropriate (from JSEA). • Geotechnical Summary Report completed and distributed at least daily. • Reporting as required. • Refer to TDVPHMP and supporting SOPs.