Hume Coal Project

INDEPENDENT PLANNING COMMISSION RECOMMENDATIONS 1 and 2: INDEPENDENT REVIEW OF RESIDUAL ISSUES OF DISAGREEMENT BETWEEN THE APPLICANT AND THE DEPARTMENT OF PLANNING ASSOCIATED WITH THE HUME COAL PROJECT

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TABLE OF CONTENTS

TABLE OF DEFINITIONS AND ABBREVIATIONS

Term	Definition
DPE	NSW Department of Planning and Environment
IPC	Independent Planning Commission
ARMPS-HWM	A 2-dimensional empirical design methodology adapted incorporating data from highwall mining methods
inbye	A direction toward the mining face
outbye	A direction away from the mining face toward the mine entry
CMW	Coal mine worker
Q1	The proportion of coal seam gas that is freely liberated upon exposure of coal sample.
Q2	The proportion of coal seam gas desorbed from a non pulverised coal sample during laboratory gas emission testing at atmospheric pressure.
Q3	The proportion of coal seam gas locked in the matrix of the coal and not released until the coal specimen is finely ground
OEM	Original equipment manufacturer
PTE	Permit to emplace – an authority to emplace material issued by the operational mine management team to cover a specific location
TARP	Trigger action response plan – a table prescribing actions to be taken at specified control levels and a component of a Hazard Management Plan
PTM	Permit to mine – an authority to mine issued by the operational mine management team to cover a specific location
Web	Solid coal left between two adjacent plunges

EXECUTIVE SUMMARY

The proposed mining technique was found to be technically feasible. The mine layout maximizes recovery of the resource and results in a long-term stable pillar system that keeps mining induced surface subsidence impacts to an imperceptible level, minimizes hydrogeological impacts on subsurface strata above the Wongawilli Seam, and provides an ability to store mining wastes and excess water underground.

The proposed pine feather mining technique utilizes advances in technology in the form of remote-controlled mining equipment and the use of high-precision inertial navigation systems to control mining equipment to provide a level of surety regarding roadway and pillar dimensions being formed to design specifications.

The mining technique enables CMWs to operate face mining machinery from locations remote from the coal cutting and coal face hazards.

Productivity from the technique is enhanced by remotely mining 120m long plunges without roof support. This ability has not been previously possible without adaptation of the modern technologies of remote control and inertial guidance systems.

It cannot be inferred that the proposed mining system is unsafe on the basis that it has not been used before in NSW, or that Hume Coal cannot or would not implement appropriate controls to manage risks to workers arising from implementing this method of mining.

Hume Coal has conducted appropriate risk assessments on the project and the proposed mining system and has identified actions and controls to minimize those risks.

The Independent Review assessed each Principal Hazard in relation to the Hume Coal Project to determine whether it could be managed practically to an acceptable level of risk or whether there was an inherent flaw in the pine feather system of work which prevented the principal hazard from being controlled.

This approach is what is considered normally to be good practice in terms of identifying and understanding hazards at the planning stage and developing appropriate risk-based management plans at the operational stage of the project.

The safety of a mining system is determined by the adequacy of risk controls identified in Principal Hazard Management Plans and implemented by the mine operator to manage these risks as low as reasonably practicable. (Resource Regulator 2019)

There is no Principal Hazard inherent in the proposed system of work which is incapable of being managed and controlled by the mine operator to a level of risk as low as reasonably practicable.

BACKGROUND

Hume Coal Pty Limited applied to the NSW Department of Planning and Environment (DPE) for development consent for the Hume Coal Project in 2017. The application was accompanied by an Environmental Impact Statement dated 8th March 2017.

The DPE enlisted the advice of two experts to provide mining advice to assist with the DPE's consideration of the application.

The DPE mining experts raised concerns with some aspects of the Application. A series of meetings and communications between the DPE experts and the Applicant were able to resolve some issues of concerns however other issues remained unresolved.

Hume Coal submitted a Response to Submissions in June 2018. This response amongst other things addressed issues raised by the DPE mining experts.

On 4th December 2018 the NSW Minister for Planning requested the Independent Planning Commission (IPC) to conduct a public hearing into the carrying out of the Hume Coal Project and associated Berrima Rail Project, assess the merits of the projects and prepare a report summarizing the actions taken by the Commission in conducting the public hearing including outlining the Commission's findings on the projects, including recommendations.

EXTRACTS FROM HUME COAL REPORT FROM IPC MAY 2019.

EXECUTIVE SUMMARY

14. *At this stage, the findings and recommendations of the commission are dominated by a number of key issues that require further information and assessment, including:*

- *Feasibility and safety of the mining technique used and the Project's consequent ability to store mining wastes and excess mine water underground.*

RECOMMENDATIONS

R1 *Because the Applicant and the Department remain a considerable distance apart regarding their positions on the safety of the pine feather method of mining, the Commission suggests that one of the Applicant or the Department, or both of them jointly, engage a new independent expert with experience in innovative coal mining technology with a view to resolving ongoing differences of opinion. This investigation would involve taking into account new information from the Resource Regulator.*

R2 *As a result of the outcomes of R1, the Applicant needs to advise if there are consequences that would arise in relation to mine design and economics (resource recovery).*

Hume Coal engaged Russell Howarth and Associates Pty Limited, as an independent expert with experience in innovative coal mining technology, to review the feasibility and safety of the proposed mining technique and the Project's consequent ability to store mining wastes and excess mine water underground with a view to resolving ongoing differences of opinion.

This review was conducted by Russell Howarth B.E. (Mining). Russell Howarth is the author of this independent report.

The author has over 45 years of experience in the underground coal industry and has held senior operating positions in the Illawarra District, Burragorang Valley, Newcastle District, Western District, Hunter Valley, Tasmania and the Queensland Bowen Basin.

Mine planning, feasibility studies, operational planning and systems of work are components of his trade. While Mine Manager at Myuna Colliery he led the team that introduced the place changing system of work into Australia. Place changing was considered innovative at that time, currently it is considered common practice in the Australian coal industry.

The author was a Research Co Ordinator for ACARP from 2000 to 2016 and has kept abreast of advances in mining technology.

INTRODUCTION

This review addresses issues reported by the DPE and IPC to be in contention in relation to the proposed Hume Coal underground mine.

The Hume Coal Project has planned a mine layout and mining system to be able to operate in a commercially viable manner within the environmental constraints present in the mining area.

The constraints required the mine layout developed to:

- Keep surface subsidence movements and impacts to an imperceptible level.
- Minimize the hydrogeological impact on sub-surface strata above the Wongawilli Seam; and
- Emplace all CHPP rejects back into the underground mine workings.

The mining system proposed has been termed the pine feather mining system. It is similar and could be considered a modification of the Wongawilli system that was practiced in the Illawarra District for many years.

One difference being that that the pine feather system does not lift off the fenders formed by driving the splits, rather it leaves them in situ to provide support to prevent fracturing of the overlying strata and to maintain voids for the subsequent emplacement of CHPP rejects and excess water.

A second difference is the pine feather system is a non-caving system and maintains long term stability of the strata. It eliminates a need for Coal Mine Workers (CMWs) to be working where the mining (coal cutting) operation is taking place. This is achieved using remotely operated mining equipment in the split drivage so that no persons are working near the coal face, or even in the split drivage at all.

The Wongawilli system was an innovation of the American Old Ben System of coal extraction, modified to suit the mining conditions in the Illawarra District. When the Wongawilli system was introduced, it was considered new and untested and as such held in doubt.

It is not uncommon in any industry for innovation to be held in doubt and criticized until it proves itself to be successful.

This report aims to provide an independent assessment of unresolved issues that may clear some of the reservations held by the consenting authority in consideration of the Hume Coal Development Consent Application.

KEY ISSUE #1

Stability of development roadway after breakaway

Issue raise by DPI experts

The stability of the development roadway after breakaways and plunges will need to be demonstrated.

The issue of breakaways has been recognised and investigated by the current independent review.

A continuous miner is a rigid body machine and its ability to turn is confined by the coal seam around it.

To break a place away from a mine heading a continuous mining machine does so by cutting a series of slices or cuts in the solid coal and progressively using the clearance created to slew itself into the breakaway (typically 3 to 5 cuts). To start the process the continuous miner needs to be relocated outbye of the centreline to commence the cutting process, of the proposed breakaway, to start the first slice (typically 7m to 9m).

The slices of the breakaway have the effect of mining the end off the web being formed and thereby increasing the effective width of the development heading that remains after completing the plunge.

The geometry of the resultant width from the solid of the development pillar to the formed plunges is a function of the model of continuous miner being used and the skill of the operator. It is also influenced by roof rib and floor conditions.

Hume Coal commissioned expert advice on;

- the breakaway capacity of a range of continuous miner models currently available
- drafting conservative (worst case) geometries of excavations likely to be formed with the currently available continuous mining machines
- the stability of the resultant development headings and any effect on the stability of the pillar system, and
- design of any additional secondary strata support that may be required in panel development headings A and B.

The stability of the development roadways after breakaways and plunges needs to be maintained for the waste emplacement phase of the mining process following the completion of mining in the panel.

The expert advice concluded that the added roadway width resulting from breakaways did not reduce the overall stability of the pillar system. Local support alternatives at the plunge breakaway could be designed and installed to suit the cutting and support erection system of the continuous miner specified and selected for the mine.

The Wongawilli full seam section enables alternate stable mining horizons to be selected to match the design and cycle of cutting and support selected. The mining floor horizon can sit on either competent stone floor capable of withstanding the slewing of a continuous miner forming a breakaway or can sit on a competent coal beam in excess of 300mm thick. The physical conditions are present to enable plunge breakaways to be formed effectively.

The optimised mining horizon at the breakaway can be graded to a different horizon in the plunge if required to maximise coal quality.

The Hume Coal Project will develop a performance specification for the continuous miner fleet to put to the market and the ability to breakaway, floor bearing pressure, traction characteristics and machine balance will be amongst the criteria requested.

While this review has looked at how the plunge breakaways may be effectively managed the operational management team and CMWs at the mine will determine how it will be done. They will use amongst other things the everyday tools of;

1. panel geological hazard plans
2. strata management plans
3. permits to mine
4. daily and weekly operating plans
5. monitoring of geological conditions by mine geologist and geotechnical engineer
6. mine inspection systems
7. risk assessment process

This independent review has not identified any reason why practical and risk based mine management processes will not be able to control risks associated with the stability of the pine feather development roadways, breakaways and plunges.

KEY ISSUE #2

Intra-Panel Pillar Formation and the Effect of Unmined webs of potential impacts of subsidence

Issues for consideration raised by Matthew Newton – Director Compliance Operations

Mine Safety August 2018

Subsidence – At this point in time subsidence levels can only be theoretical as the method of mining has not been undertaken to draw comparisons.

Drivage – the proposed 120 metre runouts will be developed remotely and as such technical challenges will need to be managed to ensure that the development of subsequent intra-panel pillars will be sufficient to ensure they are fundamentally stable. These pillars will have a significant role in the management of subsidence.

Panel Design – The proposed method is limited in dealing with variations of geology and as such a change in geology may result in the abandonment of a runout. This may have an impact on stress distribution and hence potential impacts on subsidence behaviour.

These issues have been substantially addressed in responses to submissions.

2.1 Subsidence

Subsidence – At this point in time subsidence levels can only be theoretical as the method of mining has not been undertaken to draw comparisons.

Mining experts from the DPI and Hume Coal are in general agreement with the subsidence levels predicted in the EIS.

Both an empirical and an analytical design methodology were employed. These tested and proven methods are used by experts in the field of subsidence engineering to predict likely or worst case subsidence. These experts are highly regarded and used throughout the industry. Their predictions are usually greater than actual.

The primary design method chosen by Mine Advice to determine the Hume mine layout was based on empirical design calculations using ARMPS-HWM.

ARMPS-HWM was selected due to the supporting high wall mining case history database being generally consistent with the mining geometries of the Hume Coal Project.

The long term stability of the of the Mine Advice mining layout and subsidence predictions have then been tested against 3D numerical modelling by an expert in the field (Dr Keith Heasley) from the University Of West Virginia.

This numerical modelling using the latest updated LaModel software provided a complementary assessment of pillar stability and subsidence using a different, independent methodology.

The 3D modelling provided confirmation of the magnitude of vertical subsidence as assessed in the EIS, even in the improbable scenario that an entire series of web pillars are removed (failed) from the mine layout.

The vertical subsidence levels are predicted to be minimal and to be no more than those associated with the natural ground movements generated by climate variations. Strains generated by the low levels of subsidence are predicted to be very low and to be tolerable by surface improvements and natural features present in the mining area.

The Hume Coal mine layout has been designed to deliver such subsidence protection.

This review has found no reason to believe that the Hume Coal mine layout can't be mined as designed.

2.2 Drivage

Drivage - the proposed 120 metre runouts will be developed remotely and as such technical challenges will need to be managed to ensure that the development of subsequent intra-panel pillars will be sufficient to ensure they are fundamentally stable. These pillars will have a significant role in the management of subsidence.

This issue has been recognised by the proponent.

In reviewing Hume Coal's ability to ensure that the intra-panel pillars will be developed in such a way to ensure they are fundamentally stable, I have considered the following practical matters.

- The dimensions and geometry of each intra-panel pillar will have been designed by geotechnical professionals for long term stability using tested and proven systems.
- Places will be mined in accordance with a Permit to Mine management control system.
- The as formed dimensions of each intra-panel pillar will be determined by the as driven dimensions and geometry of the plunges on either side of the intra-panel pillar and the as driven gateroad. The inbye plunge will be mined first.
- Contemporary survey standards and inertial guidance and control systems will control the real time position of the mining machine in the plunge. The miner control system will also be able to automatically and continuously monitor and record the status of the plunge drivage and make adjustments to positioning as required.
- Trigger Action Response Plans will initiate control actions in the event of deviations from the Mine Drivage plan. These response control actions may be taken in real time to correct alignment and prevent further deviation.
- If for any reason the inbye side plunge of the intra-panel pillar is driven off-line an adjustment in the position of the next outbye side plunge can be made to compensate for any loss of dimension of the intra-panel pillar. Such a response action would be included in the TARP associated with the Strata Control Management Plan. Operational planning could, at the time, also issue direction to leave a wider barrier or skip a plunge if mine geotechnical staff considered it to be necessary. This is a flexibility in the system which can be used without compromising system stability.

This independent review is confident that Hume Coal will have the practical ability to ensure that the as mined dimensions of the intra-panel pillars are sufficient to ensure fundamental stability.

2.3 Panel Design

Panel Design – The proposed method is limited in dealing with variations of geology and as such a change in geology may result in the abandonment of a runout. This may have an impact on stress distribution and hence potential impacts on subsidence behaviour.

As stated previously the subsidence effects calculated for the Hume Coal Project are very low. Taken from Hume Coal Project EIS Appendix 7 Hume Coal Project Subsidence Assessment 5.6.4 Credible Worst Case Values, words to the effect;

"The credible worst case predicted value of vertical subsidence above web pillars is taken to be 20mm. The maximum allowable span between intra-panel barriers has been set at 60m.

The following "credible worst case" values for tilt and horizontal strains have been determined:

- *Maximum tilt = 0.266 mm/m*
- *Maximum tensile strain = 0.36 mm/m*
- *Maximum compressive strain = 0.33 mm/m"*

Note: These values are for the credible worst case and actual values are expected to be significantly less.

This review considers that the abandonment of a run out would only marginally affect stress redistribution adjacent to the solid coal at the end of the plunge.

The abandonment of a run out would have negligible effect on the stability of the pillar system and would not alter the range of vertical subsidence, tilts and strains predicted.

KEY ISSUE #3

Goaf Gas

Issue raised by DPI experts;

- ***As mining retreats out of a mining (gateroad) panel, the web panels constitute goaves. Roof falls and pillar failures in the goaf can displace the goaf atmosphere. The EIS does not provide information as to the likely gas composition and gas content of the goaves and the manner in which mining operations are to be managed to control goaf gases.***

This concern was recognised by the Hume Coal Project team and has been an input to the functional requirements considered in the mine ventilation planning.

Hume Coal conceptual ventilation planning has covered;

- Total mine ventilation,
- Panel ventilation, and
- Face ventilation for development, extraction and emplacement phases of the operation

As the subsequent stages of the Hume Coal Project feasibility study progress more detailed ventilation planning will be conducted.

Gas data and ventilation planning conducted to date can be used to put the concerns raised into a reasonable perspective.

Perspective

Sampling and analysis from the exploration programs conducted determined the total gas content in the Wongawilli Seam at the Hume Coal Project to be 0.25m^3 to 0.5m^3 per tonne consisting proportionally of >96% CO_2 and <4% CH_4.

Most of the gas is in the Q3 component. Q1 and Q2 values are zero in most cases and in those few samples with a Q1 or Q2 value detected, the maximum Q1 plus Q2 content is 0.03m^3/tonne.

For any pine feather plunge while being mined the face ventilation will remove the gas from the mined coal plus the free gas component (i.e. Q1) from the immediate ribs and roof. Following mining and the removal of the production equipment from a plunge, the entrance to the plunge will be barricaded off preventing inadvertent entry of CMWs to the unventilated plunge.

Following mining, if after time all the Q1 and Q2 gas content of the full web formed by mining desorbed into an adjacent unventilated plunge, then the possible quantity of this gas can be estimated by the following calculations.

Assuming 4m wide web and 4m high seam; total possible carbon dioxide content of the web is 4 x 4 x 120 x1.4 x 0.03 x 0.96 m^3 of CO_2 = 77.4 m^3 (Note - actual mining height proposed is 3.5m and width is 4m).

Assume 4 x 4 x 120 x 1.4 x 0.03 x 0.04 m^3 of CH_4 = 3.2 m^3 of methane is contained in the web and can accumulate in an unventilated plunge.

Note – this is a worst hypothetical case used for demonstration only.

Volume of a mined plunge is 120 x 4 x 3.5 = 1680 m³

Table 1 shows the maximum potential gas content that could accumulate in a 120m plunge.

Total plunge volume m³	Volume CO_2 in plunge m³	Volume CH_4 in plunge m³	Plunge atmosphere max CO_2 content %	Plunge atmosphere max CH_4 content %
1680	77.4	3.2	4.6 or 46000 ppm	0.2
			STEL 30000 ppm TWA 12500 ppm	Allowable Intake air quality 0.25

Table 1. Maximum Potential Gas Content of a Plunge.

Gas Blowers and Gas Associated with Structure

Gas blowers and gas associated with geological structure would be detected by machine mounted face monitoring during the mining phase as the plunge is developed. Coal mine operators would respond to the presence of gas at the time in accordance with a properly prepared TARP contained in the Ventilation Management Plan.

These actions would be designed to limit the potential for gas to accumulate in a plunge above a set limit.

Carbon Dioxide Accumulation Potential

If the plunge was down dip from the gate road ventilation path the CO_2 would accumulate in the end of the plunge remote from any active working place.

If the plunge was up dip from the gate road ventilation path CO_2 would migrate out of the plunge and be diluted in the gate road ventilation stream. There would be no accumulation of CO_2 in rising plunge.

Methane Accumulation Potential

If the plunge was rising from the gate road ventilation path the CH_4 would accumulate in the end of the plunge remote from any active working place.

If the plunge was down dip from the gate road ventilation path CH_4 would migrate out of the plunge and be diluted in the gate road ventilation stream. There would be no accumulation of CH_4 in a down dip plunge.

Expulsion of Gas from a Fall in a Plunge

The Hume Coal Project plans to supply a ventilation quantity of 30m³/sec to the inbye line of cut throughs in each pine feather mining panel.

During the mining phase ventilation will travel up two intake roadways (A & B headings) with a single heading return (C heading). During the rejects co-disposal emplacement phase, ventilation will be provided via a single intake (B heading) and flanking returns (A and C headings). Palaris – Ventilation Planning Report November 2019.

In the unlikely event of a catastrophic full mining height failure of an unventilated plunge and the total plunge atmosphere being instantaneously forced into the gate road ventilation stream;

- (Worst hypothetical) 77.4m³ of CO2 would enter a 15m³/sec air flow and be diluted in 5 seconds, or
- (Worst hypothetical) 77.4m³ of CO2 would enter a 30m³/sec air flow and be diluted in 2.5 seconds
- (Worst hypothetical) 3.2m³ of CH4 would enter a 15m³/sec air flow and be diluted immediately, or
- (Worst hypothetical) 3.2m³ of CH4 would enter a 30m³/sec air flow and be diluted immediately

Physiological effects of carbon dioxide

In the unlikely event of the full failure of a 120m plunge and the expulsion of the maximum possible accumulation of gas contained in the plunge, CMWs on the immediate return side of the failure may be exposed to an atmosphere containing 4.6% carbon dioxide and 0.2% methane for a period of up to 5 seconds.

In a 5 second period a CMW may normally take no more than 2 breaths.

The short term exposure limit (STEL) for carbon dioxide is 30000 ppm (3%). A short term exposure is an average concentration over 15 minutes.

The author considers that there would be no disabling physiological effects or chemical symptoms with breathing up to 4.6% carbon dioxide for 5 seconds. Normal exhaled breath contains 3.6% carbon dioxide.

Roof falls and pillar failures in the secondary extraction areas.

A worst case scenario for a total instantaneous roof collapse in a plunge has been assessed above.

Such a scenario is an unreasonable expectation and has been examined for the purpose of gaining a perspective on the worst impact on the atmosphere in the working place.

The pine feather mining system will not create open goaf areas like traditional mining systems. The pine feather system plunges, considered by the Regulator to be secondary workings, are a component of a long term stable pillar system.

Geotechnical submissions contained in the EIS and in subsequent responses to submissions present a technically acceptable case to the effect that the 4m wide unsupported plunges and the total pillar system will remain stable.

The author's independent expert review accepts the geotechnical case for long term stability of the pillar system.

However, mining experience and localised physical variability in strata conditions cause further consideration of roof falls to be warranted.

If a fall did occur, the likely nature of a fall may range in severity from minor fretting and slabbing of the roof, where coal is present, in the unsupported plunges to a more significant fall going up to the Farmborough Claystone a strong tuffaceous rock or where this is absent to the Hawkesbury Sandstone.

Potentially unstable roof strata with a capacity to lead to more significant falls in a plunge is likely to be first encountered during the mining of the plunge.

CMWs would react to such instability at the time in accordance with a properly prepared trigger action response plan. Consequently, the likely presence of unstable roof conditions that could lead to a significant fall will be limited in standing plunges.

Falls are likely to be small in volume and will not result in the rapid expulsion of a full plunge of accumulated gas.

The rate of expulsion of gas would be less that that previously estimated for the worst case single plunge scenario.

If multiple plunges failed, they would not fail simultaneously and the rate of the cumulative ejection of gas is not foreseen to be a safety concern with the ventilation quantity planned.

***Goaf* Gas**

Note again that this is not a traditional goaf.

The gas that may accumulate in the individual unventilated plunges will consist of carbon dioxide and methane. Traces of other gases may form if the place stands for an extended period.

The gate roads and entries to the plunges will remain ventilated until the panel is stowed with CHPP refuse and excess water.

When the panel is completely mined out and stowed (or back filled) it will be sealed using rated bulkhead seals to contain water and coal rejects rather than a traditional goaf full of gas.

Independent Investigation Comment

The measured in situ gas content of the Wongawilli Seam at the Hume Coal Project is very low within the planned extraction area. When zeroing error associated with gas content testing is taken into account at these low values the gas content in the pine feather "goaf" may be zero.

A major benefit of the pine feather system of work is that it keeps coal mine workers remote from the active mining face. Exposure to gas and strata failure is minimised.

There has been additional documentation of ventilation planning since this issue was raised by DPI experts.

It is feasible to manage any likely accumulations of gas in standing plunges with the pine feather system of mining and provide a safe place of work for coal mine workers.

There is a high likelihood that the atmosphere in mined areas will be equivalent to fresh air.

There is no evidence to support any assertion that mining the Hume coal reserve with such a low gas content will be unsafe.

KEY ISSUE #4

Strata failure of a web or plunges expels irrespirable atmosphere

Issue raised by DPI experts;

- ***Strata failure in one or more plunges may expel irrespirable atmosphere and debris into the workplace***
- ***Safety if webs collapse and expel irrespirable atmosphere.***

The expulsion of an irrespirable atmosphere has been examined earlier under Key Issue #3 Goaf Gas.

The mention of flying debris has been investigated by this Independent Review.

Historically the expulsion of debris with the atmosphere forced out of a place following a fall of roof may cause harm if workers are exposed in a direct line of the fall.

The pine feather mining system develops plunges working on the retreat working up the panel from inbye to outbye with coal mine workers (CMWs) on the outbye side of the plunges. As such they will not be positioned directly in front of a plunge. They can remain outside of the direct line of the plunge. CMWs can work from gateroad areas with solid coal on either side.

No materials will be left in the plunge following the retreat of the mining equipment.

Precautions for windblast and safe operating procedures to control the risks from windblast are common across the coal mining industry.

The Safety Management Plan will contain a risk based control plan for the control of windblast. This will be properly developed by the Hume Coal mine management and workforce in accordance with the prescribed statutory process when the mine operations commence.

It is considered feasible to develop effective controls for windblast risks in the pine feather system of work.

The risk of windblast using the pine feather system of work is generally less than those mines using other systems of work that undertake partial or full secondary extraction in the underground coal mining industry. The pine feather layout has been designed with a long term stable pillar system.

The risk of windblast and flying debris with this system is fundamentally less because the pine feather mining technique has no open goaf to cave.

KEY ISSUE #5

Alignment of plunges

Issue raise by DPI experts

Misalignment of 70^{o} breakaway and deviation of plunge excavation may result in narrower than planned webs. Over 120m, a 1^{o} of deviation at the breakaway equates to 2m offline at the inbye end of the plunge.

This issue was a concern with traditional survey sight techniques used in long splits in the Wongawilli mining system. In a 90m split mine deputies would be required to advance string dropper sights to complete the second half of the split. This was done by line of sight and manually erecting the advanced sights.

The Hume Coal Project plans to use the latest developed inertial guidance system integrated with modern continuous miner control technologies. These technologies are proven and are reported from CSIRO trials to deliver a lateral accuracy of 3cm over a 120m length of drive.

The floor horizon can be tracked with gamma sensors mounted on the back of the continuous miner apron.

The continuous miner will be operated from a remote control location with constant real time recording and display of the continuous miner position and alignment.

Deviations from centre can be tracked and corrective actions taken to get back on centre.

The machine operator will know exactly where the machine is in real time and will have the ability to take action to cut the machine back onto line. The data and action logs can be recorded and analysed for improvement opportunities.

If for any reason the plunge is driven off-line to such an extent that it is outside trigger action response plan control limits and cannot practically be brought back on-line without further deviation of mining in the plunge then, mining shall cease in that plunge. If necessary, a modification to the web pillar width and or location of the plunge can be planned for the next sequence of mining. The specific circumstances on the day will be examined by a team specified in a Procedure under the Strata Control Management Plan to properly determine any further corrective action required.

The Independent Reviewer has confidence that technology exists to enable the horizontal alignment of the plunges to be controlled to a tolerance that will not compromise the stability of adjacent webs.

Limitation

The Independent Review has not determined that an inertial positioning system combined with an integrated continuous miner control system is currently available with the capability of forming a breakaway at a pre-determined location.

Control sequences are claimed to be capable of further development that will enable a breakaway sequence to be programmed into a continuous miner control system. It will be another step to integrate this control with an inertial positioning system.

Until such integration is achieved, breakaways can continue to be constructed using current industry practice by an operator with radio remote control and current survey control.

Once the breakaway is formed the inertial positioning system and integrated control system can then take over to drive the plunge.

The accurate development of plunges using inertial guidance and integrated continuous miner control systems is feasible.

5.1 Supply and Integration of current technologies

The Hume Coal Project has not specified the make and model of the continuous miners nor the make and model of the continuous haulage systems proposed to be used underground.

In fact, no mining machinery has been specified to date. It is an unreasonable expectation to believe that it would be specified at this concept stage of the feasibility study.

The necessary components for remote control mining of the pine feather mining system exist and have been shown to be effective in other applications. Inertial guidance and miner control systems have been integrated and are proven in specific instances with proprietary systems.

An engineering challenge for the Hume Coal Project will be an iterative process to mix and match mining machinery and control technologies to deliver the operational specifications required by the mining system. This is not unique to the Hume Coal Project.

The integration of technologies will be conducted by the mine operator and the mining equipment manufacturers (OEMs).

Production mining equipment is high cost and has long lead times from the date of a firm order being placed to delivery. OEMs are reluctant to spend any technical development funds on integrating technologies without a firm order being committed to by the customer.

Orders for equipment are normally made following a bankable feasibility study and investment decision being committed to by the proponent. This is not commercially possible before a development consent is granted.

KEY ISSUE #6

Flexibility of the pine feather system

Issue raise by DPI experts

The flexibility of the proposed mining technique to respond to structure and unpredicted geological anomalies is less than with other proven systems of work.

It may true that the flexibility of the proposed mining technique to respond to structure and unpredicted geological anomalies is less than with **some** historical first workings mining techniques.

Where the proposed mining technique fits within the range of mining technique flexibilities to respond to structure and unpredicted geological anomalies should not be considered as a significant determinant of the suitability of the technique to the extraction of the Hume Coal reserve.

Rather this review considers whether the pine feather mining technique as proposed has flexibility to mine the area and meet the goals of the mine plan. (refer to EIS Volume 7, Appendix L, 3.1 Summary of Mining Constraints).

Structure and unpredicted geological anomalies are a fact of mining life even though advances in exploration techniques have reduced the risk. The geological exploration that the Hume Coal Project has conducted to this stage of the feasibility study is what would be expected and is typical of that conducted across the coal mining industry.

Exploration techniques that have been used include - surface mapping, bore core logging from hundreds of boreholes, geotechnical testing of core, acoustic scanner interpretation of boreholes, 2D seismic surveys, aerial photography and LiDAR mapping, aerial and ground based magnetic surveys.

Looking at the proposed mine plan layout, this review considers that there are opportunities available for operational mine planning to minimise the impact of unpredicted structure and geological anomalies.

Hume Coal states an intention to continue a forward and in-fill exploration program through the use of in-seam drilling and other surface drilling where possible, to provide forward coverage ahead of mining.

The mining layout involves panels 300 metres in total width separated by 50m wide barrier pillars. For a general perspective, each drivage will provide geological data for adjacent panels. The greatest distance apart between positive data points confirmed by the picks of the continuous miner will be the 50m barrier plus 120m plunge length or 170m. Combined with the exploration data that will be constantly updated mine planners will be able to maintain a reasonable ability to predict trends in structure and intrusions.

There are responses that can be taken when unpredicted structure and geological anomalies are encountered while operating with the pine feather mining system including but not limited to the following;

- Confirmation of the extent of structure or anomaly by targeted surface or inseam drilling

- Change of direction of the development headings
- Shortening the plunge length in a plunge
- Abandonment of a plunge or set of plunges
- Change angles of plunges
- Realignment of subsequent panels
- Combinations of the above as seen necessary by operational management at the time.

These responses are typical of practices at all underground coal mines.

Mine planning is not a one off process carried out in the feasibility study stage of a mining venture. Mine planning is a constantly evolving process that improves as the mining advances and the proven geological data base is enlarged and the understanding and predictability of the local geology is improved.

The planning of responses to specific incidences of the intersection of unpredicted structures and geology will be managed by the operational management team and the workforce using processes prescribed in;

- Safety Management System
- Geological Hazard Management Plan
- Triggered Action Responses Plans
- Permit to Mine Procedures

The pine feather mining technique as proposed has flexibility to mine the area and meet the objectives of the proposed mine plan.

KEY ISSUE #7

The proposed pine feather mining system's ability to store mining reject and excess mine water underground

Concept Mine Plan for Co disposal

The conceptual pine feather system of mining layout as proposed by the Hume Coal Project provides suitable accessible places underground for the co disposal of CHPP refuse and excess mine water.

The concept mine plan has focused on maximising the development of panel gate roads down dip and maximising plunges down dip on one or more sides of the development headings wherever possible.

Concept studies indicate that for a range of co disposal reject slurry particle size and densities that may be produced from the CHPP there will be adequate void volume available for emplacement of CHPP reject and excess mine water over the life of the project. Palaris Report - Backfill Emplacement Schedule, April 2019 Doc No. HUME5041-04.

Survey control of the gate roads and three-dimensional data from the inertial navigation mine guidance system employed in the plunges will provide mine engineers with an accurate as built picture of the panel for operational emplacement planning.

There will be a variety of grades and configurations of the as mined pine feather panel. In specific areas of the panel down dip plunges may exist on one side, both sides or neither side of the gate roads as a result of local geology.

Operational emplacement planning may be managed by a control process like the industry common Permit to Mine system. A Permit to Emplace (PTE) would follow similar rigorous analysis of the conditions existing in the specific area to be covered by the permit.

This management control process will be a component of Safety Management System and will be developed with mine staff technical specialists and the workforce. It will likely assess the specific status of sections of the mine to be backfilled considering the condition of the plunges, floor grade, strata control, ventilation and the specific emplacement technique to be utilised in the area.

Any hazards identified by the PTE team will have suitable risk control measures put in place as part of the PTE.

It is planned to schedule the backfilling of each pine feather mining panel immediately following the completion of coal extraction in the panel and the recovery of the coal production equipment and panel conveyor.

Following completion of coal extraction from the panel, any necessary secondary support, floor maintenance and emplacement infrastructure will be installed. The panel ventilation will be maintained and may be changed to one intake and two flanking returns. Backfilling will work from the downdip inbye end of the panel outbye uphill.

At the completion of backfilling the panel will be permanently sealed with the installation of bulkhead seals; engineered, installed and certified to appropriate Australian and International standards.

Concept study investigations into the design and costing of the underground backfill crushing and pumping system concluded that pumping a high-density slurry up to 13km to an underground disposal site is technically challenging but feasible. Quality Process Solutions – Hume CHPP Backfill Concept Design Report 9/04/2019.

Slurries have been pumped this distance in other mining applications and there is no reason to believe that the Hume Coal Project can't do the same.

Investigations to date on slurry preparation and pumping have concentrated on pumping the material from the surface to the underground development mains.

It is recognised that refuse pumping will require high pressures in the reticulation pipelines. Detailed design and engineering will be required to control any risks associated with using such pressures.

The detailed design and engineering are not normally expected nor appropriate to be conducted at concept and prefeasibility study stage.

7.1 Emplacement Methodology

At this concept/prefeasibility stage of the Hume Coal Project detailed engineering and process design for underground emplacement has not been completed.

Material properties of the specific Hume Coal CHPP refuse materials are yet to be finalised.

Current pumping and emplacement concepts have been developed based on the available data from borehole samples combined with Australian and International experience.

A bulk sample is required to progress this work.

Further test work and the establishment of a reject preparation pilot plant is planned to be implemented at the Hume Coal Project. This will provide data to finalise the process and engineering design for the underground slurry reticulation and emplacement methodologies.

Conceptual Emplacement Methodology

Concepts of emplacement have been postulated by the project team.

The alternatives developed are for different slurry material properties exhibiting different beach angles when deposited.

One alternative is outlined in Palaris Report – Reject Emplacement Methodology, April 2019 Doc No. HUME5041-05. This alternative is for a slurry that will stand with a high beach angle when deposited. Deposition in this case will aim to fill the down dip plunges with sited heaps to maximise the volume emplaced.

Another alternative applicable to a lower beach angle slurry is to discharge the material from a nozzle located at local rises in floor elevation in the gate roads directing the material into individual plunges where suitable or letting it flow downhill and fill the accessible voids.

Both alternatives are based on retreat working from inbye outbye up dip. At all times coal mine workers will be located up dip of the region being stowed.

The co disposal emplacement of slurry and excess water can be achieved without the requirement for CMWs to enter a plunge. Emplacement can be achieved remotely from the development headings

Ventilation may be based upon operating with flanking returns from a central intake road. This will maintain standing plunges that may contain irrespirable or stagnant atmospheres on the return side of the working places.

Although at an early stage of engineering design, the Hume Coal emplacement system concepts are feasible.

There is no reason to believe that a feasible effective emplacement process can't be further developed.

7.2 Environmental Impact Considerations

- The Hume Coal Project plans to emplace all CHPP refuse material underground in permanently sealed panels
- At the completion of mining the access drifts and ventilation shafts will be permanently sealed as part of the mine rehabilitation
- There are no outcrop areas on the mine plan that will enable leakage of mine water to the surface
- CHPP refuse and excess water will be permanently encased underground

Underground co disposal of CHPP refuse and water is a technically challenging and expensive option for a coal mining project. Hume Coal has identified that innovative and sustainable alternatives to common practice are required to meet the expectations of the approval process to enable the project to proceed with certainty through the next stages of their corporate feasibility process.

7.3 Emplacement System of Work - Safety

The pump pressures and mains reticulation pressures proposed to move the slurry over many kilometres from the surface are high and have been recognised by the Hume Coal Project to be a hazard. High pressures are not uncommon in the underground mines, as an example, longwall systems use some very high pressures in their equipment.

The risks from this hazard will be controlled by a high factor of safety engineering design and by a formally developed Hazard Management Plan and Isolation Procedures.

Hume Coal proposes to allocate designated crews of trained supervisors and operators to the emplacement process.

The pressures at the emplacement end of the circuit will be reduced to no more than that required to discharge the slurry the required distance from the nozzle.

CMWs will be positioned outbye and up dip from the discharging material. The discharge point will be machine or skid mounted and controlled remotely.

The proposed concepts, when developed to the feasibility stage, will be able to provide a safe workplace for CMWs underground and CMWs on the surface of the mine.

KEY ISSUE #8

Principal Hazards Common to Underground Coal Mining

This independent consideration of the safety of the pine feather system of work proposed by Hume Coal includes consideration of those matters prescribed as principal hazards in the NSW Work Health and Safety (Mines and Petroleum Sites) Regulation 2014.

- Ground or strata failure
- Inundation or Inrush of any substance
- Mine Shafts and winding systems
- Gas outbursts
- Spontaneous combustion
- Subsidence
- Roads or other vehicle operating areas
- Air quality or dust or other airborne contaminants
- Fire and Explosion

Legislators have identified these principal hazards as being common to all mines and necessary to be managed at all mines.

Mr. Gavin Burns, Chief Inspector of Mines, in a submission (2019) responding to a request to provide information to the Department of Planning, apart from answering other questions, stated-

"Underground mining has inherent risks, regardless of the extraction method or the mineral being mined. Examples of these relevant to the Hume Coal project include:

- *Ground and strata failure,*
- *Inrush and inundation,*
- *Airborne contaminants,*
- *Fire and explosion; and*
- *Subsidence*

Inherent risk cannot be the sole determinant as to whether a mining operation will be safe or unsafe. Such a determination must be based on the adequacy of risk controls identified in Principal Hazard Management Plans and implemented by the mine operator to manage these risks as low as reasonably practicable."

This independent review is in complete agreement with this statement and will rely upon the Chief Inspectors wording rather than restating these facts.

This independent expert assessed each Principal Hazard in relation to the Hume Coal Project to determine whether it could be managed practically to an acceptable level of risk or whether there was an inherent flaw in the pine feather system of work which prevented the principal hazard from being controlled.

There is no Principal Hazard inherent in the proposed system of work which is incapable of being managed and controlled by the mine operator to a level of risk as low as reasonably practicable.

The independent review expects that each of these issues has been resolved, however it is worth recording each of the common Principal Hazards and their relationship to the Hume Coal Proposal.

8.1 Ground and Strata Failure

There has been extensive geotechnical expert planning, modelling and reviews conducted on the stability of the proposed mining layout in the Hume Coal Proposal.

I am familiar with the experts that have acted for the proponent and those that have reviewed the proposal for the Department of Planning.

Each of them is well qualified and highly respected within the coal mining industry. Each has made valuable contribution to this project.

Lacking their geotechnical qualifications, I have sought and used their advice over decades as a Mine Manager in the coal mining industry.

I have not however relied solely on their advice because on numerous occasions geotechnical experts do not share a common approach to an issue.

A Mine Manager (now a Manager of Mining Engineering) is required to make a final assessment of and sign off on Mine Plans, Strata Control Management Plans, Geological Hazard Plans, Triggered Action Response Plans and Permits to Mine.

Looking at the Principal Hazard of ground and strata failure through the eyes of a Manager of Mining Engineering at Hume Coal, one needs to consider;

- The expert geotechnical advice that has been given by experts commissioned by the project
- Any advice given by geotechnical experts who have reviewed the project
- Any significant differences between the advice presented that is material to the control of the Principal Hazard
- Can the consequences of any design shortcomings be controlled and or mitigated by Risk Based Operational Management Process?

There is general geotechnical acceptance that the overall pine feather pillar system and incumbent strata will remain permanently stable.

There have been questions raised about local stability issues, but no specific claims have been made that the designs are unstable.

The local stability of roadways, intersections, breakaways and plunges can be effectively managed through Strata Control Management Plans which are common practice throughout the underground mining industry.

In considering the proponents application for development consent the consenting authority may need to judge ground and strata failure issue in a similar fashion to a Mine Manager.

At the operational phase, the Safety Management System will contain a Strata Control Management Plan developed using risk-based techniques by the operational management team and CMWs. The controls in the Strata Control Management Plan and its associate Procedures, Standards and Trigger Action Response Plans will be capable of adequately controlling this principal hazard.

8.2 Inrush and Inundation

It would be ideal to develop a mine to the dip and then work to the rise leaving water and waste behind. This is not always possible due to the location of the available points of access to the coal seam. It is often precluded on commercial grounds by requiring an extended period of expense before a financial return from extraction is received.

It is not uncommon for mines to work with water stored in the mine at a higher elevation than the working sections. Numerous mines work under surface water bodies including tidal lakes.

Inrush and inundation are a principal hazard that has caused catastrophes, resulting in many mining fatalities. Historically most of the incidents have occurred as a result of mining into a water accumulation that was not known to exist, or the size and impact of the accumulation was not recognised.

Much has been learned from the catastrophes and MDG 1024 guideline and Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 has detailed requirements for working near an inrush potential.

The Hume Coal Project mine layout area has:

- No seam mined above it
- No old mine workings adjacent to it
- No rivers or water courses directed toward it
- No overlying high permeability aquifers that it will crack up into from any open goaf

The mine has been designed to leave 50m of coal seam barrier around any water that it stores underground. Fifty metres is a legislated and recognised effective barrier to prevent inrush.

The 50m barrier will be controlled by modern survey techniques, weekly operational planning, geological hazard plans, permits to work, geological and geotechnical inspection and strata monitoring.

The Reviewer has managed a mine that operated under Lake Macquarie with a 40 metre rock head cover between the workings and the bottom of the lake.

With the exception of Panel N021, water will only be stored in down dip panels and sealed by engineering designed and rated bulkhead seals at the top of the panel.

Properly designed and installed bulkhead seals are common in the coal mining industry.

The Resource Regulator commented in May 2019 – "The use of bulkhead seals is prevalent at underground coal mines in NSW. Bulkheads are designed specifically for each application in consideration of static head pressure, the nature of other materials that may be deposited behind the structure, and the strata conditions at the location where the bulkhead is to be installed".

Monitoring and the Mine Inspection System will monitor seals and water and pumping systems.

The Reviewer has not recognised a special hazard associated with underground water storage at the Hume Coal Project.

At the operational phase the Safety Management System will contain an Inrush and Inundation Management Plan developed using risk-based techniques by the operational management team and CMWs. The controls in the Inrush and Inundation Management Plan and its associate Procedures, Standards and Trigger Action Response Plans will be capable of adequately controlling this principal hazard.

8.3 Mine shafts and winding systems

The Hume Coal Proposal does not include any shafts or drifts using winding systems.

8.4 Gas Outbursts

The gas content of the target coal seam is very low to negligible and well below the threshold content for outburst to be considered a hazard at Hume Coal.

This principal hazard is capable of being controlled by operational management with the development of a Principal Hazard Management Plan (PHMP) for gas outburst, if during their Broad-Brush Risk Assessment, outburst is considered a hazard at Hume Coal.

8.5 Spontaneous Combustion

The tested propensity for spontaneous combustion of the Wongawilli full seam section at Hume Coal is low.

To my knowledge there is no record of any spontaneous combustion event in the long history of mining in the Wongawilli Seam.

The risk of this principal hazard at Hume Coal is very low. The proponent will develop a spontaneous combustion management plan and continuously monitor mine atmospheres to detect any form of heating.

This principal hazard is capable of being controlled by operational management with the development of a Principal Hazard Management Plan (PHMP) for spontaneous combustion.

8.6 Subsidence

The mine has been planned and laid out to minimise surface subsidence.

Geotechnical modelling has determined that the subsidence effects on the surface will be minimal and unlikely to be discernible against natural ground movements with climate.

Hume Coal has three geophysical monitoring devices in the ground over the project area to monitor and record natural ground movements prior to mining.

Mining induced vertical subsidence is predicted to be less than 20mm.

Surface subsidence will be regularly monitored by survey to check actual outcomes against those planned.

There is a low risk of subsidence damage associated with the pine feather layout proposed.

This principal hazard is capable of being controlled by operational management with the development of a Principal Hazard Management Plan (PHMP) for subsidence.

8.7 Roads and other vehicle operating areas

The mine surface has been properly planned to accommodate traffic flows of light and heavy vehicles and access from the main roads.

The proposed underground layout contains transport roads to all sections of the mine that are at adequate dimensions and grade to enable safe transport of men and materials.

At the operational phase the Safety Management System will contain a Transport Management Plan developed using risk based techniques by the operational management team and CMWs. The controls in the Transport Management Plan and its associate Procedures and Standards will be capable of adequately controlling this principal hazard.

8.8 Air quality or dust or other airborne contaminants

The ventilation system proposed for the Hume Coal Project supplies ample quantity of fresh air to the last open line of cut throughs in each operating panel (30 cubic metres per second).

Mine resistance has been minimised by the provision of shafts and drifts and multiple intake and return headings. Ventilation velocities have been planned at acceptable levels that will not raise excessive quantities of airborne dust.

The gas content of the target seam is minimal, and the ventilation quantities planned have targeted effective dilution of diesel particulates, control of heat, flexibility to respond to changed circumstances and providing a comfortable place of work.

Planning and design at this stage of the project have provided the necessary fundamentals for effective control of air quality, dust and airborne contaminants.

At the operational phase the Safety Management System will contain a Ventilation Management Plan developed using risk-based techniques by the operational management team and CMWs. The controls in the Ventilation Management Plan and its associate Procedures and Standards will be capable of adequately controlling this principal hazard.

8.9 Fire and Explosion

The stand-out feature when considering this principal hazard in relation to the Hume Coal project is that it is blessed with a very low seam gas content, the major proportion of which is carbon dioxide and the seam has a low propensity to spontaneous combustion. The Wongawilli seam has no history of spontaneous combustion.

The risk of the major source of fire and explosions experienced across the coal mining industry is minimal at the Hume Coal Project. That is a spontaneous heating igniting an accumulation of inflammable methane and exploding either as a gas explosion or a gas and coal dust explosion is minimal.

This review concentrated on other sources of fire and focused on possible fire sources in a plunge.

Fire hazard in areas of the mine other than plunges are no different to that at other mines and are managed by standard coal industry techniques.

Potential fire sources in plunges may be:

- equipment failure resulting in frictional heat igniting flammable material
- electrical fault causing arcing
- frictional ignition from cutter picks on incendive strata igniting a methane gas blower

These unlikely possibilities are controllable by standard coal mining control systems.

If a flame was generated, firefighting provisions will be put in place by the Operational Management Team and CMWs that may include any of the following and improved techniques that they will develop.

- Environmental and condition monitoring
- Automatically operated water spray and deluge systems
- On board automated fire suppression systems
- Inertization line and forcing face ventilation control triggered by monitoring
- Power control trip by monitoring

At the operational phase the Safety Management System will contain a Fire and Explosion Management Plan developed using risk-based techniques by the operational management team and CMWs. The controls in the Ventilation Management Plan and its associate Procedures and Standards will be capable of adequately controlling this principal hazard.

CONCLUSION

There is no Principal Hazard inherent in the proposed system of work which is incapable of being managed and controlled by the mine operator to a level of risk as low as reasonably practicable.

The Hume Coal Project will enjoy favourable mining conditions

- Very low gas content of the Wongawilli seam in the target area
- No likelihood of gas outburst
- No history of spontaneous combustion in the Wongawilli Seam
- Low stress strata conditions with depth of cover less than180 and stress relief provided on three sides of the target area by eroded river channels

Favourable mining conditions present lower risks and an easier task to provide a safe place of work.

The Hume Coal project team have conducted formal risk assessments on the proposed system of work and have identified the risks involved. There is no reason to believe that the operational management team will not have the qualifications, skills and ability to effectively manage risks identified to a level as low as reasonably practical.

APPENDIX - A

RUSSELL HOWARTH - CV

PROFESSION
Mining Engineer / Mine Manager

Russell Howarth is qualified in mining engineering and mine management with over 50 years mining experience with 40 years' experience in senior positions in the coal industry. He has been responsible for innovation in mining methods, strategic planning at the corporate and mine level and driving both the operational performance and restructuring of mines to maximize business opportunities and returns. Mr. Howarth has effectively managed coal mining operations ranging in scale from a single continuous miner operation to longwall mines producing at a capacity in excess of 6 million tonnes per annum.

QUALIFICATIONS
- BE (Mining) UNSW
- Mines Rescue Certificate
- Undermanager's Certificate of Competency
- Coal Mine Managers Certificate of Competency
- Site Senior Executive certificate QLD
- NSW Practicing Certificate

EMPLOYMENT HISTORY
RUSSELL HOWARTH AND ASSOCIATES PTY LTD - Principal Consultant
1999 – Present
Russell Howarth and Associates has provided services in the following areas;
- Contract mine manager to various mines including Baal Bone, South Bulga, Ulan, Beltana, West Wallsend, Crinum, Oaky No.1, Myuna, Ensham Underground Mine, Eagle Downs, Cook Colliery and Oaky North.
- Due Diligence studies
- Preparation of mine and material for Sale of Mine process
- Operational reviews
- Contract mining
- Operational performance improvement projects
- Development and audit of management systems
- ACARP research co ordination
- Project feasibility studies
- Mine planning
- Expert advice

POWERCOAL PTY LTD - General Manager
1994 - 1999

ENC PTY LTD - Business Manager and Assistant Superintendent
1992 – 1994

NEWCOM COLLIERIES PTY LTD – Manager of Myuna Colliery
1982 - 1992

CLUTHA DEVELOPMENT PTY LTD – Mine Manager Valley 2 Mine and Brimstone No2
1980 - 1982

J&A BROWN ABERMAIN & SEAHAM COLLIERIES PTY LTD – Undermanager at Chain Valley Mine
1979 – 1980

KEMBLA COAL AND COKE PTY LTD – Mining Engineer and Undermanager at Coal Cliff Mine, Darkes Forest Mine and Westcliff Mine
1973 – 1979

REFERENCE INFORMATION

This independent study referenced material supplied by the Applicant Hume Coal in relation to issues that were considered by the NSW Independent Planning Commission to be unresolved between the Department of Planning and Environment and Hume Coal.

Documents

State Environmental Planning Policy (Mining, petroleum Production and Extractive industries) 2007 under the Environmental Planning and Assessment Act 1979

Hume Coal Project – Environmental Impact Statement, March 2017

Hume Coal Project and Berrima Rail Project – Response to Submissions, June 2018

Paper – A Review of Highwall Mining Experience and Practice by Sungsoon Mo, Chengguo Zhang, Ismet Canbulat and Paul Hagan all from University of New South Wales. 2016

Paper – Design and construction of water holding bulkheads at Xstratacoal's Oaky No 1 Mine, Verne S Mutton (Minova Australia), Michael Salu (Parsons Brinkerhoff), Mark Johnston (Oaky No1 Mine) and Christian Mans (Oaky No 1 Mine). 2012

Information Circular 9506 issued by Department of Health and Human Services, National Institute for Occupational Safety and Health (NIOSH). June 2008. Guidelines for Permitting, Construction, and Monitoring of Retention Bulkheads in Underground Coal Mines by Samual P. Harteis, P.E., Dennis R. Dolinar, and Terence M. Taylor, P.E.

Hume CHPP Backfill Concept Design Report by Quality Process Solutions. April 2019

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Palaris Report HUME5041-12 Conceptual Ventilation Arrangements. January 2020

Mine Advice Report HUM08/1 Geotechnical Feasibility Report – Pine Feather Mining Method at the Hume Project. May 2015

Galvin and Associates Report No. 1716-12/2b Supplementary Report Independent Assessment Hume Coal Project. October 2018

Dr Ismet Canbulat Report No. DPE-HUME-2018-2 Response to *"Responses to reviews of the Hume Coal Project by Galvin and Associates, and Professor Ismet Canbulat.* 29 October 2018

Mine Advice Report HUME22/2 Response to DP and E Assessment Report, Hume Project. January 2019

Pillar Design Analysis using LaModel for Hume Coal and Mine Advice – Keith A. Heasley. 29 May 2018

B.K. Hebblewhite Report No. 1509/02.4 Summary Independent Peer Review: report on *"Pillar Design Analysis Using LaModel (29 May 2018).* 18 August 2018

B.K. Hebblewhite Report No. 1509/02.5 Summary Independent Peer Review: Report on *Interpretation of the Numerical Modelling Study of the Proposed Hume Project EIS Mine Layout"* by Mine Advice – Dr Russell Frith (June 2018) – HUME22/1. 19 August 2018

B.K. Hebblewhite Report No. 1509/02.6 Summary Independent Peer Review: *NSW Government Department of Planning and Environment – State Significant Development Assessment: Hume Coal Project and Berrima Rail Project* 21 January 2019

B.K. Hebblewhite Report No. 1509/02.7 Response to Mining Questions by Independent Planning Commission. 17 February 2019

Letter from NSW Resource Regulator, Matthew Newton -Director Compliance Operations ref DOC 18/591440 *Hume Coal Project and Berrima Rail Project: Response to submissions.* October 2018

Minute from NSW Resources Regulator, Garvin Burns – Chief Inspector of Mines ref AREQ0003181 *IPC Assessment of Hume Coal Project – request for additional information.* May 2019

Mine Advice Report HUME 22/2, Assessment of Plunge Breakaway Roof Stability as a Function of Varying Heading Width – January 2020

Presentation Palaris Hume 5178-13, Alternative to 6.5m Roadway Cut. January 2020

SMRS Mine Rescue and Gas Detection – Jim Strang and Paul Mackenzie-Wood

Legislation

Work Health and Safety Act 2011

Work Health and Safety Regulation 2017

Work Health and Safety (Mines and Petroleum Sites) Act 2013

Work Health and Safety (Mines and Petroleum Sites) Regulation 2014

Meetings and inspections

Rod Doyle – presentation on Hume coal geology at Hume Coal Project office and inspection of selected drill core at the storage facility in Moss Vale. October 2019. Summary Gas File supplied Nov 2019

Meet with Tyson Zastrow from Applied Mining Technologies at QCAT Pullenvale Brisbane. Inspection of underground inertial navigation technology Mining Guidance System and discussion on its practical capabilities for application to the pine feather mining system. October 2019

Meet with Russell Frith from Mine Advice for discussion on geotechnical inputs to Hume Coal mine design and practical issues for breakaway of plunges. October 2019

Meet with Darren Mathewson QPS and discuss content of his report and its battery limits. November 2019.

Meetings with Greig Duncan to seek information and discuss issues raised by this Independent Review.