TECHNICAL REVIEW BOARD ANNUAL REPORT

September 2013 – August 2014

State Government Victoria

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Executive Summary

The Technical Review Board (TRB or Board) was established by the Victorian Government in 2009 following the Warden's Inquiry into the collapse of the North East Batter at Yallourn Mine in the Latrobe Valley. A primary function of the TRB is to provide independent advice to assist the Victorian Minister for Energy and Resources (the Minister), the Victorian Department of Economic Development, Jobs, Transport and Resources (the Department) (formerly the Department of State Development, Business and Innovation) and industry on managing risks associated with ground instability in the mining and quarrying sectors. The Terms of Reference (TOR) for the TRB focus on risks to the environment, public safety and infrastructure.

The TRB was reappointed in September 2013 for a third two-year term, with membership of the Board unchanged. During the 2013-14 reporting period, the TRB had a particular focus on supporting research and education initiatives and promoting collaboration between stakeholders at all levels in the mining sector.

The TRB is now mid-way through its third term. Since its inception, it has reported to two governments, four ministers and two government departments. In light of these changes, this annual report includes an overview of TRB activities, findings and recommendations from the past five years. It is encouraging to note the progress made by all stakeholders and the many key outcomes achieved, during this time.

During the current reporting period the Board met formally on six occasions. Additionally Board members, individually and collectively, had involvement in a range of activities associated with the TOR. These included:

- a focus on fostering greater engagement and collaboration amongst all stakeholders
- contributions to developing a successful department bid for research funding to undertake a batter stability study
- motivation and involvement in the development of a *'Guideline for Management of Ground Control Risk in Latrobe Valley Brown Coal Mines'* of Victoria
- a briefing on the interim peer review report dealing with the repair of the Morwell River Diversion
- advice to the Department arising out of Mine Stability Management Audits undertaken by the Department
- site inspection and advice relating to unplanned batter movement at Yallourn Mine that resulted in the temporary closure of a secondary public road
- the development and successful launch of the Latrobe Valley Geotechnical Interest Group, affiliated to the Australian Geomechanics Society (AGS)
- participation in and support for the research and education initiatives of the Geotechnical and Hydrogeological Engineering Research Group (GHERG) at Monash University and, subsequently, Federation University
- maintaining a watching brief on mine stability across all brown coal mine sites
- assisting mine sites with the development of Ground Control Management Plans.

In the remaining reporting period for 2014-15, the TRB's focus across the Latrobe Valley will be on:

1. embedding the improvements to date in managing mine stability
2. fostering education and research to help better understand key factors that impact on mine stability and effective rehabilitation.

Encouraging ongoing cultural change and the development of field research projects, such as the batter stability research project, are key elements in achieving these objectives.

By world standards, Latrobe Valley brown coal mines are large and complex structures. The TRB reiterates its earlier advice that the effective rehabilitation of mine sites will take time; time to research and develop a proper understanding of the issues that govern ground behaviour and time to work through the subsequent implications for the safety and security of surrounding infrastructure. The allocation of funding in the 2013 Victorian Budget to initiate and fast track a range of actions to address mine stability risks at major coal mines in the Latrobe Valley was timely. Nevertheless, the initiatives being supported with this funding represent only a small component of the research effort required, albeit a very important and critical component.

Although the TOR for the TRB extend to beyond the brown coal sector, this component has consumed most of the TRB's attention to date. This is due to the recent frequency and scale of brown coal related incidents and the challenge of addressing legacy issues in order to move forward. The TRB intends to broaden its focus in the 2014-15 reporting period to include a number of additional operating quarry sites and defunct mines that present rehabilitation challenges.

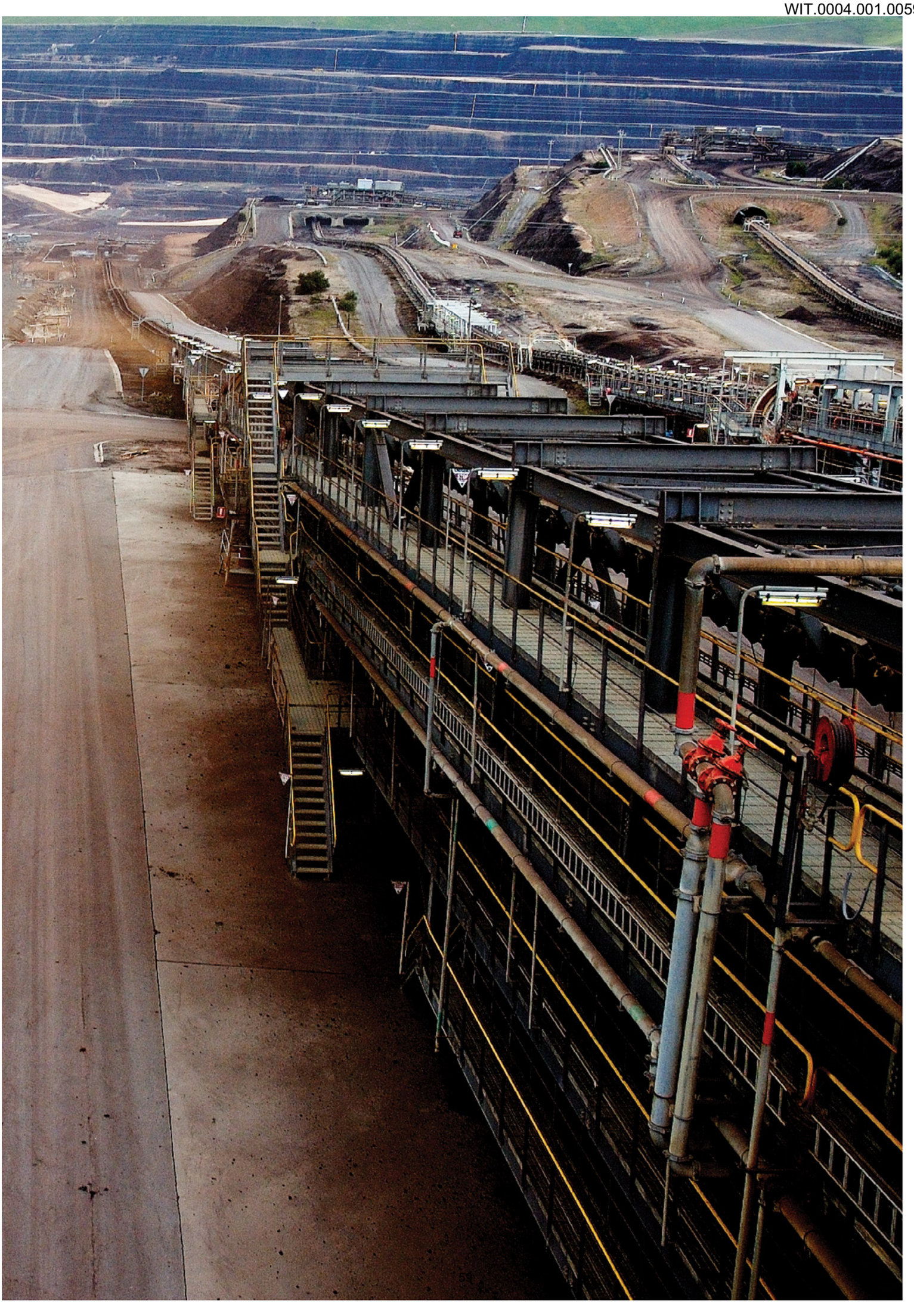
Reflection on the history of events leading up to the mine instabilities in the brown coal sector, the manner in which these incidents were managed and mitigated, the findings of high level geotechnical reviews and exposure to the approval processes, has led the TRB to conclude that there are significant uncertainties and gaps in the management of stability in the Latrobe Valley mines that relate to the interacting elements of knowledge and competency, risk management, and regulation.

There is an emerging appreciation amongst all stakeholders of the gaps and uncertainties in knowledge, competency and risk management, but there is still some way to go. Research and education are fundamental to addressing these matters and, therefore, are focal points of the TRB in its new term, which commenced in September 2013.

The history of recent instabilities in the Latrobe Valley mines and the events leading up to them cause the TRB to be of the strong view that designs for critical mine infrastructure need to be subject to robust, independent, third party review. The Board will continue to advocate that this should be an integral part of risk management embedded in each mine's Ground Control Management Plan.

The TRB will be focusing during its new term on regulatory aspects relating to mine stability with a view to providing advice on improving efficiency and effectiveness. The current legislative requirement for mines to provide stability reports to the regulator on a six monthly basis, for example, appears to be particularly onerous for the mines and to stretch the Department's resources to undertake a meaningful review of the information and to respond to it in a timely manner. The TRB will be considering whether the development of effective Ground Control Management Plans could enable this process to be streamlined and made more effective by enabling mine owners to report on a 'by exception' basis.

In summary, the TRB is encouraged by the signs of a cultural change in how mine stability is being managed in the Latrobe Valley. Research and education initiatives are a priority to support this change and to foster greater engagement and collaboration amongst all stakeholders. It is timely for stakeholders to give consideration to whether the current administrative processes and their resourcing are the most appropriate for mines that are already large and complex by world standards and continuing to become more so.



Introduction

The Technical Review Board (TRB) was established by the Victorian Government in 2009 following the Warden's Inquiry into the collapse of the North East Batter at Yallourn Mine in the Latrobe Valley. The Inquiry identified several areas where improvements in the Victorian mining industry could be made. It was established as an Advisory Panel under Sections 54A, 54C, 54D and 54E of *The Mineral Resources (Sustainable Development) Act 1990*. Its purpose is to provide independent advice to the Victorian Minister for Energy and Resources (the Minister), the Victorian Department of Economic Development, Jobs, Transport and Resources (the Department) (formerly the Department of State Development, Business and Innovation) and industry on managing risks associated with mine instability in the Victorian mining and quarrying sectors. The Terms of Reference (TOR) for the TRB focus on risks to the environment, public safety and infrastructure.

Terms of reference

The TOR for the TRB have a wide scope and call for advice to be provided to the Minister and the Department in three general areas. These are:

1. strategy
2. mine stability assessments
3. other activities, including education, research and interaction with industry.

The overall aim of the TOR is to improve geotechnical and hydrogeological performance and knowledge within the Victorian mining industry.

"The Board will report to the Minister on an annual basis. The Minister may subsequently release the Board's report to the Department and relevant industry stakeholders.

The Board will periodically provide advice on mine and quarry stability, to the Minister and the Department, in the following areas:

a. *Strategy*

Written and/or verbal advice on the Department's strategies and regulatory approach to mine and quarry stability and geotechnical issues.

Written and/or verbal advice on new developments in technology and science relating to the understanding, monitoring or management of mine and quarry stability and related geotechnical and hydrogeological issues.

b. *Stability Reports*

Review mine and quarry stability reports including monitoring data that has been submitted to the Department and provide written advice to the Minister.

c. *Other Activities*

Advise the Minister in formulating appropriate response to significant events related to mine and quarry stability and related geotechnical and hydrogeological issues.

Advise the Minister on appropriate guidelines and educational initiatives related to mine and quarry stability.

With the knowledge and agreement of the Minister, interact directly with industry on mine and quarry stability and related geotechnical and hydrogeological issues, including participation in site visits, presentations and dialogue, particularly with respect to communicating findings of reviews with relevant stakeholders.

In conjunction with the Department, interact directly with Federation University (formerly Monash University, Gippsland campus) in relation to the Research and development program on brown coal geotechnical and hydrogeological issues."

Board Members

The Board comprises four members.

Emeritus Professor Jim Galvin - Board Chairman

Professor Galvin has extensive international experience in mining and geotechnical engineering, risk management and Occupational Health and Safety (OH&S). His career encompasses working in and managing underground mines, leading and directing research bodies, headship of the School of Mining Engineering at the University of New South Wales, and consulting. Current and recent appointments include member of the New South Wales Planning Assessment Commission (part-time); independent member of the Health, Safety, Environment and Community (HSEC) Advisory Committees to the Boards of BHP Billiton and Solid Energy New Zealand; chair of the Federal Government Australia-China Joint Safety Taskforce to Improve Safety in Coal Mining, and of the Continuing Professional Development Committee of the Mine Managers Association of Australia. Professor Galvin has been a member of the TRB since its inception in 2009 and Chairman of the Board since 2011.

Professor Ian Johnston - Board Member

Professor Johnston graduated from the University of Southampton, United Kingdom (UK), with a bachelor's degree in civil engineering and a PhD in geotechnical engineering. After practicing in the UK, the United States of America and Europe, he joined Melbourne's Monash University in 1975. He became Dean of Engineering at Melbourne's Victoria University in 1993 and five years later moved to Coffey Geotechnics where he was a Senior Principal. In 2009, he was appointed to the Golder Chair of Geotechnical Engineering at the University of Melbourne. He has more than 40 years' experience in geotechnical engineering, both as an academic and as a consultant for major projects in Australia and overseas. His interests cover a wide range of topics and he is particularly well known for his work on soft and weak rock and the engineering problems associated with the stability of this material in civil and mining engineering.

Professor Rae Mackay - Board Member

Professor Mackay holds a degree in civil engineering from Imperial College, London University and a PhD in Hydrogeology from the University of Newcastle upon Tyne. In 2011, he was appointed as Director of the Geotechnical and Hydrogeological Engineering Research Group at Monash University – Gippsland Campus. Prior to moving to Australia to take up this appointment, Professor Mackay was an advisor to the UK nuclear waste management program. He was also Professor of Hydrogeology and Head of the Hydrogeology Research Group at Birmingham University, UK, where he worked on a diverse range of subjects including arid zone hydrogeology, sustainable urban water resources, geothermal energy exploitation and nuclear waste disposal. His current research role is directed at understanding risks and impacts associated with the ongoing development and eventual long-term rehabilitation of the brown coal mines in the Latrobe Valley, with his primary interests being in understanding subsurface flow and transport processes and developing predictive models for engineering and environmental applications. Professor Mackay is also a member of the Clean Coal Victoria Advisory Group.

Mr Alan Moon – Board Member

Mr Moon is an engineering geologist with more than 40 years' experience in ground investigations for civil and mining projects in a wide variety of geological environments in Australia and overseas. He has a bachelor's degree in geology from Imperial College, London, a master's degree for research in slope stability and soil mechanics from the University of Tasmania and has held part-time teaching positions at several universities. From 1997 to 2013, he was a Senior Principal with Coffey Geotechnics, providing specialist and review inputs to projects in Australia and overseas. He is now self-employed. Mr Moon has specialist expertise in soil and rock slope stability and risk assessment and management, with most of his recent work being as a geotechnical specialist on technical review panels associated with dams and slopes.

TRB Overview: September 2009 - August 2013

The TRB was created by the Victorian Government in response to findings from the Warden's Inquiry into the collapse of the North East Batter in East Field at Yallourn Mine in November 2007. It met for the first time in September 2009 and is now mid-way through its third two-year appointment. Since its inception, the TRB has reported to two governments, four ministers and two government departments. In light of these changes, this annual report includes an overview of TRB activities, findings and recommendations from the past five years.

It should be noted that the term 'risk' is used by the TRB in a manner consistent with *International Standard ISO 31000:2009 Risk Management – Principles and Guidelines*, to which Australia subscribes. As such, risk is a combined measure of the likelihood of an event occurring and the consequences should it occur. A batter with well-developed signs of ongoing movement could be expected to be classified by the TRB as 'at risk' on the basis of the likelihood of this movement eventually leading to a serious stability problem in the absence of engineering intervention. However, a batter with relatively minor levels of ongoing movement could also be classified as 'at risk', despite the lower likelihood of it becoming unstable, if the consequences of instability were unacceptably high (for example, derailment of a train).

TRB1: September 2009 – August 2011

The inaugural Technical Review Board (TRB1) comprised four members and was chaired by Mr Tim Sullivan, the Warden who conducted the Yallourn Mine Batter Failure Inquiry. Mr Sullivan is an engineering geologist who is internationally recognised for his expertise in slope stability. Remaining Board members were:

- Mr Ted Waghorne, an experienced mine manager and consultant in the Victorian brown coal sector
- Professor Adrian Brown, a specialist in hydrogeology based in the USA but with past operating experience in the Latrobe Valley
- Professor Jim Galvin, an experienced black coal mine manager and specialist in risk management and underground geotechnical engineering.

The activities of TRB1 focused across a broad spectrum and included:

- Assessment of the stability of brown coal mines in the Latrobe Valley and at Anglesea and identification of associated impacts and consequences.
- Assessment of mine and quarry stability issues in Victoria in general, including assessment of ground control risk management processes.
- Assessment of current and future legislative frameworks.
- Interaction with Monash University to foster the establishment of the Geotechnical and Hydrogeological Engineering Research Group (GHERG) as another government response to the findings of the Yallourn Mine Batter Failure Inquiry.

By the end of TRB1's first term, the assessment of the stability of the brown coal mines was still a work in progress, with seven 'at risk' batters identified. The seven 'at risk' batters were:

- The North East Batter at Yallourn Mine (the site of the 2007 failure) – due to ongoing movement in the mine floor and the batter in the general area of the 2007 collapse.
- The Northern Batter, west of the North East Batter, at Yallourn Mine – due to the nature of ongoing movement and its close proximity to the failed North East Batter.
- The Northern Batter at Hazelwood Mine – which subsequently experienced significant unplanned movement towards the end of the term of TRB1, resulting in closure of the Princes Highway for seven months.
- The Hernes Oak Batter at Yallourn Mine – which subsequently experienced excessive movement some distance further along the batter, requiring engineering intervention. The original site retains the classification of being 'at risk'.
- The Morwell River Diversion at Yallourn Mine – which subsequently failed.
- The Southern Batter at Anglesea Mine – which was subsequently restabilised on the basis of TRB1 advice to the Minister through the Department.
- The Southern Batter at Loy Yang Mine, on which all of the conveyors out of the mine are situated, and where there was previous experience of a localised unplanned movement.

Based on these early assessments, TRB1 identified a range of fundamental issues relating to how geotechnical risk was being understood and managed by both mine owners and Earth Resources Regulation (ERR). These issues primarily related to the long history of the mines and how they had evolved independently of the mainstream Australian mining industry; the privatisation of the coal mines and power stations; and the selling off of the principal group responsible for managing geotechnical and hydrogeological risks in the vicinity of the mines, namely the State Electricity Commission of Victoria (SECV). TRB1 determined that the latter two factors resulted in significant changes in how mine stability, and the impacts of the mines outside their immediate footprint, was being managed.

The SECV was a government institution and, while focussed on coal production and power generation, it also directed due consideration to the more regional potential impacts of mining. When the mines were privatised, the defunct mining areas were included in the sale and the new owners inherited the legacy of all the previous mining. Over time, it appeared that old mining areas came to be regarded as only "rehabilitation issues". In many instances, inherent geotechnical problems recognised at the time of mining were largely forgotten with the passage of time.

Surface movements, both inside and outside the Latrobe Valley open cut mines, are a standard feature during mining in this environment, however in some areas they continue decades after excavation has stopped. TRB1 expressed concern regarding the consequences of these movements, especially with the passage of time and as the size and depth of the mines increased. It identified that mine slopes and surrounding areas excavated in brown coal in the Latrobe Valley are potentially subject to four generic types of movement. They are:

1. Regional (Latrobe Valley-wide) groundwater extraction-induced settlement.
2. Horizontal and vertical movement that occurs around the mines, well away from the mine edges, during and soon after mining has been completed.
3. Ongoing movement at specific locations in and around the mines, in some cases decades after cessation of mining in the immediate area.
4. Localised movement related to slope instability.

Experience at the time showed that Type 1 movements can extend for several kilometres (km) from the edge of the mine, while Type 2 and 3 movements may extend for up to 700 metres (m) (and conceivably further in some instances). Prior to privatisation, these movements and their resultant impacts were monitored and assessed by the SECV. However, after privatisation, monitoring stopped in many areas other than for Type 1 movements and some controls were relaxed. This lead to potential impacts not being fully assessed and the presence of some problematic areas being forgotten. There is now significant natural and man-made infrastructure located within areas susceptible to the consequences of these movements.

TRB1 reported that the last fundamental research into the mechanical properties of brown coal in the Latrobe Valley was undertaken in 1965. It concluded that there was an urgent need to initiate research in critical areas of mine stability and rehabilitation. This research was required to be a mix of applied and theoretical, across a broad spectrum of areas. TRB1 was of the view that this overall research program would best be formulated within a framework that was governed by the internal structure model adopted by GHERG.

TRB1 concluded in respect of mine stability that:

1. There had been a significant loss of corporate understanding and history (memory).
2. The mines had become conditioned to ground movements and to the risk of mine instability. Some risks had been normalised. That is, they had come to be considered a normal situation, something to be expected and nothing to be too worried about.
3. The design of the Latrobe Valley mines did not adequately address all potential movement mechanisms.
4. This had led, in part, to a situation where two of the basic mine design objectives - serviceability and durability - were not being addressed effectively.
5. It was not well understood that mine design was relative to critical or extreme loading events, nor was it undertaken to a sufficiently high standard appropriate to the risks.
6. Because the mine sites had become conditioned to risk, the TRB1 was not confident that all risks with potentially serious consequences in the long-term had been identified.

The Northern Batter at Hazelwood Mine was one of the examples chosen by TRB1 to illustrate the loss of corporate understanding and memory. This preceded the batter moving and resulted in the closure of the Princes Highway for an extended period of time. TRB1 identified that the possible impacts of movements in the Morwell Main Drain, which runs along the top of this batter, were recognised back in the 1970s by the SECV. Nevertheless, the Princes Highway was subsequently re-routed and placed adjacent to the drain and within the zone of significant batter movement known at that time. Hence, new and elevated risks to public safety and infrastructure developed, leading to a number of incidents since 2011.

In regard to Victoria's legislative framework, TRB1 determined that there was an overlap between Work Safe (now the Victorian WorkCover Authority) and the Department in regulating mine stability. This occurred because each statutory body was focused on different performance outcomes: work place health and safety in the case of Work Safe and environmental and community impacts in the case of the Department.

TRB1 identified a range of initiatives to help address some of the issues:

1. Systematic detailed site inspection and review of ground stability at each mine to assist the mines and to improve TRB confidence that all potentially major risks had been identified.
2. Training of mine personnel and departmental officers in mine stability principles and practices and in failure mechanisms and investigations.
3. Training of mine personnel and departmental officers in ground control risk management principles and practices.
4. A higher focus on independent external peer review.
5. The development of a *Guideline for Management of Ground Control Risk in Latrobe Valley Brown Coal Mines*.
6. Presentation of a number of workshops and coaching sessions in the Latrobe Valley relating to mine stability and rehabilitation.

It is noted for the purpose of this 2013-14 Annual Report that initiative No. 1 has been completed and implementation of all other initiatives is well advanced.

TRB2: September 2011 – August 2013

As a result of issues identified by TRB1, the membership of TRB2 was reorganised. Professor Jim Galvin was appointed as Chair and Professor Rae Mackay took up a standing position on the TRB in his role as Director of GHERG. Professor Ted Brown AC was appointed to TRB2 in recognition of his internationally-renowned expertise in civil engineering, mining rock mechanics and of his pioneering geomechanical research in brown coal in the Latrobe Valley in the 1960s. Professor Ian Johnston was appointed in respect of his expertise in the behaviour of soft and weak rock and the engineering problems associated with the stability of this material in civil and mining engineering. Upon the retirement of Professor Brown, Mr Alan Moon was appointed due to his expertise in engineering geology with respect to dams and slopes.

From its beginning, TRB2 adopted a policy of engaging more closely with mine management. This approach was in the interests of fostering collaboration and transparency and developing an industry-wide understanding of the issues associated with ground stability and rehabilitation in Victoria's brown coal sector. This continues to deliver positive outcomes to the TRB and GHERG today, and by all accounts, to the mine sites. It has been a catalyst in promoting education of all stakeholders and in helping change culture in regard to the management of mine stability.

Two significant batter instability incidents occurred during the first year of TRB2. These incidents were the failure of the Morwell River Diversion and the movement of the Hernes Oak Batter. As already noted, both of these features had been identified by TRB1 as being 'at risk'.

At the time of preparing the TRB2 2011-12 Annual Report, the Morwell River Diversion failure was in the early stages of investigation and remediation. Discussions were also ongoing regarding the remediation of the Morwell Main Drain as one of a number of actions related to the Hazelwood Northern Batters instability event that impacted the Princes Highway.

The 2011-12 Annual Report concluded that there had been virtually no advancement for many years in the brown coal sector's understanding of the characteristics, mechanisms and movements of slopes and batters and the consequences of these movements for public safety, surrounding infrastructure, continuity of coal supply and the environment. Technical areas that appeared not to have experienced continuity and ongoing development at all mines in recent years included:

1. Construction of both local and regional geological cross-sections and models.
2. Determination of geotechnical properties of strata to underpin design and stability assessment.
3. Hydrogeological measurements to support mine design, verification of design effectiveness, and timely detection of changed conditions.
4. Stability assessment techniques.
5. Regular stability inspections.
6. Extent, regularity and presentation detail of monitoring.
7. Hazard mapping, risk assessment and mitigation.
8. Planning for mine closure.

Accordingly, TRB2 expressed the view that stakeholder culture needed to change in regard to managing ground control within a risk management framework if further incidents of major instability were to be avoided. It identified a need to significantly improve the technical expertise and understanding of all stakeholders in the Victorian brown coal sector so that standards, practices and risk management were commensurate with international best practice.

Given the nature of the legacies and the complexity of the issues, TRB2 advised that it would take some time to develop, implement and refine effective solutions. A range of initiatives were identified in the 2011-12 TRB Annual Report for consideration, with six principal initiatives noted to be:

1. Geotechnical Studies. TRB2 recommended that all public infrastructure and significant natural features within one kilometre of the crest of brown coal mine batters be identified and mapped, and that they be classified as being of minor, moderate or major significance according to the potential consequences arising from mining-induced ground movement.
2. Contingency Planning. Many key activities and operations were not clearly supported by contingency measures in the event of being impacted by ground instability. Accordingly, TRB2 recommended that each of the mines review their operations to identify vulnerable infrastructure, activities and operations, with a view to developing appropriate contingency measures.
3. Monitoring, Data Processing and Reporting. An extensive array of important monitoring equipment was installed in and around the mines for measuring ground displacements, pore water pressures and water flow volumes. However, TRB2 identified that there appeared to be variable levels of monitoring and the reliability and use of the data obtained was much less than desirable. A number of improvement measures were suggested for consideration.
4. Rehabilitation. Based on its analysis and insights from instabilities, TRB2 was of the view that mine rehabilitation measures considered to date fell well short of what could reasonably be considered as adequate. There appeared to be a general presumption and acceptance that the mines would simply become flooded to form inland lakes, with no consideration given to a range of complicating issues. TRB2 recommended that immediate steps be taken to assess rehabilitation issues, processes, risks, amelioration options, time lines, priorities and, most importantly, the cost liabilities associated with the closure of each existing mine.
5. Future Direction for GHERG Research and Education. TRB recommendations arising from the reviews carried out at Yallourn and Hazelwood Mines highlighted research and education needs to be considered for inclusion into the research and education programs of GHERG in the year ahead.
6. Changing Stakeholder Culture. TRB2 developed a government proposal for changing stakeholder culture. This was based on greater engagement between all stakeholders; the development of a Geotechnical Guideline by an industry working party, the development and implementation by each mine of a robust, risk-based Ground Control Management Plan; an increased emphasis on research and education forums; and a higher focus on independent, external peer review.

At the time of preparing the 2012-13 TRB Annual Report, stability assessments for all Latrobe Valley brown coal mines had been completed by Mr Sullivan and provided by the Department to TRB2 for review and advice. One new 'at risk' batter had been identified, being the Northern Batter at Loy Yang Mine. This batter was classified `at risk' primarily on the basis of a lack of understanding and data relating to the cause of movements at that point in time, albeit that the movements did not give rise to any immediate cause for concern.

In its 2012-13 Annual Report, TRB2 advised that it was pleasing that there had been meaningful progress in addressing technical issues and advancing initiatives identified in the 2011-12 TRB Annual Report. In particular, technical progress had been made in areas relating to water management, monitoring and data processing, and it was evident that culture was changing at a mine site level in regard to the management of mine stability.

TRB2 proposed a number of activities to continue to support cultural change. These included:

- An approach to the Victorian Chapter of AGS, a technical group sponsored by Engineers Australia (EA) and the Australasian Institute of Mining and Metallurgy (AusIMM), to set up a Latrobe Valley Geomechanics Group.
- The start of educational initiatives through GHERG, with courses appropriate to the development of a greater understanding of stability issues at the mines in general accordance with TRB2 recommendations.
- The development of guidance material for managing geotechnical risk in Victorian brown coal mines. This need was also identified by TRB1. Funding to support the initiative was allocated by the Victorian Government in the 2013 budget.

TRB2 maintained a watching brief on the remediation of the Morwell Main Drain. It was also consulted extensively by the Department in regard to the causes of the failure of the Morwell River Diversion, the repair program, and the implications of the failure for the long-term stability of sections of the diversion further upstream and for the mining of the Maryvale Extension.

TRB2 remained of the opinion that original measures proposed for the rehabilitation of the Latrobe Valley mines fell well short of what could reasonably be considered as adequate for achieving long-term safe and stable batters from a ground control perspective. Experience indicated that rehabilitation was a far more complex matter than envisaged when rehabilitation plans were developed as part of the work plans for the mines. Progress was being made in addressing these shortcomings.

There was an emerging appreciation amongst all stakeholders of the gaps and uncertainties in knowledge, competency and risk management, but there was still some way to go. Research and education were fundamental to addressing these matters. TRB2 strongly supported a departmental approach to government funding a batter stability field research project. This type of research was considered fundamental to developing an adequate understanding of batter stability and options for rehabilitation that delivered long-term safe and stable final mine slopes.

In summary, at the end of its term, TRB2 was encouraged by the signs of a cultural change in how mine stability was being managed in the Latrobe Valley. Research and education initiatives were still a priority to support this change and to foster greater engagement and collaboration amongst all stakeholders. It was timely for stakeholders to give consideration to whether current administrative processes and their resourcing were the most appropriate for mines that were already large and complex by world standards and continuing to become more so.

2013-14 Activities and Status

Introduction

TRB3 was constituted in September 2013 for a two year term, with Board membership unchanged. During the 2013-14 reporting period, TRB3 had a particular focus on supporting research and education initiatives and promoting collaboration between stakeholders at all levels in the mining sector. This included advising the Department on its application for funding to support research into batter stability and on the construction of the research program. The Board considers this type of research to be essential if mine stability and rehabilitation issues are to be successfully addressed.

TRB3 continued to maintain a watching brief on mine stability in the Latrobe Valley and also at Anglesea and on the remediation of the Morwell River Diversion. This included investigating and advising the Department in regard to an unplanned batter movement at Yallourn Mine that resulted in cracking of Latrobe Road, requiring its closure for several days.

While TRB3 had no direct involvement in combating the Hazelwood Mine fire, it maintained a watching brief on firefighting activities and liaised with the Department on a number of occasions.

Summary of TRB3 Activities

A summary list of key TRB3 activities during the 2013-14 reporting year is presented in Table 1. The full Board met formally on six occasions. Two Board members also contributed to a workshop on the Batter Stability Research Project. A range of tasks was completed out of session.

TABLE 1: SUMMARY LIST OF KEY TRB3 ACTIVITIES SEPTEMBER 2013 TO AUGUST 2014

DATE		WHO	KEY ACTIVITIES
2013	30 October – 1 November	Full Board	• Meeting with DSDBI Earth Resources Regulation Executive Director and General Manager Operations. • Onsite meeting with GDF Suez Hazelwood Mine on the development of a Ground Control Management Plan. • Loy Yang mine site visit. • Advice to the Department regarding TRB3 research recommendations.
	17 – 19 December	Full Board	• Presentation to DSDBI and TRB3 by Coffey International regarding Progress Report on Independent Third Party Peer Review - Task 1 of Morwell River Diversion Recovery Works. • TRB3 participation in Batter Stability Research Project Workshop – project scope and deliverables. • Discussions on First Annual Conference on Geotechnical Engineering in Brown Coal (October 2014). • Letter to the Department regarding the status of the Morwell River Diversion Repair Peer Review.

DATE		WHO	KEY ACTIVITIES
2014	25 – 26 February	Full Board	• DSDBI update and discussions on the fire situation in the Latrobe Valley mines. • TRB3 participation in Batter Stability Project workshop – scope, time-frames, staffing requirements, outcomes, and the need for a Technical Leader and Technical Advisory Group. • Advice to the Department regarding the implications of the Hazelwood Mine fire on the risk of batter instability.
	31 March – 1 April	Full Board	• Site visit to Alcoa Anglesea Mine. • Letter to Minister providing an update on developments subsequent to 2012-13 TRB2 Annual Report.
	4 April	Professor Mackay and Professor Johnston	• TRB3 participation in Investment Logic Map Workshop on Batter Stability Research Project.
	10 – 11 June	Full Board	• Discussions on Hazelwood Fire Inquiry and associated batter stability issues. • Meeting with Minister. • Letter to the Department regarding the identification of batters at risk. • Discussions on Loy Yang and Hazelwood Mine Ground Control Management Plans. • Discussions on Batter Stability Project and Latrobe Valley Geotechnical Guidelines. • Discussion on proposed amendments to Declared Mines Reporting.
	10 – 15 August	Full Board	• Site visit and discussions regarding Latrobe Road incident. • Site visit to Hazelwood Mine. • Meeting with Clean Coal Victoria, including presentation by TRB3 Chairman. • Site visit to Loy Yang Mine. • Site visit to Yallourn Mine. • Meeting with the CEOs of the Latrobe Valley brown coal mines.

MRD Peer Review Presentation

In December 2013, Coffey International presented its peer review of the Morwell River Diversion repair to TRB3. The presentation was based on an interim report completed in October 2013. The Board was impressed with the quality and extent of the work undertaken and the manner it was being reported. The peer review process appeared to be flushing out many key issues and providing a number of valuable points of reference for moving forward. Nevertheless, TRB3 noted that many of the interim findings of Coffey International's peer review were highly qualified and the Board cannot provide assurance that all of the more important issues had been addressed at the time of the presentation.

Geotechnical Guideline

The inaugural TRB identified the need for the development of a geotechnical guideline for managing ground control risk in the brown coal mines of Victoria. In 2014, the Department commissioned a specialist to assist an industry committee in developing this guideline. Its overall aim is to collate the current body of knowledge, experience and practice for managing ground control risks associated with the design and operation of the Victorian brown coal mines.

Mine Stability Management Audits

During the 2013-14 reporting period, the Department undertook a Mine Stability Management Audit at each of the three Latrobe Valley brown coal mines. TRB3 reviewed the outcomes on behalf of the Department. It determined that while there have been advances in ground control management, many areas remain that require further development, especially at some mines. A fully functional Ground Control Management Plan is a key element in any ground control management process. At present, only one mine has a fully developed and implemented plan. The *Guideline for Management of Ground Control Risk in Latrobe Valley Brown Coal Mines*, scheduled for completion in the next reporting period, will assist in developing and enhancing the Ground Control Management Plans of these mines.

Latrobe Valley Geotechnical Interest Group

The Latrobe Valley Geotechnical Interest Group (LVGIG) was established at the end of 2013 with the encouragement and support of the TRB. The LVGIG has obtained recognition from the AGS and financial support from the AGS towards its seminar program. An interim steering committee comprising members of the Latrobe Valley geotechnical community and chaired by Professor Mackay was established at the first meeting to develop a program of seminars and a symposium to be delivered in 2014. The seminar and colloquium schedule is presented in Table 2.

TABLE 2: 2014 SEMINAR SCHEDULE OF THE LVGIG

DATE	SEMINAR TOPIC
11 February	Gippsland Regional Geology and the History of Brown Coal Mining.
8 April	Structure Mapping – Understanding and Implementation.
10 June	Seismic Events – Cause and Effect in Gippsland.
12 August	Seismic Engineering of Embankment Dams.

In addition to AGS assistance, financial support for the seminars has been provided by the three Latrobe Valley brown coal mines and GHD, with the Gippsland campus of Federation University (formerly Monash University) providing the venue. The first four seminars held in the reporting period were well attended with more than 40 persons registered for each meeting.

TRB3 has contributed to the planning of the one day symposium scheduled to be held in the Latrobe Valley in October 2014. The symposium will deal primarily with geotechnical issues and will include presentations from the mines and consultants from the Latrobe Valley and elsewhere. TRB3 will also contribute to a half day workshop on Ground Control Management Plans to be held in conjunction with the symposium.

Batter Stability Project

TRB3 was involved in a substantial program of work in 2013-14 to develop a research project proposal and brief within the Department for a batter stability study at Yallourn Mine. Progress on the technical development of the project was made through two short-term projects in August 2014 to prepare a basic database founded on the Latrobe Valley Regional Borehole Database. The short-term projects were to assemble a database centred on the location of the 2007 batter failure at Yallourn Mine and to undertake a preliminary review of this data. The project brief was approved by government for $2.2M funding in August 2014. The research program will extend over a period of four years.

The major goals for the project are:

- To build a more complete understanding of all geotechnical processes required for long-term management of mine stability, mining environmental impacts and mine rehabilitation.
- To develop strategies for geotechnical and hydrogeological data collection and monitoring to support the mitigation of the geotechnical risks at the mines.

The TRB considers research to be of the highest priority for developing a proper understanding of mine stability and rehabilitation options. This project is an important, albeit small, step forward.

Engagement and Collaboration

In its 2012-13 Annual Report, TRB2 discussed the need to foster greater engagement and collaboration amongst all stakeholders. With that aim in mind TRB3:

- initiated several meetings with the Mineral Council of Australia (Victoria Division)
- met with the Minister in Melbourne
- met with Latrobe Valley CEOs to discuss progress in managing geotechnical risk in the brown coal mines and to encourage closer interaction with all stakeholders
- visited all Latrobe Valley and Anglesea brown coal mines and had constructive discussions with mine management.
- Made a presentation to Clean Coal Victoria in Traralgon on the work of the TRB3 and the challenges facing the mine operators. This presentation was attended by the Minister.

GHERG

On 1 January 2014, GHERG transferred from Monash University to Federation University Australia (Fed Uni) as part of an agreement to merge the Monash University Churchill Campus with Ballarat University. GHERG continues to operate with the facilities and resources it has built since 2010 and remains located in the Latrobe Valley. Its staff and student complement are increasing and at the end of the reporting period comprised three full time research staff, four academic staff, two professional staff and eight postgraduate research students.

During the current reporting period, a five year extension of support for GHERG covering the period from July 2014 to June 2019 was agreed between the Department and Fed Uni. The specific objectives of the research group going forward are to:

a. provide broad range geotechnical and hydrogeological research and development support to the Latrobe Valley coal mines, thus assisting in addressing the issue of insufficient expertise and skill shortages
b. foster research and innovation in coal geotechnical and hydrogeological engineering, particularly in the areas of mine stability, mine monitoring systems and interpretation, ground subsidence, effect on rigid structure such as infrastructure, ground and surface water control in mines and evaluation of models used in practice
c. contribute to the TRB through the standing membership of the Director of GHERG
d. provide support to the TRB
e. develop training programs for mine personnel through short courses presented by members of the research group as well as local and international academic and industrial experts. Other training may be provided through elective units in current civil engineering courses and/or a Masters level course.

These objectives retain the majority of the objectives for GHERG during its first five year term. They reflect the significant investment needed to deliver on the major research needs and dissemination of the new knowledge acquired.

GHERG continues to make progress on each objective. In relation to objectives (a) and (e), four actions have been pursued:

- At the end of 2013, GHERG completed its series of three half-day courses on probabilistic risk assessment methods for slope stability analysis.
- The part-time Masters in Geomechanics and Geohydrology was fully approved by Fed Uni. The course was advertised at the end of 2013 and the first applicants were recruited to the program and completed their first semester courses for the foundation year.
- GHERG continues to provide skills training and education to undergraduate and graduate students at Fed Uni on aspects of brown coal mining.
- GHERG staff actively supported the development of the LVGIG, Professor Mackay has acted as the interim chair of LVGIG and GHERG has provided administrative support to facilitate the LVGIG's development.

In relation to objective (b), GHERG staff and students have continued to undertake fundamental and applied research covering:

1. material properties and processes related to slope stability
2. mining induced environmental change
3. new model development and testing
4. mine rehabilitation.

Papers have been prepared and presented at conferences and through journals during the year on these topics. Theses covering the recent research on consolidation, shear testing and surface water-groundwater interactions are expected to be finalised in 2015. Importantly, rehabilitation research has increased in prominence in the current period. Two research programs being undertaken in conjunction with AGL Loy Yang are expected to provide important contributions in this area through investigations on mine void filling strategies and surface covering of mine voids.

Objectives (c) and (d) are being addressed through Professor Mackay's ongoing membership of the TRB and through GHERG's day-to-day involvement with the Department. GHERG has worked with the Department to develop the one day symposium on Geotechnical Engineering in Brown Coal, scheduled for October 2014. It also engaged with the Department in the design and development of the Batter Stability Project. As part of this activity, GHERG completed a short-term project in conjunction with Energy Australia and GHD (formerly known as Gutteridge Haskins & Davey) to collate and review all existing data for the project. The full project presents a step change in the approach to building the required understanding of long-term batter movements and the risks of batter failure by providing site specific investigation and monitoring.

GOING FORWARD

The focus of TRB3 in 2014-15 in respect of the Latrobe Valley will be on:

- embedding the improvements to date in managing mine stability
- fostering education and research in order to develop a satisfactory understanding of the key factors that impact on mine stability and effective rehabilitation in this region.

Encouraging ongoing cultural change and the development of field research projects, such as the batter stability research project, are key elements in achieving these objectives.

It needs to be appreciated that by world standards, the Latrobe Valley brown coal mines are large and complex structures. TRB3 reiterates its earlier advice that it will take time to research and develop a proper understanding of the issues that govern ground behaviour and its implications for the safety and security of surrounding infrastructure and the effective rehabilitation of mine sites. The allocation of funding in the 2013 Victorian Budget to initiate and fast track a range of actions to address mine stability risks at major coal mines in the Latrobe Valley was timely. Nevertheless, the initiatives being supported with this funding represent only a small component of the research effort required, albeit a very important and critical component.

Although the TOR for the TRB extend to beyond the brown coal sector, this sector has consumed most of the TRB's attention to date because of the frequency and magnitude of incidents within it and the challenges faced in addressing legacy issues in order to move forward. It is the intention of TRB3 to broaden its focus in the 2014-15 reporting period to include a number of operating quarry sites and defunct mines that present rehabilitation challenges.