

MLRA MINE CLOSURE WORKSHOP

Pathways to sustainable mine closure

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ACKNOWLEDGEMENT OF COUNTRY

Find about our actions towards First Nations Inclusion:
crctime.com.au/research/first-nations-inclusion



Today's presentation

- **We'll focus on three areas:**
 - Beyond closure: Reframing the challenge.
 - Supporting knowledge, education, tools and networks.
 - Tackling the most significant challenges – locally, nationally and internationally.

Beyond closure: Research agenda

We're part of a broader ecosystem seeking to support better outcomes.

Our focus includes:

- Understanding what 'post-mine transition' means to different people and groups, particularly First Nations.
- Facilitating a shift from site to regional scale consideration.
- Developing new ways to understand and incorporate values – what is most important to people at a given time and place – into planning and actions.
- Bringing together engineering and biophysical dimensions with the social, cultural and economic aspects.





Work so far

- Understanding what we know and don't know better.
- Australian-first mapping of mine closure solutions industry.
- More than 20 projects in delivering, covering all dimensions.
- On ground activities:
 - Climate-adapted seed sourcing trials.
 - Stakeholder values research.
 - Economic framework piloting in Bowen Basin and Pilbara
 - Collaborative planning process in the Latrobe Valley.
 - Other projects across Australia.

Firstly, an acknowledgement...

Thank you to our Victorian partners, peers and representatives.



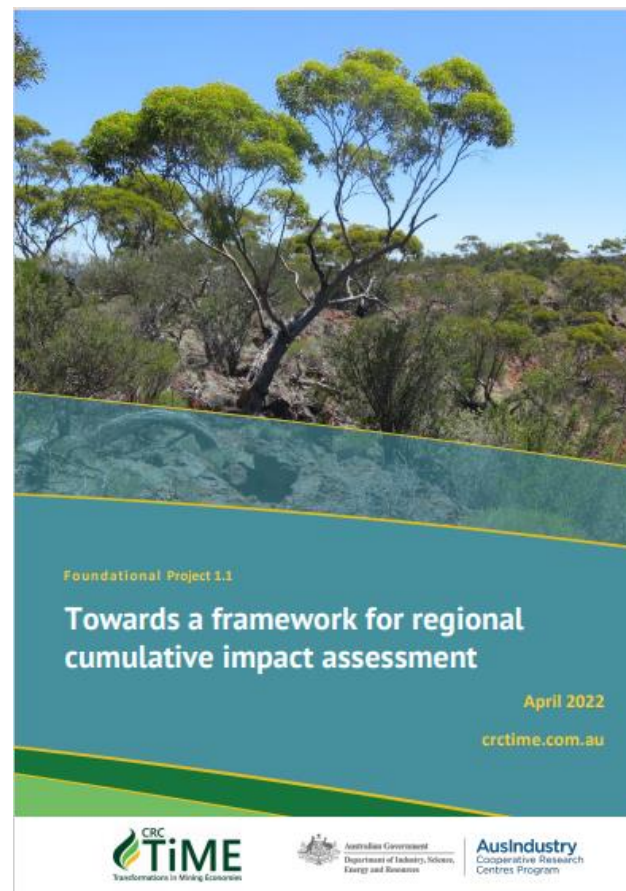
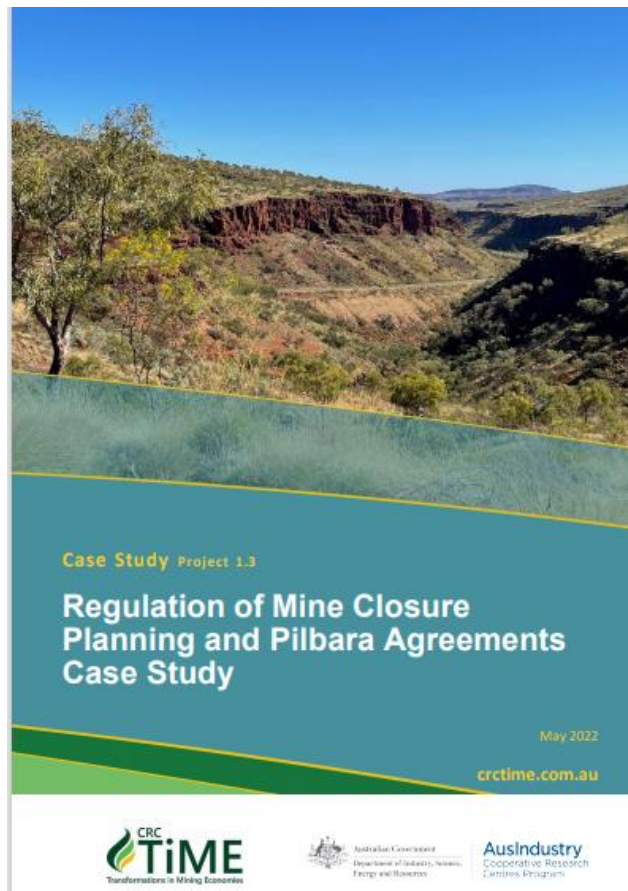
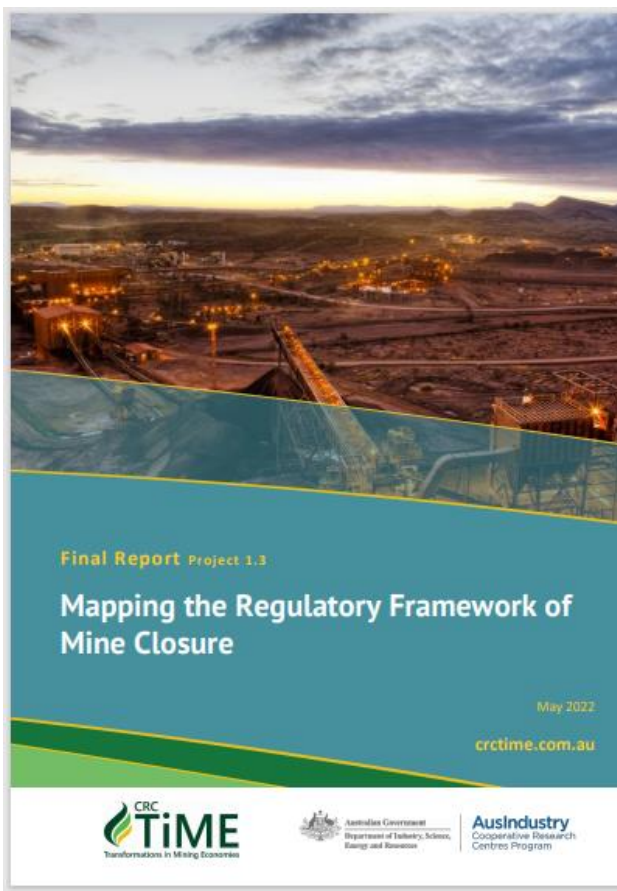
Beyond closure

Reframing mine closure and post-mine transitions

- Policy directions
- Mine closure solutions industry
- Asset and land repurposing



In focus: Our work to date



Watch this space

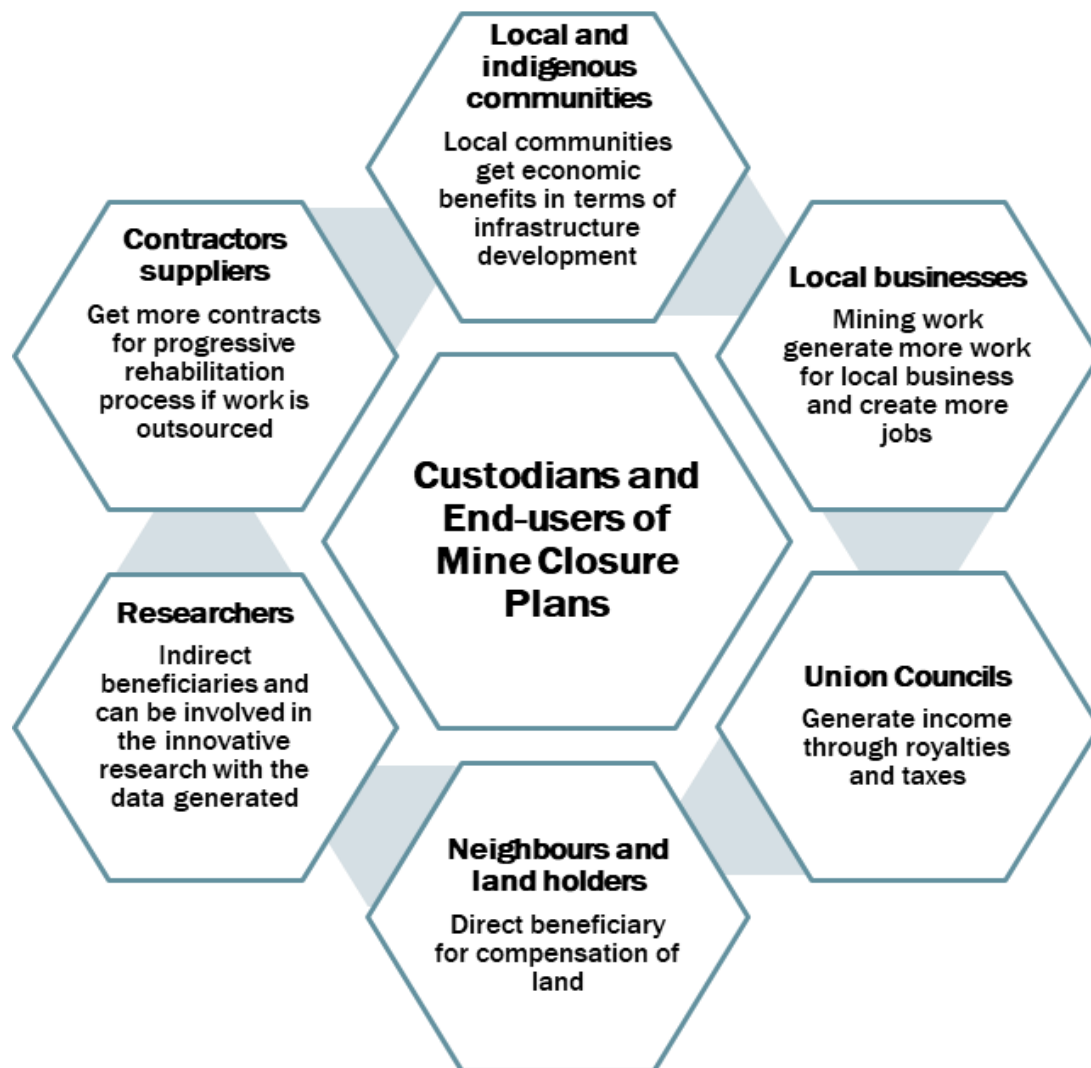
*Mine closure guidance:
Review and comparative
analysis*



What are we transitioning into? Re-thinking mine closure as an end

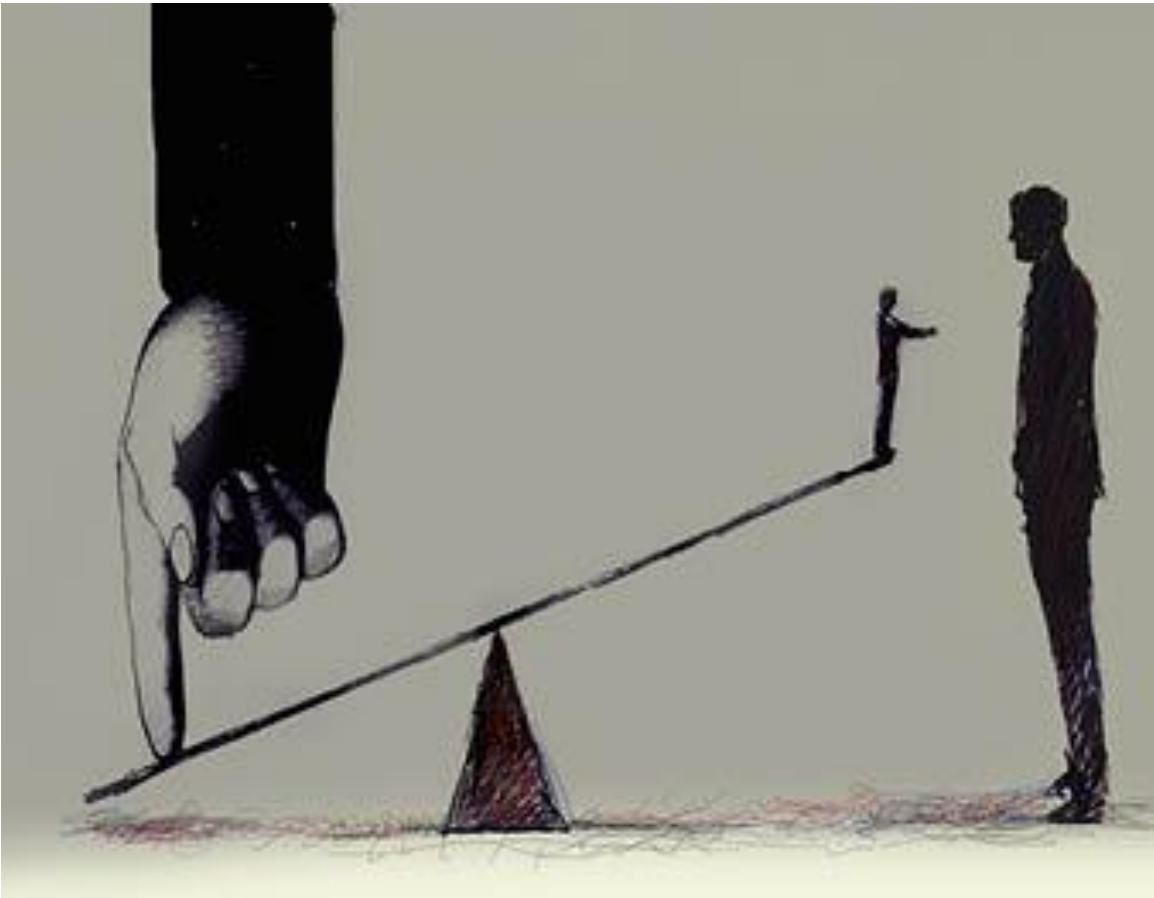
- [Review by Gardner et al.](#) noted concept of ***transition*** in contrast to the concept of ***closure***.
- Understanding personal grief and loss through transitions – personal stories, connections and impacts.
- Economic transitions are difficult, even when planned.
- Who knows what and when varies.
- Disconnected mine closure and regional development policy.

Transitions require us to change the model of closure



“While the concept of post-mining transition economies is plausible, the reality is that the mining operator's attention (legal commitment and responsibility) does not extend beyond the transfer to the state of rehabilitated land...” Mine Regulator Perspective (Dzakpata et al. 2021)

Power imbalance in 'proponent-led' consultative models



Source: BMJ 2014. Power imbalance prevents shared decision making
doi: <https://doi.org/10.1136/bmj.g3178> (Published 14 May 2014)



Mine closure and post-mine policy regimes

COMPONENT	MINE CLOSURE PLANNING	POST-MINING DEVELOPMENT PLANNING
Values-based policy arguments	(1) Risk mitigation enables net-positive outcomes Relinquishment of a mining lease requires demonstrable achievement of safe, stable, sustainable landform	(2) Realising post-mining land use requires taking a pragmatic, flexible, adaptive (future-oriented) approach to formulation of closure criteria (3) Realising net-positive outcomes requires investment in and attraction of human capital
Core institutional arrangements	Proponent-led proposing mine closure criteria	State and local government planning for regions and local communities
Type of ‘capital’ emphasised	Natural (landform)	Human (skills and training)
Mode of financing	Closure bonds Voluntary corporate commitments	State and local government budgeting
Policy instruments	Indicative concept or master planning Latrobe Valley Regional Rehabilitation Strategy (LVRRS)	Statutory and strategic spatial planning Multi-stakeholder visioning Latrobe Valley Authority Transition Plan (2022–2023)
Collaborative structures and processes (examples)	Latrobe Valley Mine Rehabilitation Advisory Committee	Gove Peninsula Futures Reference Group Collie Delivery Unit & Just Transition Working Group Latrobe Valley Authority

Directions: What's next for us

- **National principles:** Building the case for national principles on mine closure and post-mine transitions
 - Consolidate knowledge across all dimensions, including considering post-mine land use and diversification.
- **Guidance:** Comparative analysis of state/NT, national and global mine closure guidance
- **Residual Risk Transfer:** Review of models for net benefit transitions
- **Potential changes to land tenure:** an overview of the role of tenure and principles for better outcomes
- **Relinquishment:** Developing policy roadmap
- **Cooperative research:** Australian-first report by 13 CRCs mapping contribution to decarbonisation



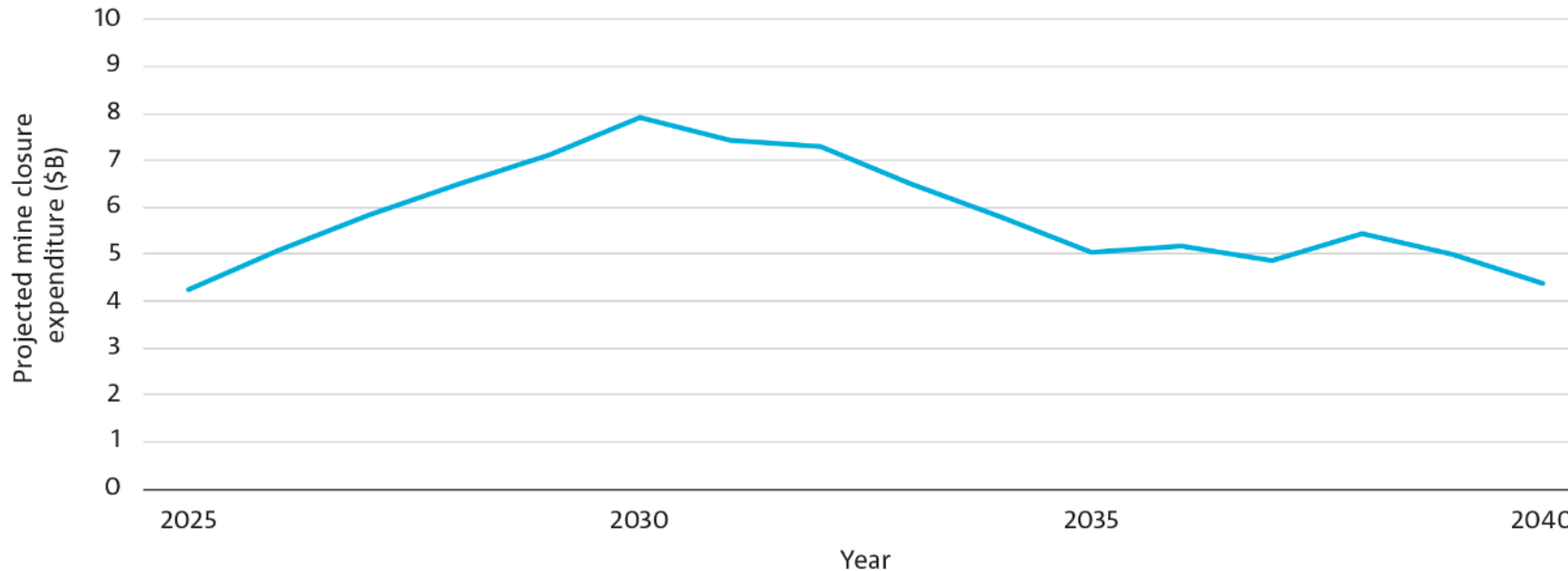
In focus: From gas decommissioning to mine closure solutions

- Broad recognition of potential for a specialist gas decommissioning industry
 - Australian Government developing roadmap
 - Estimated at \$60 billion activity over 30 to 50 years
- **What if we looked at mine closure the same way?**





In focus: Opportunities for Australian industry



- Almost 240 Australian mines projected to complete operations by 2040.
- Estimated **more than \$4 billion - \$8 billion annual expenditure** on mine closure activities annually to 2040.
- Opportunities across diverse business areas – potential to turn into global growth.

CSIRO Futures calculation; S&P Global Market Intelligence 2023, S&P Capital IQ Pro, Asset Data, Metals & Mining Properties, Australia. Graph displays a 5-year moving average trendline, so 2021–2024 data points are omitted. 2025 data point is interpreted as average expenditure from 2021–2025 and so on.

Science, innovation and technology

Engagement and partnership

Solutions that enable effective engagement, co-design, and mutually beneficial partnerships to improve social performance, reduce social and governance risks and optimise outcomes.



Waste reduction and resource recovery

Solutions that enable cost-effective reduction, reuse, and recycling of mine waste to minimise closure liabilities, residual risk, and ongoing maintenance costs.



Mine closure solutions

Mine rehabilitation

Solutions that improve the performance or cost-effectiveness of mine rehabilitation activities to ensure that mined land is safe, stable, non-polluting and able to support an appropriate land use.



Land use transitions

Solutions that address challenges preventing the establishment of post-closure land uses on mined land to generate lasting social, environmental and economic value and offset the costs of managing ongoing liabilities.



What actions do we need to take to enable growth?

Multi-stakeholder actions

1. Increase visibility of mine closure challenges and opportunities to support partnerships and innovation with MCS providers.
2. Develop and implement methods that value the social and environmental outcomes of mine closure and transitions.
3. Encourage collaborative research and support demonstration of innovative mine closure solutions.

MCS industry actions

4. Develop a coherent MCS industry identity and aligned strategy.
5. Broaden customer base through adaptability, interoperability and export.
6. Align solutions with evolving stakeholder expectations and miner requirements.
7. Strengthen commercialisation and business development skills of emerging providers.

Mining industry actions

8. Embed performance indicators that increase the focus on mine closure and transitions within mining companies and drive uptake of effective solutions.
9. Ensure that procurement policies allow new market entrants and small companies to provide innovative mine closure solutions.

Government actions

10. Review regulatory barriers to novel mine closure and transition solutions.
11. Support MCS industry capability development and export opportunities.



In focus: What's next

What's the opportunity for Victoria?

Hannans North Tourist Mine Kalgoorlie, WA

Historic gold mine converted into a visitor attraction and educational site.



Clean energy hub Kidston, QLD

Gold mine under transition to develop renewable energy generation and storage site with solar, wind and pumped hydro technologies.

Image: Genex Power



Woodlawn Eco-Precinct Tarago, NSW

Open-cut mine pit converted into a bio-reactor landfill creating bio-gas to fuel a power generator. Site also holds aquaculture facilities, solar and wind farm.

Image: Veolia



Lake Kepwari Collie, WA

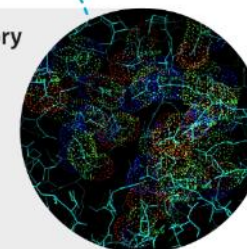
Recreational lake that was created from conversion of a coal mining pit via local river diversion.

Image: CRC TiME



SUPL: Stawell Underground Physics Laboratory Stawell, VIC

Laboratory located in an operational gold mine 1km underground, where conditions are optimal for research into dark matter, neutrinos and geoscience.



- Education and training
- Creating connections



Skilled and productive workforce

- Closure related workforce is diverse, growing and required across lifecycle
- Traditionally education and training has:
 - Focused internally – company-specific
 - Focused on workforce needs, rather than that of communities, regulators/policy makers /others involved in mining ecosystem.

Australian picture

- Only 36 professional development courses cover mine closure in some form (two specifically).
- 15 higher education units with mine closure as a learning outcome.
- No VET currently available.





In focus: Our work

Strategic directions

Broadening
accessibility

Understanding
specific needs of
Indigenous peoples
and communities

HDR program
focused on industry
and regional
placements


Post-graduate
options
development


In focus: Expanding availability of quality low-cost education


Mass Open Online Course on Foundations of Mine Closure and Sustainable Transitions


- 406 enrollments in beta version
- Seven modules, including:
 - Environmental stewardships
 - Integrating Indigenous cultural values
 - Social and economic planning
- About 30 people were regulators/policy makers
- Full course in development
 - Free learning (40 hours)
 - Assessed/paid version (60 hours)

Foundations of Mine Closure and Sustainable Transition Mass Open Online Course






 406 people enrolled

 53% female attendance

 60% retention rate

 77% industry professionals, 9% postgraduate students, 7% given regulators/policy makers

 60% (246) from Australia  8% from Brazil 
7% from Canada  and 25% from 30 other countries

     with a diversity of topics covered

In focus: First Nations VET Pathways (Stages 1 and 2)

Indigenous-led project to develop VET products relating to mine closure and post-mine transitions.

- Indigenous Steering Group
- Focus on skills and knowledge to:
 - support negotiation and working with mining companies.
 - develop business enterprises.
 - maximise employment opportunities.
 - Support mining-related income.
- Includes supply and demand analysis.
- Community workshops to commence soon.



In focus: HDR program focused on industry, regional challenges

- 23 PhDs investigating a diversity of topics.
- Focused on strengthening First Nations pathways – our goal is at least double the National benchmark.
- Overall target of 50 students over our life.

Our program encourages and funds regional and partner placements, recognising the shared value.

Consider a PhD placement.

Interview with Benedictor Kemanga

Working on future impacts of climate change on pit lake water balance, Ben's important research is supported by a CRC TIME top-up scholarship.



EDUCATION AND TRAINING PROFILE RESEARCH



In focus: Facilitating connections that outlive us

- Regions in transition, including our [2023 Regional Knowledge Exchange](#)
- Fostering local networks
- Bringing together communities of practice
- ['Restoring Country' webinar series](#)
- [Dig Deeper webinars](#)



In focus: Developing connections that outlive us

Global reach

- Cambridge University Press 'Research Directions' – Mine Closure and Transitions Journal.
- NSF Global Coal Transitions Research Coordination Network.
- International Network of Acid Prevention partnership.
- World Mining Congress – dedicated session.
- ICMC Responsible Leaders Forum – Mine Closure as a key conversation on trust.
- International Mine Closure Conference.



**26th World
Mining Congress**
BRISBANE AUSTRALIA
26–29 JUNE 2023

**Research
Directions**
Mine Closure
and Transitions



Mine Closure 2022

Proceedings of the 15th International
Conference on Mine Closure

4–6 October 2022 | Brisbane, Australia

Volume One

EDITORS Mark Tibbett, Andy Fourie & Guy Boggs





DELIVERING NEW KNOWLEDGE, DECISION TOOLS, TECHNOLOGY AND WAYS OF WORKING FOR POSITIVE TRANSITIONS



Work underway across ESG dimensions (highlights)

Dimension	Areas of work include
Environmental	<ul style="list-style-type: none">• Technical guidance on mine pit lakes• Technical guidance to prevent and manage AMD/NMD• Natural capital assessment, accounting and forecasting for enhanced integration into decision-making• First demonstrations of climate-adapted seed sourcing strategies• Australian seed-scaling initiative
Social (including cultural and economic)	<ul style="list-style-type: none">• First Nations VET pathways• Understanding stakeholder values in the context of transition• Tools to help identify capacity drivers and undertake scenario planning for economic transitions• Understanding community aspirations and approaches for engaging about mine pit lakes• Understanding enablers for First Nations to negotiate, partner and engage on mine closure• Post-mine land use planning and enabling economic post-mine transitions
Governance	<ul style="list-style-type: none">• Mapping of mine closure regulation (Western Australia, Victoria and Queensland)• Different models for Regional Cumulative Effects Assessments and Management, including Indigenous-led assessments (framework, typology, case studies)• Collaborative planning approaches for post-mine development (Latrobe Valley, with national lessons)• Comparative analysis of mine closure guidance and residual risk transfer models• Multi-criteria optimisation framework based on CRC TiME values research

Regions in transition

Challenge

Ensuring people and place are at the centre of planning and decision-making.

Goal

Tested tools and ways of working that enable inclusive, comprehensive and evidence-based planning and action.

Collaborative planning for post-mine planning, Latrobe Valley



Support deliberation and consensus-building to identify viable, feasible and desirable options for lands zoned for but not used for mining.

Stage 1 (2023)

Stage 2 (2024)

Regional Economic Transition framework



Enabling evidence-based regional scenario planning.

- Develop and test tools to analysis regional strengths and transition pathways
- Establish and test a stakeholder consultation process for regional economic resilience planning
- Provide locally-relevant, trusted analytics

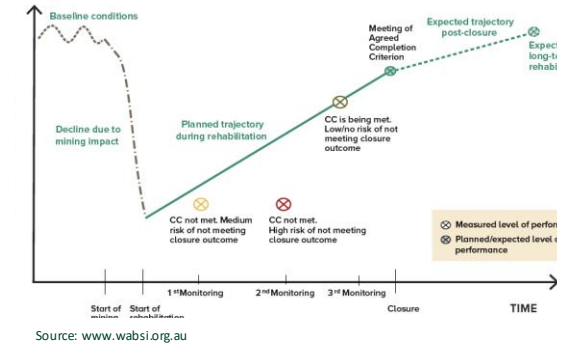
Regional assessments and management

Challenge

Shifting from site to regional scale understanding and management of different risks, opportunities and impacts.

Goal

Holistic frameworks that integrate social, economic, environmental, cultural and governance dimensions to improve outcomes during transitions.



Regional cumulative effects assessment and management

Stage 1 (2023-24)

- Case studies showing a diversity of approaches in Australia and Canada
- Typology

Stage 2 (2024-25)

- Roadmap and toolkit
- Potential governance model
- Study on First Nations-led assessments

Ecosystem forecasting

- Tools for ecosystem forecasting and predicting for better closure and transition planning.

Enhancing decision systems for positive outcomes

Challenge

Improving long-term decision-making by addressing prioritisation of short-term productivity.

Goal

Broaden what is included in modelling (including intangible factors) to improve decision-making, including addressing time, cost and benefit, interpretation and trade off disconnections.

Natural Capital Accounting in the mining sector



Support development of capability, systems and data to establish NCA over time.

Deliverables

- Business case, roadmap and gap analysis
- Case studies
- Guidelines
- Building a NCA Consortium

Broadening NPV through a multi-criteria optimisation framework



Understand and address limitations in Net Present Value (NPV) calculation.

Deliverables

- Multi-criteria optimisation framework for broadening NPV calculations
- Identify stakeholder perspectives of value and risk and modify financial architecture
- Undertake case study to analysis outcomes to compare framework with standard processes.

Mine pit lake assessments and management

The project will:

- Assess closure and relinquishment case studies of sustainable and beneficial post-closure opportunities.
- Develop stakeholder 'common language' and engagement strategies.
- Develop guidance tools to assess categories, risks and opportunities associated with pit lakes.
- Make recommendations on approaches for modelling future water quantity and quality, and provide data and longer-term monitoring needs to assess future risks and beneficial use options.

Timeframe: 2023 – 2027



Latrobe Valley rehabilitation performance

The project is investigating possible consequences of climate change on vegetation's soil cover performance in the Latrobe Valley rehabilitation environment.

- In-depth literature review
- A soil plant study in controlled conditions
- Hydrological numerical model to apply, simulate and parameterise the measured water fluxes in soil-plant atmosphere
- Sample plant and soil information

Timeframe: Ongoing



Collaborative planning for post-mine development in the Latrobe Valley

A multi-stage deliberative, inclusive process to support identification and consideration of potential options for lands zoned for mining, but not used.

- Needed identified through community consultation.
- Locally-led by Dr Jess Reeves.
- Stage 1 involved robust, consensus-building processes to identify viable options. Report to be released soon.
- Stage 2 to commence shortly – to analyse identified options:
 - Youth deliberations
 - Traditional Owner-led deliberations
 - Citizens' Jury.

Timeframe: Ongoing.

Watch a webinar on Stage 1.

IN SUMMARY



Thinking and working differently

- Mine closure is *about the transition to something new* – not the end of an operation.
- The transition occurs in a context:
 - Shaped and changed by the operation, often over decades
 - That is shaped by locally-specific and dynamic values.
 - Must consider and balance socio-economic, cultural and economic dimensions holistically.
- Risk is only part of the picture. We also need to think about opportunity – what is the cost of focusing on risk?
- We're all learning to do better together.
- Our work aims to support yours.

 **THANK YOU**

