



# Clean & Recover

ElectroClear Water Treatment  
[cleanandrecover.com.au](http://cleanandrecover.com.au)

## CAPABILITY STATEMENT



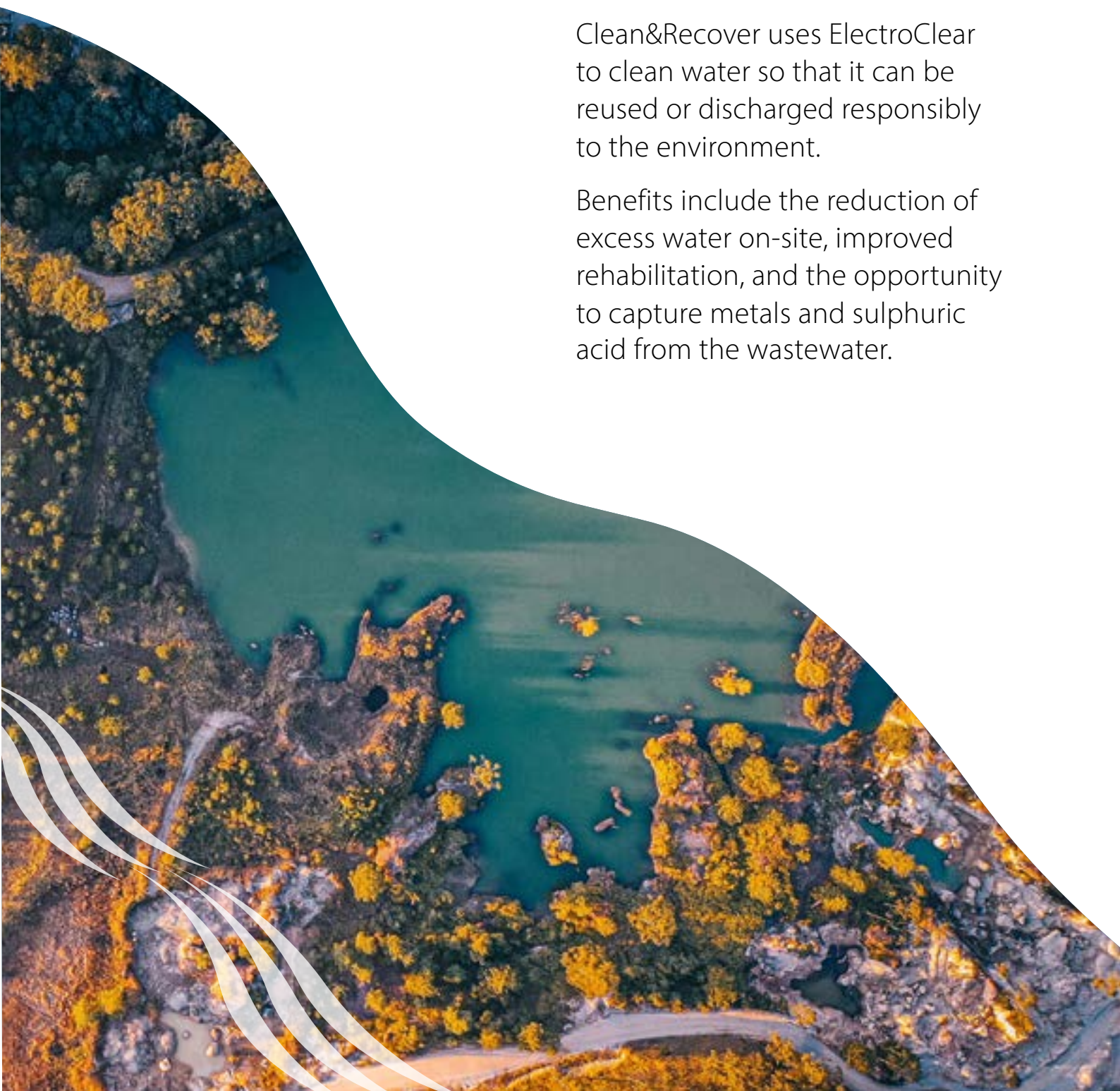
## COMPANY PROFILE

Clean&Recover cleans water on mine-sites and recovers value from it.

**We have developed ElectroClear to treat mine-affected water such as acid mine drainage (AMD).**

Clean&Recover uses ElectroClear to clean water so that it can be reused or discharged responsibly to the environment.

Benefits include the reduction of excess water on-site, improved rehabilitation, and the opportunity to capture metals and sulphuric acid from the wastewater.



## VISION AND MISSION STATEMENT

**Our vision is to provide more sustainable, safer, simpler, and lower cost solutions to clean and return acidic and sulphidic water and to capture the resources present in the water.**

## CONFRONTING THE CHALLENGE OF ACIDIC WATER

Thousands of mines around the world face issues with AMD. The United Nations has called AMD the second biggest environmental problem in the world.

Acid mine drainage occurs in sulfidic soils. Sulphidic soils host the principal ores of copper, zinc, nickel, cobalt, and molybdenum, as well as many gold, coal, and other metalliferous and non-metalliferous mines.

AMD forms through disturbance of the soil and can form a toxic mix of sulphates at a pH around 2.5. It percolates through soil, dissolving metals in the soil including arsenic, mercury, cobalt, and base metals at levels far in excess of safe standards

according to prevailing water quality guidelines around the world.

Dealing with AMD is challenging and costly. An estimate of the annual costs of AMD management at operating sites in Australia has been estimated as US\$120 million, excluding the costs of managing AMD at closed sites, which is rising as AMD becomes progressively worse over time.

**The total global cost for the environmental liabilities associated with AMD is estimated to be in the order of US\$100 billion.**



## OUR OFFERING

*ElectroClear* is an electrochemical process for treating acid mine drainage and acidic water to remove metal contaminants and sulphates while producing water of a quality that meets environmental standards for release. It uses electricity and not chemicals to treat the water, applying greater control and precision, and avoiding costly and dangerous chemicals.

The technology can also be applied to raise the pH of water used in mining operations, for purposes such as high-pH water required in metals processing.

# WHY CHOOSE ELECTROCLEAR TECHNOLOGY?

ElectroClear can help mining companies meet their environmental treatment requirements for acid mine drainage and mine-affected water more efficiently and with greater benefits to the mining company.

Through our proprietary process for cleaning mine-affected water and extracting value from it, we can:

- ➔ reduce excess water on mine sites, helping to avoid the need for building or enlarging tailings storage facilities
- ➔ return the water for reuse within mining operations or for environmental discharge meeting the required water parameters for discharge to the environment
- ➔ extract valuable metals from the water for later use
- ➔ extract hydrogen, and sulphuric acid during the process which can be treated as a resource
- ➔ significantly reduce a mine's emissions of carbon dioxide from traditional lime-based methods of water treatment

(for a medium sized flow of mine-affected water, this would amount to 50,000 tonnes of carbon dioxide emissions reduction per year)

- ➔ help mines avoid many of the issues of lime-based treatment – such as gypsum-clogged pipes, poor lime purity, difficulties with fine grinding and mixing with lime, costly management of the toxic sludge generated by lime treatment, and high water use as an input in hydrating the lime.

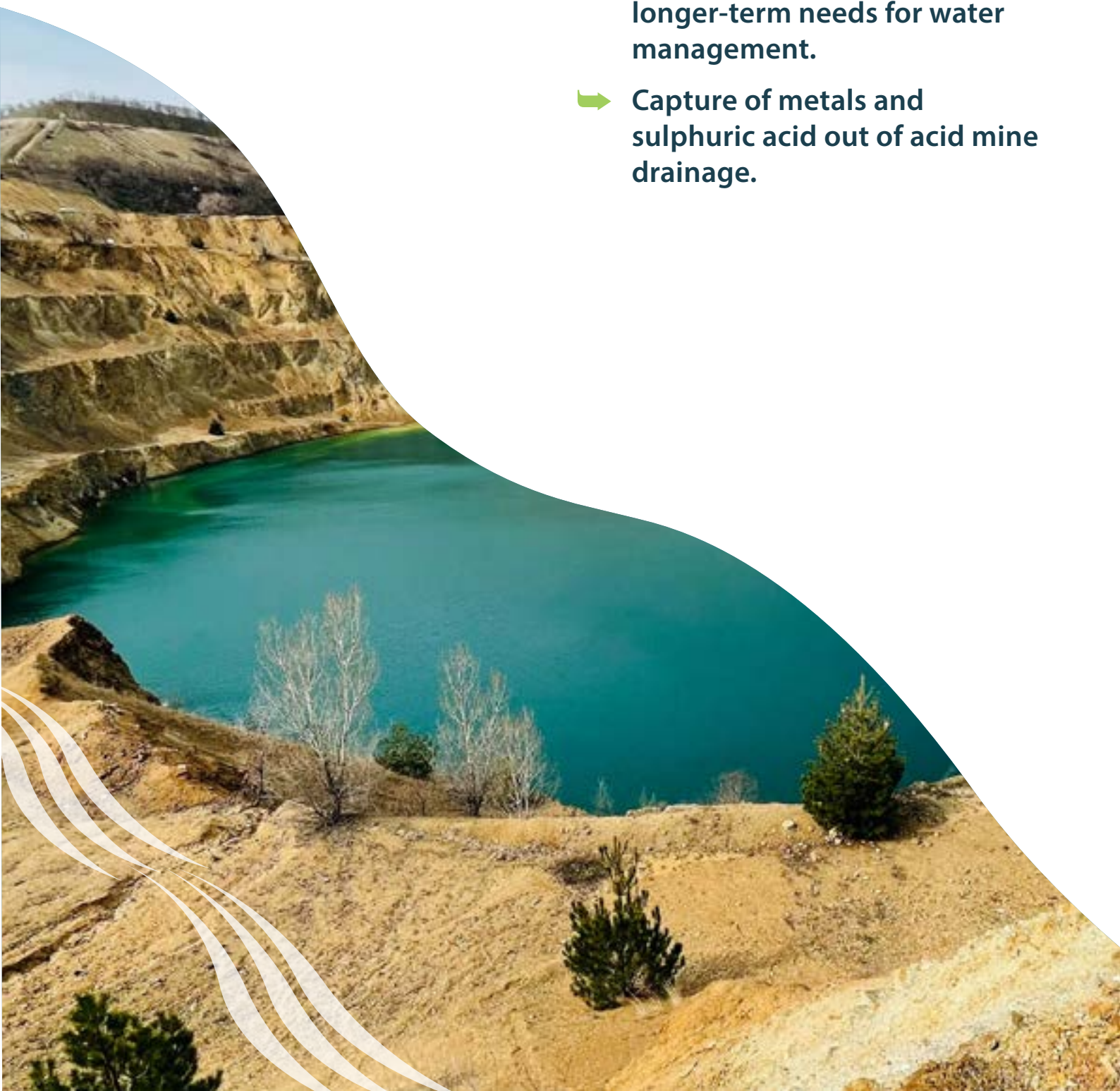
Our technology is lower cost and more reliable than existing lime-based treatments. It avoids the safety risks of transporting, storing, and handling strong alkaline chemicals.

ElectroClear can clean acid mine drainage for low energy use (starting from 0.7 to 2 kWh/1000L depending on water chemistry).

# CORE COMPETENCIES

**Our core competencies are:**

- ➔ **Adaption and improvement of technologies to treat acidic and sulphidic water.**
- ➔ **Collaborating with mining and wastewater companies to determine deeper and longer-term needs for water management.**
- ➔ **Capture of metals and sulphuric acid out of acid mine drainage.**



# ENVIRONMENTAL CREDENTIALS



Remove toxic water from the environment to reduce its impact on waterways and aquatic life



SDG 6.3 – Clean water and sanitation – improve water quality by reducing pollution



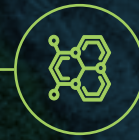
Cleaning AMD produced by mining or other activities, which is otherwise impounded in tailings dams, discharged into waterways, or treated using lime. ElectroClear cleans the water to a standard acceptable for environmental release.



Clean acidic and sulphidic wastewater to mitigate its impact on the environment. Eliminate the need for using lime with its embodied carbon emissions in treating wastewater.



SDG 12.4 – Ensure sustainable consumption and production patterns - Achieve the environmentally sound management of chemicals and all wastes through their life cycle



Eliminating the use of chemicals in treatment of AMD and vastly reducing the toxic sludge that is produced by adding chemicals to AMD to treat it.



Capture valuable by-products from acidic and sulphidic water including metals, sulphuric acid, hydrogen, oxygen, and chlorine.



SDG 12.5 – Ensure sustainable consumption and production patterns – Substantially reduce waste generation



Turning a waste product (AMD) into a valuable resource (for example, metals, clean water, sulphuric acid, hydrogen, oxygen, chlorine)

## OUR TEAM

### LUKE BERRY, CEO

- ➔ Luke has experience in consulting, infrastructure delivery, government policy, economic analysis and problem-solving. He is responsible for marketing, risk management and project coordination.

### FELIPE SILVA, Process Engineer

- ➔ Felipe Silva is a process engineer with over a decade of experience in the mining and metals industry at Vale SA and RHI Magnesita. He has managed research projects across 33 different areas and led Lean projects that significantly reduced costs while improving operational, environmental, and safety standards. Felipe's qualifications include a bachelor's degree in industrial engineering and an MBA in Quality and Process Improvement.

### CALEB FREW, Electrical and Automation

- ➔ Caleb's professional experiences include working in the Centre for Hypersonics setting up and automating preparation for experiments. For a range of companies, he has worked on electrical design of robotic systems.



## OUR OFFERING

*Clean&Recover* has worked closely with companies such as OZ Minerals, Rio Tinto, Boliden, and Evolution Mining to find solutions to industry challenges and conduct trials on acid mine drainage.

We have developed new water treatment technologies from concept stage to full commercialisation.

## AWARDS AND RECOGNITION



### **Winner of four industry challenges:**



OZ Minerals Waste to Value challenge



Queensland Government Low Carbon Accelerator



Evolution Mining Catchment if You Can challenge



OZ Minerals Ingenious Extraction challenge.



### **Winner of funding support at State and Federal level.**

We have tested and treated acid mine drainage and acidic water from a range of companies including Rio Tinto, OZ Minerals, Evolution Mining, and Boliden.

## PRODUCT DEVELOPMENT

We have a strong focus on testing, trialling, and repetition to prove our products work. We talk to miners to understand what they want to achieve.

This consultation process helps to ensure our products are fit for purpose and suit local needs and conditions.

## CLIENT TESTIMONIALS

*We are very interested in Clean&Recover's technology's ability to selectively recover metals from acid mine drainage.*

### **RIO TINTO**

*Clean&Recover's electrodialysis for metal recovery from solutions was successful in funding as part of the Ingenious Extraction Challenge. OZ Minerals has also selected Clean&Recover as part of the Waste to Value program.*

### **OZ MINERALS**

*Mungari mine have worked with Clean&Recover on their technology for raising the pH of raw water.*

### **EVOLUTION MINING**

## PEER-REVIEWED JOURNAL ARTICLES

### **ELECTROCLEAR**

*Brewster, Emma Thompson, Stefano Freguia, Mansour Edraki, Luke Berry, Pablo Ledezma, Staged electrochemical treatment guided by modelling allows for targeted recovery of metals and rare earth elements from acid mine drainage. Journal of Environmental Management 275 (2020) 11 1266*

*Villa Gomez, Denys, Paul Hong, Luke Berry, Di Liu, and Mansour Edraki, Element distribution in electrochemically treated acid mine drainage for efficient resource recovery and water treatment (unpublished)*

## CONTACT DETAILS

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