



TIWEST

We add value

Sustainable Mining at Tiwest Cooljarloo





Introduction

Cooljarloo is one of the world's largest mineral sand mines located in one of the world's most biodiverse areas (Figure 1). Over 470 million tonnes of material have been mined to produce 10 million tonnes of mineral concentrate since mining commenced in 1989. This concentrate is separated into valuable mineral products, including ilmenite, at the Tiwest Chandala processing facility with ilmenite further processed into Synthetic Rutile

and ultimately into brilliant white Titanium dioxide pigment at the Kwinana Pigment Plant. This pigment is used in paint, food products and cosmetics. Process waste from Chandala and Kwinana is returned to the mine and encapsulated in purpose built clay-lined cells. The full integration of Tiwest allows the company to minimise waste and maximise efficiency to ultimately maximise economic, environmental and social benefit.



Figure 1: Tiwest Location Map

Cooljarloo employs 250 people and is certified to the ISO 14001/2004 Standard for Environmental Management Systems. It is also compliant with statutory environmental requirements. The Business Plan (Attachment 1)

integrates economic, social and environmental considerations and ensures the delivery of good and continually improving environmental performance on site and regional environmental and social benefit.

Demonstration of Commitment

Seven environmental and community relations specialists assist the site in achieving its environmental and community relations targets. Performance against these is articulated in a publicly available Annual Environmental Report formally presented to key stakeholders and placed in local libraries. High standards of performance are assisted by an effective site Environmental Committee with broad workforce membership. These ambassadors implement environmental themes such as energy conservation, housekeeping and biodiversity protection in the workplace. The diligent use of a mine entry wash-pad to prevent the introduction of the potentially devastating Dieback Fungus (*Phytophthora cinnamomi*) has been particularly important.

The development and practical application of technologies to overcome a number of issues is particularly relevant to sustainability and includes:

Clay slimes management

A \$12 million investment in a sustainable slimes project in 2002 ensured that 1.5 million tonnes of benign clay slimes produced annually plus 400,000 tonnes of remedial slimes were solar dried within the mine path (Figure 2) and ultimately blended into the landscape. This removed the future need to create large slimes dams sitting proud of the landscape and eliminated a significant environmental legacy.



Figure 2: Dried Clay in Slime Cell 3

Creating Sustainable landforms

Soil research has enabled components of the 40 million tonnes of material, including slimes, excavated at Cooljarloo each year to be mixed to create soil profiles that are non-

erosive and will support native vegetation. This work included the expenditure of \$1.7 million to remediate eroding clay capping on old process waste cells (Figure 3) and millions of dollars land-forming other eroding structures on site (Figure 5).

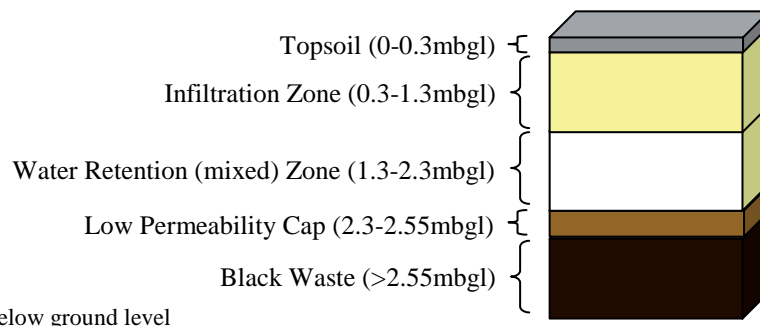


Figure 3: Constructed store and release cover waste on process cells



Figure 4: Aquifer recovery in north mine bore-field

Achieving outstanding rehabilitation quality

High biodiversity bushland has been established on constructed landforms (Figure 6) using native seed locally collected by the Billinue Aboriginal Corporation. All area available for rehabilitation has been rehabilitated and funds have been provided to rehabilitate the remaining 1,700 ha that currently remains active.

Protecting vegetation from groundwater drawdown

Unexpected vegetation stress from groundwater drawdown in the north mine bore-field in 2001 triggered a major study into the groundwater relationships. Groundwater and vegetation specialists collaborated for three years consuming several million dollars to determine a sustainable groundwater operating strategy. The stressed vegetation fully recovered as groundwater levels rose (Figure 4) and is now protected by ensuring ground-water always remains above ecological limits.

Protecting biodiversity

Tiwest protects biodiversity through minimising land disturbance by having strict controls on land disturbance, progressive rehabilitation and preventing the introduction of *Phytophthora cinnamomi* to active mining areas. The Cooljarloo fauna monitoring programme commenced in 1985 and is one of the longest running in Western Australia. It has provided valuable information on the development of fauna communities in rehabilitation areas.

In a broader sense, support (ie. \$60k/year for past 5 years and

a commitment for a further 5 years) of CALM's Western Shield fox baiting (Figure 9) has reduced regional fox populations to the point where previously uncommon animals such as echidnas and brush-tailed wallabies are now commonly seen and locally extinct animals including Woylies, Tammar Wallabies and Quenda have been released into nearby Nambung National Park. Tiwest also partner the Perth Zoo's marsupial Nightstalk programme (\$60k/year) which has proven popular with Tiwest employees and the local community.

Benefits and Industry Relevance

Clay slimes

Clay tailings were a significant business threat to Cooljarloo in 2002 with an estimated three million tonnes of liquid clay consuming most available storage capacity and restricting area available for rehabilitation. The development of solar drying as a sustainable solution has eliminated this

business threatening legacy and obviated the need to construct large containment structures external to the ore-body greatly facilitating aesthetics and future rehabilitation. Slimes are now managed at Tiwest as standard business practice in an industry littered with casualties who were unable to surmount their slimes issues.



Figure 5: Land-forming eroding Dam 8 (November 2005)

Sustainable Landforms

The soils at Cooljarloo are a complex mozaic of materials including dunal sand and dispersive sodic clays. The management of the 40 million tonnes of material excavated annually to achieve stable landforms capable of supporting native vegetation was a major challenge. Optimal blending to create Class 1 material was determined from years of

research and is now routinely applied. A programme of remedial earthworks to stabilise large eroding landforms created prior to the “slimes project” and to repair capping on process waste cells has also addressed historical legacies (Figure 5). This was critically important from a biodiversity conservation viewpoint and relevant to the mineral sands mining industry, particularly for those working with dispersive clay soils.



Figure 6: Rehabilitation Monitoring

Achieving Outstanding Rehabilitation Quality

Fresh or a blend of fresh and older topsoil, stabilised with mulched vegetation and enriched with seed locally collected by the Billineue Aboriginal Corporation is applied to stable landforms to provide the propagules and microflora necessary to re-establish native vegetation of equivalent biodiversity to analogue sites (Figure 6). Tiwest has demonstrated a capacity and willingness to reinstate the

high biodiversity bushland that was present at Cooljarloo prior to mining. This is relevant to the mining industry in general and to biodiversity conservation in Western Australia. Four Shire road borrow pits were also successfully rehabilitated in 2004 and 2005 in collaboration with three schools (Figure 7). Children are educated on the consequences of poor past practices and on practical rehabilitation techniques.



Figure 7: Borrow Pit Revegetation

Protecting Vegetation from Groundwater Drawdown

Tiwest's groundwater studies not only enabled the safe abstraction of groundwater but contributed to the development of regulatory guidelines for the management of ground-water in Western Australia and also

South Africa with a delegation from CSIR (South Africa) being briefed on the outcomes of the Cooljarloo study in 2003. Besides rigorous monitoring, a whole site groundwater model is maintained to predict the extent and magnitude of any drawdown associated with dredging or supply abstraction.



Figure 8: Billinue Seed Collection

Protecting biodiversity

The direct impacts of mining at Cooljarloo have been mitigated by minimising land disturbance, progressively achieving high quality rehabilitation, preventing *Phytophthora cinnamomi* infection of active mining areas and sustainably abstracting groundwater. It is expected that biodiversity values in land disturbed at Cooljarloo

will be ultimately comparable to analogue sites.

In a broader sense the establishment of a sustainable community at Billinue (Figure 8 & Attachment 2) and the support of the CALM Western Shield programme have provided enduring social and environmental benefit for the region.



**Figure 9: Western Shield Signing Ceremony
October 2005 with the Director of CALM, WA Minister for
Environment and Tiwest GM Corporate Services.**

Innovation

The solar drying of clay slimes and their incorporation into stable landforms to achieve high quality rehabilitation in tandem with the sustainable abstraction of groundwater is achievement through innovation. Each project involved the commitment of resources and collaboration with experts to determine a

“best practice” solution. This was important to Cooljarloo and relevant to the mineral sand industry. Information has been publicly reported and provided to regulators. Tiwest is an active participant in industry forums and participates in formal bench-marking exercises with industry peers.



Figure 10: Night Stalking at Karakamia

Partnering for Sustainability

A sustainable community supported by seed picking income has been established on freehold land donated by Tiwest and the collected local provenance seed is being used to revegetate bushland disturbed by mining. The celebration of the 10 year anniversary of the partnership between the Billineue Aboriginal Corporation and Tiwest in 2004 was described by the Minister for Indigenous Affairs John Kobelke as a role model of reconciliation (Attachment 2).

Long term support of CALM's Western Shield (Figure 9) and partnering the Nightstalk programme (Figure 10) with the Perth Zoo is directly benefiting regional biodiversity and enabling the workforce and community to directly participate in fauna conservation.

Tiwest collaborated with CSIRO, Parsons Brinkerhoff, Kings Park, Edith Cowen University and the University of Western Australia to develop sustainable groundwater abstraction techniques.

Attachments

Attachment 1

2006 BUSINESS PLAN

KEY STRATEGIC THEMES			
SAFE WORKPLACE AND CULTURE	SUPERIOR FINANCIAL RETURNS	CONTINUAL IMPROVEMENT	COMMUNITY SUPPORT

OUR PEOPLE GOALS	CRITICAL ACTIONS
Live our values and develop our successful team	<ul style="list-style-type: none"> Inspire behaviours through effective leadership Further develop continuous improvement culture and capability Continue towards an all staff workforce Improve and embed integrated training systems Build on communication processes Improve our retention and recruitment strategy
Safe and healthy workforce	<ul style="list-style-type: none"> Embed mutual responsibility for safe behaviour Continue to develop our safety management program Implement an effective contractor safety management system Finalise & embed occupational health plans & policies
OUR BUSINESS GOALS	CRITICAL ACTIONS
Efficiently manage our assets	<ul style="list-style-type: none"> Develop and implement practices to improve plant equipment uptime and maintenance costs Review and implement improved business processes and systems Develop long term capital plan Capital expenditure on budget and on time
Increase production outputs	<ul style="list-style-type: none"> Achieve 120kt pa Pigment by Q4 2006 Complete design to achieve 132kt pa Pigment at 97% quality by Q4 2008 Achieve 240kt pa SR production Complete pre-feasibility study for SR Plant expansion Achieve 94tph Dry Mill throughput Achieve 720kt pa HMC production
Develop market opportunities	<ul style="list-style-type: none"> Fully sell all mineral products at optimal market price Implement pigment production plan in line with product marketing strategy Develop activated carbon and iron oxide co-products business
Develop and implement a sustainable resource strategy	<ul style="list-style-type: none"> Effectively manage exploration and long term ore development Develop long term mining plan Develop 5 year integrated 'whole of business' operational plan Expedite regulatory approvals for new projects
Deliver a sustainable, year on year real unit cost reduction	<ul style="list-style-type: none"> Develop sustainable improvements in mining and processing efficiency Create synergies through working as "One Tiwest" Extend cost awareness and accountability Improve accuracy of forecasting Develop and implement Business Objects
Identify and reduce our risks	<ul style="list-style-type: none"> Further develop integrated 'whole of business' risk management process and tools Have mitigating controls in place for high business risks
OUR COMMUNITY & ENVIRONMENTAL GOALS	CRITICAL ACTIONS
Strengthen relationships with our community and government	<ul style="list-style-type: none"> Implement stakeholder liaison program Maintain full legal compliance Continue to foster community partnerships
Strive for environmental excellence	<ul style="list-style-type: none"> Develop integrated water and waste strategy Continue to develop our environmental management program Develop and implement an energy/greenhouse strategy Minimise and effectively rehabilitate land disturbance

SAFETY, HEALTH & ENVIRONMENT	COOPERATION	HONESTY & INTEGRITY	OWNERSHIP	BUSINESS EXCELLENCE
We operate with high regard for the Safety, Health & Environment of our people and community	We work together effectively to achieve a common goal	We demonstrate respect for each other by communicating honestly & acting with integrity	We understand our responsibilities and we are all accountable for our actions	We ensure a sustainable business through continuous improvement, innovation & clear objectives

ONE TIWEST – ONE TEAM

Attachment 2: Speech by Hon John Kobelke MLA Minister for Indigenous Affairs at presentation of commemorative plaque to Billinue Aboriginal Community

Date: Wednesday October 13, 2004 Time: 10.15am

Location: Billinue Community

Acknowledgements: First I would like to acknowledge the traditional owners of the land we are meeting on today. May I also acknowledge:

Billinue Elders Mal and Edna Ryder (Mal is chairperson of Billinue Aboriginal Community)

- Pat Emory Tiwest General Manager for Northern operations
- Fellow parliamentarian, Dee Margetts MLC
- David Charles, Tiwest General Manager, Corporate Services
- Anthea Pate, Tiwest Group Leader Environment and Community
- Ian Rennie, Acting CEO Shire of Dandaragan
- Shire of Dandaragan Councillors: Cr Lee Smith, Cr Michael Russell, Cr Maree Brooks, Cr Laurie Short
- Members of the Billinue Community

Ladies and gentlemen, it gives me great pleasure to be here today to celebrate the wonderful relationship between the people of Billinue and the Tiwest Joint Venture mining operations at the Cooljarloo Mine. You have worked together for 10 years and achieved an extraordinary working partnership that has become the envy of many other Aboriginal communities and big businesses. I am delighted to be here to represent the Gallop Government and to recognise your efforts to create a viable business arrangement that is underpinned by cultural, economic and environmental respect. You must be proud looking back on how this project has developed, since the early days when Malcolm and Edna Ryder and their family came to Cooljarloo to set up this community. Those were challenging times, when you started from scratch to build homes and the Tiwest Business Partnership. But, today, I know you are all justifiably pleased about how far you have come to create this economically sustainable and independent community. I particularly want to commend Mr and Mrs

Ryder for their dedication to the creation of this community and all the years of hard work they have put in to building Billinue to the success it is today. This hard work has enabled Tiwest to fulfil its commitment to rehabilitating the mineral sands mine site land at Cooljarloo to as close as it can get to its original state. Without the professionalism of the Billinue People this would not be possible – and I know Tiwest is most appreciative of the continuing reliability of your work to supply native seeds for this rehabilitation program. This important commercial service to Tiwest has enabled the Billinue community to develop into a self-supporting, independent community, answerable only to itself and not to an external ‘welfare’ or other system. I know this self-governance has given the people at Billinue great satisfaction and freedom. It has earned the community a respected place as a role model for many other Aboriginal communities around the State. The WA Government is now working with indigenous people around the State to work out how we can best work together and how the voice of aboriginal

people can most effectively be represented when decisions are made which affect them. The relationship between the Billinue community and Tiwest is a role model we look up to, as an example of how communities, industry and government can do business in a way that benefits everyone involved. Your partnership is also a wonderful example of the practical application of reconciliation – People working together respectfully, and understanding and accepting each other's cultures and needs. Like in all communities, I know there are still - and always will be - some areas that can be worked on and

improved in your life here at Billinue. And the department of Indigenous Affairs will continue to be an advocate of your work, and stands by to provide appropriate support where it can be provided. But I am sure that in your capable and committed hands, any challenges that arise will not impede your progress as a successful business operator, and will not stop you in your mission to provide a happy and safe community for your people. I wish you all the very best for your future in this remarkable and successful business arrangement and congratulate you on your first 10 years together at Cooljarloo.