

CO-OPERATIVE PARTNERSHIP AND INNOVATION IN THE PLANNING AND EXECUTION OF THE DECOMMISSIONING OF THE MT MCCLURE GOLD PROJECT¹

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Abstract. The standards achieved in the closure of the Mt McClure Gold Mine in Western Australia (W.A.) in 2004, was recognized with a Golden Gecko Award for Environmental Excellence, the highest environmental award available in W.A.. The project was also awarded the Newmont Australia Award for Environment as “the best environmental project in 2004” across the Australian operations.

The key to the successful closure of Mt McClure was the genuine and dynamic partnerships, which were developed and nurtured primarily by the Newmont-McClure management team, with a vision to create the best possible closure outcome “effectively a closure with pride”. Newmont engaged and worked closely with leading consultants, researchers and contractors in earth moving, plant demolition, tailings closure design, land rehabilitation, environmental monitoring and feral animal control to achieve the closure of Mt McClure.

Mining at Mt McClure commenced in 1991, and was then operated by four different companies before it came under the control of Newmont Australia.

Significant challenges for the closure project, included.

- No closure and rehabilitation plan, and little waste characterisation data.
- Little progressive rehabilitation had been completed to the standards set by the site licence conditions and commitments.
- Existing rehabilitation works had generally failed or was inadequate.
- Lack of cash flow, necessitating the injection of significant capital.
- No feral animal management, leading to significant vegetation damage.
- Lack of an appropriate environmental monitoring regime.
- A processing plant that had degenerated to having no resale value.
- A general lack of competency in the earthmoving contracting sector with regard to rehabilitation earthworks, and a prevailing contractor attitude that rehabilitation works were not core business.
- No process of verification of the works carried out, to assure regulators and other stakeholders of the quality and consistency of performance.

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Contract negotiations and preliminary rehabilitation earthworks commenced in early 2003, in parallel with a range of research activities. These activities increased in scale and intensity from that time, such that for 15 months, approximately 30 Newmont staff, contractors and consultants were dedicated solely to the project of decommissioning and rehabilitation.

Although divestment by Newmont of the Mt McClure tenements was always an option, the company committed, resourced, and drove a comprehensive closure and rehabilitation process which set new benchmarks for rehabilitation planning, earthworks and project management in the Western Australian Goldfields. The program was heavily influenced by reference to the important closure guidelines, “Strategic Framework for Mine Closure”, (ANZMEC / MCA) and the Best Practice Environmental Management in Mining –Mine Decommissioning, Environment Australia (2000).

By way of presenting this paper we broke the subject into a series of sub-headings and present, via lists, the more interesting aspects of this mine decommissioning, the heading:

- indicate the significant challenges identified in the closure
- the physical and financial commitment Newmont had to make to address the challenges
- the positive contribution made to the distant non-mining community,
- the company’s overall attitude to the closure process
- and innovation demonstrated during the closure process.

Nature of Challenge

The significant challenges identified in the initial scoping process for the project can be broken down into ten key areas:

1. **Planning**: Lack of a detailed, fully-costed and technically-justified Closure and Rehabilitation Plan to guide and direct all works throughout the project area – no plan had been submitted to government.
2. **Material Characterisation**: Lack of sufficient data on the characteristics of mine waste and rehabilitation materials, to adequately develop a robust plan for rehabilitation.
3. **Incomplete Earthworks**: Due to the sudden end of operations in 1999 (the mine went into receivership) little progressive rehabilitation had been completed to the standards set by the site licence conditions and commitments.
4. **Unsuccessful Rehabilitation**: Some rehabilitation works had been completed, but these had failed or been constructed inadequately with regard to conditions and commitments.
5. **Financial Provisioning**: Lack of cashflow from operations associated with the Mt McClure Project necessitating the injection of significant capital.
6. **Biodiversity Issues**: Lack of adequate feral animal management programs in the previous five years, which had led to significant vegetation damage on rehabilitated areas. Large goat populations had built up in association with the fresh water in mine pits. Weeds were also established on a number of the facilities.
7. **Rehabilitation Monitoring**: Lack of a comprehensive and consistently-applied environmental and rehabilitation monitoring regime, and poor or non-existent documentation of that which had occurred

8. Plant Site Decommissioning: A complete processing plant remained at the project, but had degenerated to the point to which there was no resale value
9. Contractor Management: A general lack of competency in the earthmoving contracting sector with regard to rehabilitation earthworks, and a prevailing contractor attitude that rehabilitation works were not core business
10. Verification: No process of verification of the design and material utilisation principles promoted in the initial closure plan, to assure regulators and other stakeholders of the quality and consistency of the designs. (**Plates 1, 2, 3**).

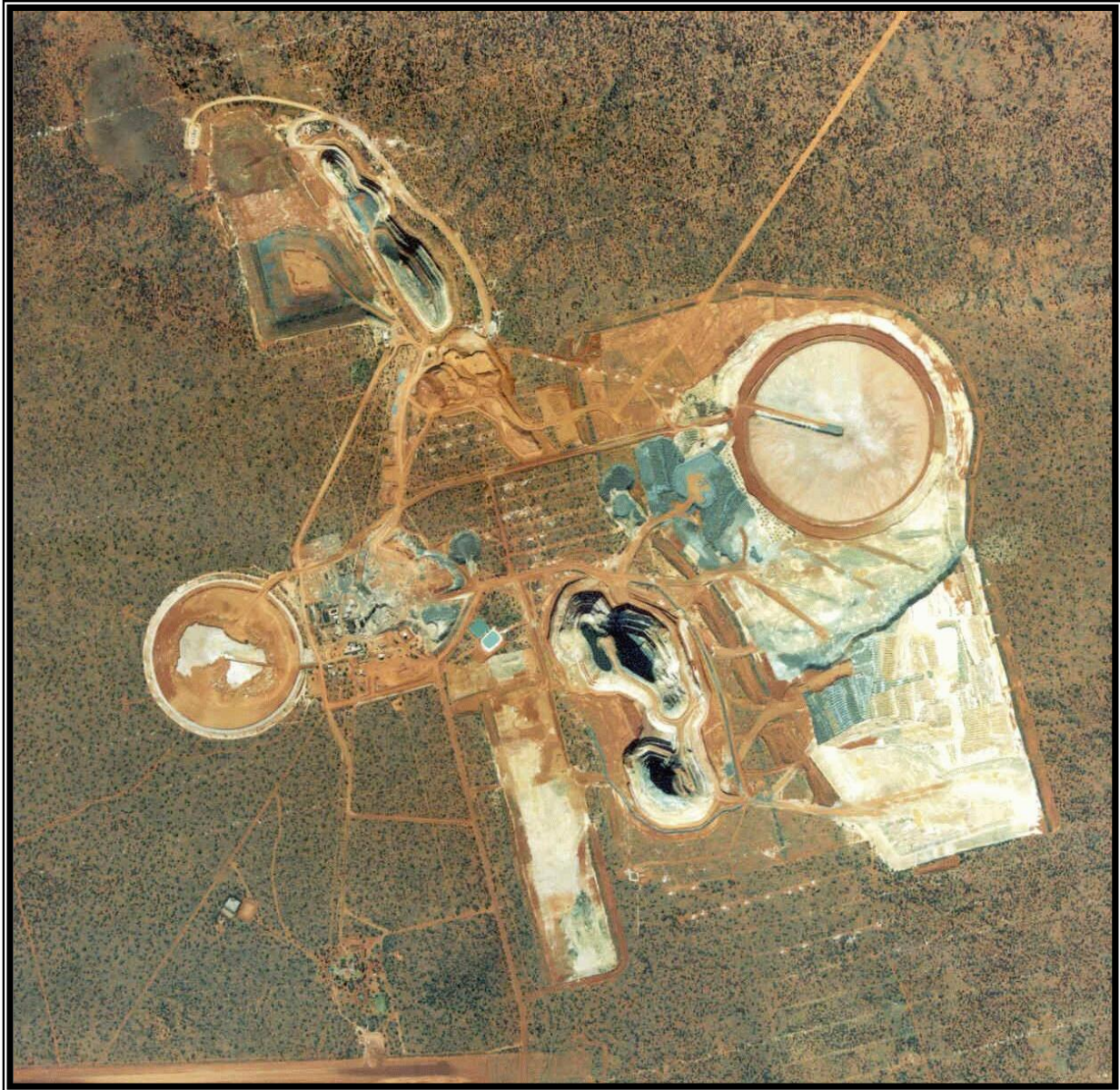


Plate 1 **Mt McClure Mine Site Prior to Closure - 2000**



Plate 2 **Waste Rock Material Prior to Rehabilitation**



Plate 3 **PAF waste material uncapped over landform surfaces**

Physical and Financial Commitment to Address the Challenges

1. Planning

Specialists with experience in closure plan development were recruited by Newmont to drive and develop the Closure Plan. This plan addressed all aspects of closure and rehabilitation that had been brought out in a prior scoping process, and included a review of literature, conditions, commitments and standards, and a closure planning workshop with stakeholders.

2. Material Characterisation

A program of research and investigation was commenced in mid-2002 to establish a detailed understanding of materials characteristics to adequately inform the plan. This involved extensive sampling programs and detailed analysis by a range of specialists. The program included:

- Geochemical characterisation of waste landforms and tailings dams
- Geophysical characterisation of prospective covers, tailings and near-surface waste
- Chemical and physical properties of all potential root zone materials
- Rehabilitation and erosion modeling for potential sheeting materials.

3. Incomplete Earthworks

Extensive design work and modeling of options for the rehabilitation of incomplete facilities was carried out, including a benchmarking process within the region, to establish best practice for the local context. This included cover material assessments, bunding specification designs, water retention and freeboard capacity calculations and materials inventories.

4. Failed Rehabilitation

Previously rehabilitated areas were mapped to establish problem areas and develop detailed plans for each waste landform. Cover depths were verified through a system of test pits, and rainfall simulation studies were carried out to test erodibility of waste materials and covers. Finally a landscape evolution model was created for some of the rehabilitated waste dumps to gauge likely improvement in landform stability after the planned remedial works.

5. Financial Provisioning

A very detailed process of estimation and quantification was carried out in 2002 to develop accurate cost assessments for each aspect of the Closure and Rehabilitation Process at Mt McClure. The Closure and Reclamation Technical Taskforce within Newmont, managed an independent review of the cost assessments and a detailed breakdown and timeline for all cost areas. This was then inserted in to Newmont's accounting system as a project and has been used throughout the process. Significant upgrades in the capital requirements were approved in the early stages of this process by Newmont.

6. Biodiversity Management

In 2002 a comprehensive feral animal strategy was developed and led to the completion of two campaigns of goat mustering and two of goat culling in the mine area leading to

dramatic reductions in goat damage. Fencing options were reviewed and a goat-proof fence design was developed and constructed around all rehabilitation areas associated with the Mt McClure Project. Newmont has also participated in feral cat and dog eradication programs in the area. A very comprehensive weed eradication program was carried out in both mining rehabilitation and exploration areas in 2003 with follow up spraying in May 2004.

7. Environmental Monitoring

Monitoring commenced in early 2003 using Ecosystem Function Analysis (Tongway and Hindley, 1995; Tongway *et al.*, 1997) to provide a baseline of consistent data, provided by this highly-regarded monitoring practice for the project area. This was repeated in mid-2004.

8. Plant Decommissioning

The removal of the processing plant and associated infrastructure was the focus of a specifically-recruited project manager, safety officer and an environment professional that were responsible for supervising the salvage and demolition contractor. Through this process, all parties involved were able to maximise the re-use and recycling of scrap and salvage and ensure management of any contaminated sites or potential contaminants through the process. A specialist poly-pipe recycling company was on site for five months, salvaging approximately 60km of poly and PVC pipe for recycling. Pipe was collected from the plant, mining and associated borefields areas.

9. Contractor Management

A rigorous and transparent contract tendering process was carried out for the rehabilitation earthworks and the plant decommissioning contracts. This included high standards required for day to day environmental management for tenderers and criteria focused on quality, training and safety. Training in environmental earthwork competencies was a requirement within the contracts as was a commitment to indigenous participation, quality control and cost efficiencies, based on innovation. These practices lead to the maintenance of high standards but at reduced costs.

10. Verification Process

A verification process was developed and included aerial surveys and *in-situ* test pit sampling to provide assurance to regulators and other stakeholders that the project was implemented according to the design criteria. Such critical issues as water retention characteristics, cover depths and freeboard could be demonstrated with verifiable as-built data.

Positive Contribution to the Community and Community Awareness and Participation

Although the Mt McClure and neighbouring Bronzewing operations are situated over 100 kilometres from the nearest non-mining community, a number of significant and pro-active initiatives were instituted through the process of Closure and Rehabilitation of the Mt McClure Project.

1. Over 1000 tonnes of scrap metals and other recyclables were recycled through the project, with some of the funds generated being donated to a recycling charity. This came to approximately \$10,000 in donations.

2. Neighbouring properties were actively engaged in the process, through local pastoralists (Weebo, Barwidgee, Banjawarn and Wonganui) taking away a range of scrap and salvage items for use on their properties.
3. A media tour was conducted by Newmont throughout the Mt McClure Project Area in late 2003 in partnership with the Western Australian Chamber of Minerals and Energy, giving more than 20 journalists first-hand experience of the closure process, and the techniques being utilised.
4. Newmont generated public reports in 2002, 2003 and 2004 which detailed progress in the closure and rehabilitation of Mt McClure.
5. A Closure Planning workshop was held in early 2003, specifically to create a forum for regulatory, technical and Newmont stakeholders to contribute to improved design principles and processes for the project. This included visits to most of the facilities and reviews of information and data available.
6. Indigenous participation was significant, due to the fact that the majority of the parties tendering for the rehabilitation contract were Native Title holders in the region. Indigenous leaders in the region participated in a detailed site tour, prior to commencement, and received detailed presentations and a scope of works as part of the process. All tenderers were required to make substantial commitments to indigenous participation as a part of the contract. The successful tenderer committed to 20% of the earthworks workforce being indigenous people, including supervisory roles. The Mt McClure rehabilitation contract achieved one of the highest rates of sustained indigenous employment in the history of the region and consistently maintained a training position for a young Aboriginal person throughout the life of the project.

General Attitude Towards Environment

In mid-2002 an internal audit had identified approximately 14 non-compliances with lease and licence conditions and commitments over the Mt McClure and Bronzewing Leases. Although the operations were preparing for closure, Newmont considered any non-compliance to be unacceptable. Resources for a rigorous and concerted campaign to address these issues were made available in order to make all operational and closure activities compliant.

One of the most significant historical issues on site was exploration drill holes, drill pads and access gridlines inherited from previous owners. Over an 18-month period from mid-2002, a team of 3 to 5 Newmont and contract personnel worked continuously to rehabilitate over 20,000 drill holes and pads and over 100km of grid lines in the region, surrounding the Mt McClure Project.

The above activities, along with revamped accountability management within the organisation, weed and feral animal management programs and the construction of a major bioremediation facility led to the company being free of non-compliances by the end of December 2003. Two external audits were conducted and an aggressive campaign has resolved most issues brought out in the audit.

The number one goal of management and personnel with regard to the environmental management process at Mt McClure has been “Closure with Pride”.

Innovation

1. Planning

The planning process commenced with a risk assessment, which formed the basis for the plan as it developed. Another key feature of the plan was the development of a process map which outlined in a detailed manner the planning steps and sequences. The plan was broken into four components, which dealt with

- a. Introductory and background issues
- b. Closure management systems and processes
- c. Supporting documentation
- d. Project Task Areas, which broke down into almost 300 discreet task sheets

2. Material Characterisation

The information required was gathered using a broad range of techniques and expertise, some of which is quite recently developed. In addition to sampling from test pits, an auger drill rig was used to take samples through the entire vertical profile of the tailings facilities and oxide waste dumps. Rainfall simulation trials were conducted on a number of the waste dumps to establish the comparative erodibility of different cover materials. Landform modeling was trialled on some of the waste landforms to ascertain the level of improvement in stability over the longer term, as a result of different surface treatments.

3. Innovative Designs

One of the key features of much of the work at the Mt McClure Project is the considerable effort put into good drainage control to manage water appropriately on the tops and berms of the facilities. In many cases, rolled clay bunds were built and then armoured with a coarse caprock. In other places bunding was used to create cells across the upper surface of the tailings facilities and landforms, to ensure that areas of ponded water were minimised, and infiltration maximized.

Plate 4, 5, 6 and 7

Large, angle-of-repose landforms were formed into concave slopes and capped with laterite rock mulch. The site has approximately 10 km of slopes in this form, providing a large-scale trial for observation and assessment of the merits of this new form of slope design.

4. Contract Management and Supervision

The detailed process of contract tendering, and the focus on quality, had a significant bearing on the project. The style of contract promoted innovation and quality above simple volume movements

On a monthly basis, the principal and contractor carried out a performance measurement process, which reviewed performance in all of the criteria established during the tendering process. The contract was closely supervised by experienced Newmont personnel who, in partnership with the contractors continually responded to issues arising throughout the life of the project. The Mt McClure Project is an example of a rare occasion when the entire closure process is treated as a stand-alone project and managed as such, rather than as a supplementary activity.



Plate 4 Steep Slopes pre-rehabilitation TFS4



Plate 5 Slopes shaped concave and overlaid with oxide



Plate 3 Laterite placed over oxide layer on PAF slopes



Plate 6 Fine topsoil placed over laterite

5. Benchmarking and Training

One of the most significant innovations throughout the project was the benchmarking tours undertaken by key personnel involved in designing and supervising the project, including contractors and consultants. Dozens of closed and abandoned mines were visited and an immense amount was learned with regard to the response of certain materials and design concepts over time, and as a result of particular weather patterns. By visiting these closed mines throughout the Eastern Goldfields region, the project leadership group gained first hand appreciation of trends and design concepts throughout much of the rehabilitation estate.

6. Biodiversity Management

The immediate removal from the rehabilitation areas of the most significant grazing pressure from goats, quickly led to a substantial improvement in regeneration. Longer-term solutions such as goat-proof fencing around all of the facilities will lead to a much more robust and sustainable result on the landforms

7. Verification Process

The verification process was an innovation that demonstrated that works in their completed state are in alignment with the various principles and technical specifications outlined in the plan. The process included aerial photography, photography of test pits and sample analysis together with monitoring of water and rehabilitation (**Plate 7**).



Plate 7 Capping material over acid waste material

8. Partnership Approaches

The key to the successful rehabilitation of the Mt McClure tenements was the genuine and dynamic partnerships, which were developed and nurtured primarily by the Newmont-McClure management team, and by a range of supporting experts and organizations, all with a vision to create the best-possible closure outcome. Newmont engaged and worked closely with leading consultants and contractors to achieve the closure of Mt McClure with pride.

The standards achieved in the closure of the Mt McClure Gold Mine in Western Australia was recognized with a Golden Gecko Award for Environmental Excellence, the highest environmental award available in W.A.. The project was also awarded the Newmont Australia Award for Environment as “the best environmental project in 2004” across the Australian operations. (**Plate 8 and Plate 9**).



Plate 8 TSF4 Before Rehabilitation Works



Plate 9 TSF4 During Rehabilitation

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