

## Third Annual Report of the Independent Monitoring Panel for the Cowal Gold Project – August 2007

### Introduction

The Independent Monitoring Panel (IMP) was established in accordance with condition 8.8(b) of the Development Consent for the Cowal Gold Project. The members of the IMP are:

- Emeritus Professor Clive Bell, University of Queensland; former Executive Director, Australian Centre for Minerals Extension and Research (ACMER)
- Allen Kearns, Deputy Chief, CSIRO Sustainable Ecosystems
- a NSW Department of Planning representative

The IMP was established under the Development Consent to:

- provide an overview of the independent audits required under condition 8.8(a) of the Development Consent;
- regularly review all environmental monitoring procedures undertaken by the Applicant and monitoring results; and
- provide an Annual Statement of the Environment Report for Lake Cowal with particular reference to the ongoing interaction between the mine and the lake and any requirements of the Director-General.

Construction activities commenced at the mine site in January 2004. Site visits were made to the mine site by members of the IMP before construction (Allen Kearns, September 16-17, 2003 and November 22, 2004) and after the commencement of construction (Clive Bell, December 14-15, 2004; Allen Kearns, February 9, 2006; Clive Bell and Allen Kearns, July 3-4, 2007).

The Director-General has not specified any requirements under condition 8.8(b)(ii) for the preparation of this report. This report covers site activities and environmental monitoring information provided to the IMP in the 2006 Annual Environmental Management Report (AEMR). The 2007 IMP Report includes the review of the Independent Environmental Audit Report (July 2006) for the period January 2006 to June 2006 and the Independent Environmental Audit Report (May 2007) covering the first year of the ore processing operations for the period from April 2006 to April 2007.

### Overview of the Independent Environmental Audits (IEA)

As in 2004 and 2005, independent environmental audits of the mining and infrastructure areas and construction works were conducted by Trevor Brown & Associates applied environmental management consultants (aemc). Reports were prepared by aemc and provided to the IMP for the periods January 2006 to June 2006 covering the status of the construction activities. A subsequent report was provided to the IMP for the period covering the first year of operations of the ore processing plant from April 2006 to April 2007. Site visits were undertaken by aemc during preparation of each of the reports to assess

the status of the development activities and environmental monitoring compliance. The independent environmental auditors reviewed the available documentation covering licenses and approvals granted by Government for the project as well as the environmental monitoring documentation held by Barrick at the mine site office in order to verify compliance with the conditions of approval.

As mentioned in the First IMP Report in February 2005 and the Second IMP Report in March 2006, the independent environmental auditors established a logical framework for verifying compliance by setting out the entire list of requirements, in the thirteen separate management plans that have been prepared by Barrick, that cover environmental management under the Minister's Conditions of Approval. These separate plans include:

- Indigenous Archaeology and Cultural Heritage Management Plan
- Flora and Fauna Management Plan
- Erosion and Sediment Control Management Plan
- Soil Stripping Management Plan
- Landscape Management Plan
- Bushfire Management Plan
- Land Management Plan
- Compensatory Wetland Management Plan
- Site Water Management Plan
- Hazardous Waste and Chemical management Plan
- Dust Management Plan
- Blast Management Plan
- Noise Management Plan
- Traffic Noise Management Plan

The compliance by Barrick against the requirements of the above-listed plans was assessed by the Independent Environmental Auditors and comments were made against those approval conditions that had been activated. The same template-based approach has been used in the last four six-monthly reports prepared by aemc leading up to this 2007 IMP reporting period. The IMP recognises that this well-structured approach for addressing complex environmental compliance requirements continues to be an example of best practice for easily accessible and updated environmental compliance information. For example, the use of construction activity photographs tied to the site map is a very useful communication device. On a minor point, please note that Figure 4 Status of Cowal Gold Project development in the aemc Independent Environmental Audit (July 2006) should be labelled December 2005, not June 2005.

The independent environmental audit for January to June 2006 included coverage of the following major activities:

- Completion of the process plant construction
- Commissioning of components of the process plant
- Southern Tailings Storage Facility (STSF) completed with discharge of tailings from May 2006
- Installation of bird deterrent units on the STSF
- Completion of the fauna proof fence around the tailings storage facilities
- Main Workshop completed and equipment maintenance undertaken
- Fuel farm and vehicle wash bay established
- Covered stockpile area and conveyor system established for crushed ore
- Mine pit excavation advanced with excavation of low grade and high grade ore stockpiles

The Independent Environmental Auditors (aemc) drew the following conclusions in their July 2006 report:

*The audit findings confirmed compliance of the Cowal Gold project with all the documentation approvals and requirements contained in the MCoA (Minister's Conditions of Approval) related to the construction of the mine infrastructure and pre-commissioning of the process plant. No non-compliances were identified in relation to the requirements of the conditions attached to the Minister's Consent, Environment Protection Licence or Mining Lease.*

In April 2007, the Independent Environmental Auditors (aemc) conducted site auditing and prepared an independent environmental audit report (May 2007) for the period from April 2006 to April 2007 covering the first 12 months of operations after commencement of the ore processing plant. Future independent environmental audit (IEA) reports are now scheduled every three years until decommissioning of the mine and ore processing operations respectively or as otherwise directed by the Director-General.

The Independent Environmental Auditors (aemc) drew the following conclusions in their May 2007 report:

*The audit findings confirmed compliance with annual returns for the CGP with the requirements of the conditions attached to the Minister's Conditions of Consent, Environment Protection Licence and Mining Lease.*

The IMP has reviewed the reporting process used in the two recent Independent Environmental Audit reports covered by the 2007 IMP report. The IMP was easily able to independently assess and verify the status of environmental management information at the site and the high degree of compliance with development consent conditions, licenses and approvals granted to Barrick, as reported by the independent environmental auditors.

**2007 IMP Recommendation 1:** Because the next IEA is not due for three years, the IMP recommends that Barrick consider continuing use of the template-based approach established by aemc for environmental auditing of

operations in order to regularly and systematically update progress on each of the environmental management and monitoring components. This approach would greatly assist the IMP in its annual review.

### **Review of Environmental Monitoring Procedures and Monitoring Results**

The 2006 Annual Environmental Management Report (AEMR) was sent to the IMP on 20 May 2007. The 2006 AEMR covers the period 23 December 2005 to 22 December 2006. Overall, it is a well-structured and informative report prepared in accordance with the Department of Primary Industries – Minerals guidelines for AEMRs and in consultation with relevant stakeholders. The IMP made three recommendations in the 2006 IMP Report concerning environmental monitoring procedures, and these recommendations are assessed below in terms of adequacy of response by CGP since the 2006 IMP Report. .

### **IMP Assessment of Response to 2006 IMP Recommendations**

The IMP made three recommendations in the 2006 IMP Report as outlined below. Barrick responded to Department of Planning (DoP) by letter on 15 August 2006 setting out their course of action for addressing the three recommendations.

**2006 IMP Recommendation 1:** *The timing discrepancy between the reporting schedule for the IMP and the availability of the AEMR needs to be rectified by NSW Department of Planning and Barrick to allow for more timely evaluation of the annual environmental monitoring information by the IMP.*

**2007 IMP Assessment 1:** Barrick received regulatory approval from NSW DECC to vary the reporting period and submission date for the AEMR to align with the Annual Environmental Return (AER). Barrick then recommended DoP to revise the timing for submission of the IMP's State of Environment Report for Lake Cowal. DoP notified Barrick and the IMP by letter of 20 September 2006 that the IMP Report would be due two months after the Panel has had time to review the AEMR and the AER provided to the DECC.

This alignment of reporting for both the AEMR and the AER has allowed for more effective evaluation of environmental monitoring information by the IMP in 2007. There have been some unavoidable delays caused by unavailability by the IMP in the 2007 IMP reporting period resulting in a three month review period from the time of receiving the AEMR and completing the 2007 IMP Report.

**2006 IMP Recommendation 2:** *That Barrick provides more timely resolution of anomalous environmental monitoring results in the future.*

**2007 IMP Assessment 2:** The IMP notes that Barrick has developed a quality assurance control process for environmental sampling programs, and this has already facilitated the resolution of anomalous dust sampling results. For example, the IMP notes that Barrick has reviewed their dust sampling procedures and changed analytical laboratories to improve the quality of

sampling and analysis and the usefulness of monitoring results. Barrick has also initiated third party review of dust analyses and a research project to be conducted by the University of Sydney into the characterisation of dust particles. The IMP welcomes these actions and response to the 2006 IMP Recommendation 2.

**2006 IMP Recommendation 3:** *That Barrick comment on whether the suggestions made in February 2005 by the IMP have been acted upon, in particular the adoption of the ANZECC/ARMCANZ Water Quality Guidelines introduced in 2000.*

**2007 IMP Assessment 3:** The IMP notes on page 15 of the 2006 AEMR that Barrick have signalled their intention to commence a review of their surface water, groundwater, meteorological and biological monitoring programs including consideration of the 2000 ANZECC/ARMCANZ Water Quality Guidelines and the incorporation of an adaptive management approach. Barrick have consulted with CSIRO and CRC Freshwater Ecology in Wagga Wagga in regard to the monitoring programs and held discussions with one of the IMP members (Allen Kearns) in Canberra in June 2006 about the design and objectives of the revised monitoring program. Barrick have also proposed to consult with CSIRO and the IMP prior to implementation of the revised monitoring program, particularly in regard to the revised sampling design for Lake Cowal. Barrick has also proposed to engage the CRC Freshwater Ecology to provide technical advice on relevant field sampling methodologies and technical review of the biological component of the revised monitoring program.

The IMP also notes Barrick's intention to adopt and use the 2000 ANZECC/ARMCANZ Water Quality Guidelines, where applicable, on pages 34 and 35 of the 2006 AEMR. The IMP recognises Barrick's response to the 2006 IMP Recommendation 3 and confirms the importance of incorporating these guidelines in the next AEMR.

The IMP also noted that the 2006 AEMR has many references to various aspects of the Cowal Gold water management system such as the volumes of water in different storages; buying surface water from other sources in the region; dewatering the pit; abstraction of groundwater from the Bland Creek Paleochannel and recycling of process water within the closed water management system.

**2007 IMP Recommendation 2:** The IMP suggests that the whole water management system is summarised in one section of the AEMR and that a water balance is established to track the stocks and flows of various sources of water entering the Cowal Gold Project.

### **Environmental Monitoring and Adaptive Environmental Management**

In 2005 and 2006, the IMP referred Barrick to consider key references on the design of environmental monitoring programs, decision-making and impact assessment for the Cowal Gold Project such as Batley et al. (2003), Keough

and Mapstone (1997), Underwood (1997), Underwood and Chapman (2003) and Downes et al. (2002).

Batley et al. (2003) provide a useful summary of the new features and improvements in the 2000 ANZECC/ARMCANZ Water Quality Guidelines, namely:

- Being issue-based
- Being risk-based
- Use of integrated, holistic assessments
- Site-specific focus
- Departing from single numbers
- Co-operative management

The IMP encourages Barrick to design and evaluate its proposed revisions to the environmental monitoring program against these key features described in Batley et al. (2003).

Two other recent publications offer useful insights into the design and evaluation of environmental monitoring programs. Based on experience in Canada with pulp and paper mills and mining projects, Kilgour et al. (2007) discuss the common disconnect between environmental assessment (EA) and prediction of impacts before approval of major infrastructure projects and the ongoing environmental effects monitoring (EEM) after a project is operational. For example, the EA process is commonly based on assessing the impacts of 'stressors' such as heavy metals in effluents on the receiving environment. Monitoring programs designed prior to the approval of the project emphasise the measurement and monitoring of stressors, as is the case for the existing monitoring program at Lake Cowal. The EEM process is commonly based on assessing the effects on the performance of biological indicators of value such as components of aquatic ecosystems.

EEM is also based on knowledge gained about how local environments function during the operational phase of the project. In the case of Cowal Gold, prolonged drought and a dry lakebed have made fire a relatively bigger risk to the Lake Cowal environment than torrential rain or release of effluents from the site. In addition, the design of the mine to avoid discharge of effluents to the lake means that monitoring of chemical stressors in soils and waters in the lake, as was set out in 1991 for the existing environmental monitoring program, is unlikely to be of much use in assessing the state of the environment when the lake is dry. Other performance measures of lakebed condition and ecosystem functions are likely to be more useful such as vegetation cover and area cropped, burned or covered by water. For example, these measures could be derived and developed using satellite imagery to give a broader understanding of the dynamics of Lake Cowal than could be derived by the use of chemical measures in soils.

Field et al. (2007), based on Australian experience, address some of the common constraints and failures in ecological monitoring programs and suggest ways to make monitoring programs more useful and meaningful. They discuss problems caused by inadequate funding or too short a time period allowed to

detect change in the environment; the lack of clear articulation of objectives and success measures for a monitoring program and the need to approach sampling design and the evaluation of early results with "learning and improvement explicitly in mind, that is, it should be experimental and adaptive to the greatest extent possible".

**2007 IMP Recommendation 3:** In considering the redesign of the environmental monitoring programs at Lake Cowal, Barrick should consider the insights referred to in the three publications mentioned in this section (Batley et al. 2003; Kilgour et al. 2007; Field et al. 2007). One ongoing focal point for consideration needs to be on assessing the interactions between the mine and Lake Cowal as the lake inevitably undergoes major environmental changes expected when the lakebed finally floods again. A descriptive, and eventually predictive, understanding needs to be developed of the sequences of expected changes in biota, particularly bird life and fish populations as the lake floods. This information can be developed through consulting local people with knowledge as well as the scientific literature for the Lake Cowal environment and similar arid zone wetlands.

The aim of developing this conceptual understanding of how the Lake Cowal ecosystems would develop after flooding is to better understand the potential for adverse interactions between bird life and the mine site and to set in place improved environmental management practices that will limit the potential for unintended consequences.

#### ***Proposed Changes to the Cyanide Monitoring Program***

Members of the Independent Monitoring Panel (IMP) have reviewed the letter of 1 December 2006 from Garry Pearson, Environmental Manager, Cowal Gold Mine, to the Director General, Department of Infrastructure Planning and Natural Resources in which a case was made for amendments to the cyanide monitoring program as required by Section 6.2.5 of the Cowal Gold Mine Cyanide Management Plan (CMP).

The CMP (Section 6) provides for-

- Monitoring of CN(WAD) levels of the aqueous component of the tailings slurry stream at the discharge point to the tailings dams
- Monitoring CN(WAD) levels in the decant water of the tailings dams
- An on-site laboratory for "quickly" establishing CN(WAD) levels in the liquid at the discharge point to the tailings dams and in the decant ponds for monitoring purposes(Consent Condition 8.2(b)(iii)).

As stated in the letter of 1 December 2006 from Barrick to the Director General, the monitoring program which fulfils the requirements of the Development Consent Conditions, Cyanide Management Plan and Environment Protection License, involves-

- Samples being collected twice daily from the tailings slurry stream and decant water in accordance with the AS/NZS 5667:1998 Water Quality-Sampling.
- Samples being analysed on-site twice daily in accordance with APHA Standards Methods for the examination of Water and Wastewater

- Samples being analysed off-site in West Wyalong twice daily in accordance with APHA Standard Methods for the examination of Water and Wastewater
- Samples being analysed off-site at a NATA-accredited laboratory once per week in accordance with APHA Standard Methods for the examination of Water and Wastewater(as per EPL 11912).

The most important proposed change to the cyanide monitoring program is to use a Picric Acid Colorimetric method for weak acid dissociable cyanide (CN(WAD)) rather than the APHA Standard Method for rapid on-site, twice daily measurement of CN(WAD). The Picric Acid method is listed by the International Cyanide Management Institute as an acceptable alternative to the more time-consuming and complex distillation (APHA) method.

As justification for using the Picric Acid method, Barrick provided the results of statistical analyses on data collected over a 5-month period. These data show that the on-site Picric Acid analyses for CN(WAD) are not statistically significant from Total CN on the same samples measured by SGS and the NATA-accredited laboratory but are statistically significantly higher than the CN(WAD) values measured by the outside laboratories. The net result is that the use of the Picric Acid method for CN(WAD) provides a safety factor in the management of cyanide at the mine. The Picric Acid method has the additional advantages that it is rapid and that it does not require a skilled chemist to undertake the analyses.

**2007 IMP Recommendation 4:** As the mine is not recommending any change in the frequency or methods of sampling or in the requirement to have samples analysed off-site by both local and NATA-accredited laboratories, the IMP recommends that the proposed amendments specified in the letter of 1 December 2006 from Barrick be accepted.

## **Baseline Assessments and New Research Initiatives**

### ***Characterisation of Overburden for Selective Placement***

The waste rock at many gold mines contains levels of sulphides which have the capacity to produce acid rock drainage (ARD) which can have a detrimental impact on the surrounding environment (DITR 2007). The Cowal Gold Mine is fortunate that acid-base accounting analyses of overburden indicate that there is a very low likelihood of ARD generation from waste rock and tailings.

The results of characterisation for ARD potential undertaken for North Limited in 1998 and for Barrick in 2004 by Environmental Geochemistry International Pty Ltd (EGI) appear to be consistent in predicting a low risk for ARD generation, and thus EGI states in its 2004 report:

*“Therefore, no special handling requirements are indicated for ARD control at Cowal. However, operational monitoring and testing should be carried out on an occasional and as needed basis to confirm the low ARD potential of all waste types with particular focus on any unexpected rock types or alteration types which may be exposed during mining.”*



**2007 IMP Recommendation 5:** That the Mine Geologist and Environmental Manager continue to monitor the waste rock being removed from the pit to ensure that pockets of potentially acid-generating material, which may have not been identified in previous core sampling, are identified and selectively placed within the waste rock dumps to preclude ARD generation. This requirement is particularly important with waste rock being used to heighten the Lake Protection Bund.

#### ***Water and Tailings Management in the Tailings Storage Facility***

During the site visit by the IMP on the 3 and 4 July 2007, it was noted that there was an extensive water surface in the tailings storage facilities. Although the levels of cyanide have been shown by the Independent Environmental Audits to be less than 20 mg/L weak acid dissociable (WAD) cyanide, and therefore in compliance with the Development Consent, there would appear to be merit in keeping the water surface area as small as practicable to reduce the attractiveness to birds.

It is possible that the efficiency of recycling of water from the tailings storage facility is being reduced by the presence of saprolytic clay in the processed ore. This clay does not readily flocculate and settle in the tailings storage facility. The IMP was informed that addition of flocculants has been trialled with limited success in the Southern Tailings Storage Facility. The low density of tailings will not only impact on the efficiency of water recovery but also result in more tailings storage volume being required than perhaps planned for during mine development.

**2007 IMP Recommendation 6:** That consideration should be given, at this early stage of mine operation, to options for thickening of the tailings stream to:

1. ensure the recycling efficiency of water is improved and the area of exposed water is reduced for bird attraction, and
2. reduce the possibility of the tailings volume, over the predicted life of the mine, exceeding the volume of the two constructed tailings storage facilities.

#### ***Groundwater Monitoring***

The changes in water table levels surrounding the pit are reported in Section 3.4 and Appendix B of the 2006 Annual Environmental Management Report. In order to provide a clearer picture of the trends in water table levels with time and distance from the pit, it would be helpful for the levels to be plotted against distance from the pit for different time periods. Such plots may assist in predicting the drawdown of the water table in sensitive surrounding woodland areas. In addition, star plots of groundwater composition should be plotted at the same scale in order to improve their usefulness for comparing groundwater of different quality.

**2007 IMP Recommendation 7:** That improvement is made to the visual presentation of groundwater data in the next AEMR.

#### ***Rehabilitation Trials on Lake Protection Bund***

The IMP is encouraged to see that Cowal Gold management is supporting the establishment of additional rehabilitation trials on the Lake Protection Bund to

assess the effectiveness of different mulching treatments in stabilising sloped areas. These trials are being conducted by an Honours student from the Australian National University (ANU) and follow preliminary trials conducted in 2006 by another Honours student from that university. The new trials were inspected by members of the IMP on 3 July 2007 together with ANU and mine personnel.

#### ***Characterisation of Dust Particles***

The IMP supports the initiation of a research program through the University of Sydney which has the objectives of:

1. determining the presence of dust accessions within the local Lake Cowal Region,
2. assessing the distribution, and amalgamation effect, of dust additions to the soil profile in this region, and
3. establishing and monitoring baseline dust metal concentrations.

This research, which will involve a PhD student, is expected to provide the data to allow modelling of spatial distribution patterns leading to development of an efficient dust management strategy.

#### **Annual State of the Environment Report for Lake Cowal**

The IMP is required to provide an Annual State of the Environment Report for Lake Cowal with particular reference to the on-going interaction between the mine and Lake Cowal.

Lake Cowal continued to be dry during 2006 as a consequence of the prolonged drought affecting the central west region of NSW and eastern Australia in general. Consequently, there was no surface water sampling results available for review by the IMP. Observations of bird breeding activity and bird habitat in January, August and October 2006 was undertaken by Paul Peake from University of Adelaide as part of his ongoing observations first established in 1989. He reported that the lake was dry, and the only waterbirds present were in habitat peripheral to the lake.

The AEMR (p95) reported that a large fire (2,500ha) had burned through lignum areas on the lakebed at the northern end of Lake Cowal – Bogey's Island from 19-22 November 2006. Barrick provided some of the fire fighting resources to control the fire.

The IMP also noted that, in 2006, there was exploration activity on the lakebed; the continued development of the Lake Protection Bund structures and a series of lake foreshore revegetation trials. These activities were undertaken by Cowal Gold without detriment to the functioning of Lake Cowal as an ephemeral lakebed ecosystem..

Finally, Condition 8.8(b)(ii)(c) requires the IMP to respond to "any requirements of the Director General". To date, the IMP has not been provided with any information or requests on other "requirements of the Director General".

## Summary List of IMP Recommendations for 2007

**2007 IMP Recommendation 1:** Because the next IEA is not due for three years, the IMP recommends that Barrick consider continuing use of the template-based approach established by aemc for environmental auditing of operations in order to regularly and systematically update progress on each of the environmental management and monitoring components. This approach would greatly assist the IMP in its annual review.

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## Independent Monitoring Panel

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