



DEPARTMENT OF REGIONAL DEVELOPMENT,  
PRIMARY INDUSTRY, FISHERIES AND RESOURCES

## **RESPONSE TO 2009 AUDIT REPORT:**

### ***Independent Monitor Audit of the Environmental Performance of the McArthur River Mine 2008 Operational Period***

**October 2009**



## Executive Summary

A review of the *Independent Monitor Audit of the Environmental Performance of the McArthur River Mine – 2008 Operational Period*, submitted by the appointed Independent Monitor consultancy Environmental Earth Sciences Victoria, was undertaken by the Department of Regional Development, Primary Industry, Fisheries and Resources (the department) in October 2009.

The review focused on the compliance and technical issues raised by the Independent Monitor (IM) relating to the environmental condition, management and monitoring of the McArthur River Mine (MRM) site by the operator and regulatory overview by the Northern Territory Government.

The approach taken by the IM in the audit encompassed six key aspects for the review period October 2007 to September 2008:

1. a review of the environmental assessment and monitoring activities, procedures and systems implemented by the operator in order to maintain compliance with statutory commitments and conditions of operation;
2. review and assessment of the operator's technical compliance with their conditions and commitments;
3. a review of the audits and assessments undertaken by the department to monitor the operator's environmental performance;
4. formal environmental risk assessment;
5. gap analysis; and
6. site inspections undertaken by the IM in December 2008 and June 2009.

In its audit report only minor observations and comments were returned by the IM, with respect to the department, indicating the robustness of its mine site evaluation process and environmental check monitoring program, with some areas of improvement identified in relation to auditing.

In relation to the activities of the operator, the IM identified two issues for further investigation under the *Independent Monitoring Assessment Conditions* (IMACs) Section 6.4. The specific issues identified in the correspondence were as follows:

1. Tailings Storage Facility (TSF) Cell 1 – Seepage to Surprise Creek; and
2. Salt discharge through dam walls at the Bing Bong Dredge Spoil Ponds.

In accordance with the IMACs the department wrote to MRM requesting information on what action was being planned and/or undertaken to address the identified issues with subsequent communication from the operator committing to undertake a range of actions. The commitments provided by MRM in its response to issues identified in the IM's notification letter are to be incorporated into the company's submitted Mining Management Plan (MMP) for the 2009/2010 operating year, and will be reviewed by the department.

Additionally a detailed technical audit of MRM's environmental program was completed for the period October 2007 to September 2008 with the provision of further discussion and recommendations regarding seven key areas:

1. Surface water and artificial water monitoring.
2. Groundwater monitoring.
3. Dust, soil and sediment monitoring.
4. Marine monitoring.
5. Flora and fauna monitoring.
6. River diversion hydraulics monitoring.
7. Civil works monitoring.

The department uses Mining Management Plans, Annual Environmental Reports, Water Management Plans and the broader *Mining Management Act* to encourage operators to implement best practice methods, systems and processes into their activities. This in turn facilitates continuous improvement and is consistent with the Act's co-regulatory approach.

Having reviewed the findings of the MRM IM audit report, the department is of the view that issues raised have, or are, being addressed by the operator and the department via a process of continuous improvement.

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## **1 OUTPUT**

A review of the *Independent Monitor Audit of the Environmental Performance of the McArthur River Mine – 2008 Operational Period* (the MRM IM Report), submitted by the appointed Independent Monitor (IM) consultancy Environmental Earth Sciences Victoria (“EES”), was undertaken by the Department of Regional Development, Primary Industry, Fisheries and Resources (DRDPIFR – the department) in October 2009.

This review focuses on the compliance and technical issues raised by the IM relating to the environmental condition, management and monitoring of the McArthur River Mine (MRM or the operator) site by the operator and regulatory overview by the Northern Territory Government (NTG).

### **1.1 Review focus**

While only minor observations and comments were returned by the IM, indicating the robustness of the department’s mine site environmental check monitoring program, it is still considered essential by the department to benefit from the observations and recommendations made by the IM with regards to the operator.

The review provides a discussion of the following five aspects:

1. General overview of the MRM IM Report,
2. Review of DRDPIFR process and regulation,
3. Review of the MRM process and regulation,
4. Aspects identified as requiring further investigation,
5. Technical review of MRM’s environmental monitoring.

## **2 GENERAL OVERVIEW OF THE REPORT**

The objectives of the 2009 MRM IM Report for the 2008 operational period were stated as follows:

1. Review the environmental monitoring and assessment practices undertaken by MRM and DRDPIFR.
2. Identify and report urgent issues requiring investigation.
3. Provide an annual audit report to the Minister for Primary Industry, Fisheries and Resources that:
  - assesses the environmental performance of MRM operations; and
  - recommends improvement measures to increase environmental performance.

The approach taken by the IM to evaluate these aspects is as follows:

- a review of the environmental assessment and monitoring activities, procedures and systems implemented by the operator in order to maintain compliance with statutory commitments and conditions of operation;
- review and assessment of the operator’s technical compliance with their conditions and commitments;
- a review of the audits and assessments undertaken by the department to monitor the operator’s environmental performance;
- formal environmental risk assessment and gap analysis; and

- site inspections undertaken by the IM in December 2008 and June 2009.

### **3 REVIEW OF DRDPIFR PROCESS AND REGULATION**

The department undertakes what is termed an 'environmental check monitoring' of selected mine sites within the Northern Territory. This involves the collection of surface and groundwater samples for field measurements and subsequent analysis by a National Association of Testing Authorities (NATA) approved laboratory.

The monitoring points selected and the analyte suites examined for are designed to provide a representative sample of the operator's environmental monitoring program to ensure a meaningful comparison of the department's data and the operators. The analytical suite is selected on a mine-by-mine basis with recognition of the dominant analytes within that water body reflective of mining process and surrounding geochemistry.

These water quality results are then compared against environmental water quality data supplied by the operator to 'check' that the mine site's water quality data are comparable and provide the department with confidence regarding the overall site data supplied by the operator. The departmental monitoring also enables interpretation of trends for validation against the operator's reported performance in comparison with appropriate standards such as the Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines and appropriate waste discharge licensing criteria.

Should a significant change in concentration occur, this will trigger the collection of a broad semi-quantitative scan in the next sampling trip which provides parts per billion (ppb) concentrations of 67 elements.

The department reviews the suite of elements annually during the mine site environmental monitoring program review, and periodically when results returned from a sampling event (department or operator) indicate significant changes in concentrations.

Assessment of both operator and departmental analytical data is undertaken as it is received throughout the year, and a formal annual review of all data forms part of the department's annual mine site review and monitoring program assessment. Additional formal comparison is undertaken with the review of the operator's annually submitted Annual Environmental Report (AER).

#### **3.1 Independent Monitor assessment of the DRDPIFR process and regulation**

The 2009 MRM IM Report confirmed that environmental check monitoring and evaluation programs undertaken by the department to assess the environmental performance of the mine site were supported by procedural documentation requested by the IM. This assessment process also included staff interviews as indicated within the body of the report and on site assessment from the previous operational period of the environmental field sampling program. Aspects assessed included:

- the department's statutory requirement to undertake the monitoring and evaluation of the environmental performance of the mine, including all environmental assessments and audits;



- forms and procedures that demonstrate the systems, projects and activities undertaken with respect to monitoring the environmental performance of the mine by the regulator;
- how the department interprets the quality and significance of the environmental performance data collected;
- the department's evaluation report and environmental data set for the operational period; and
- the department's current surface and groundwater sampling and analysis methodology including, but not limited to:
  - sampling method;
  - sampling location and analyte rationale;
  - order of sampling; and
  - field quality assurance and control measures.

It was noted that the environmental field check monitoring program, in-house data comparison and assessment and the formal assessment of authorisation documentation under the *Mining Management Act* is undertaken at regular intervals. However, a formal compliance audit of performance against the MMP was last undertaken in November 2006. As such the department will continue to undertake its current programs and review its resource allocation with respect to compliance auditing.

#### **4 REVIEW OF MCARTHUR RIVER MINE PROCESS AND REGULATION**

In general it was stated by the IM that MRM has demonstrated a high level of conformance with respect to procedures and systems, as assessed through the provision of evidence of the works undertaken and commitments to undertake further work or continual improvement.

The procedural audit scope of the MRM operation focussed on the key procedures and systems and selected commitments and conditions associated with the following aspects considered significant by the IM:

- hydraulic performance of river diversions;
- success of revegetation and installation of fish habitat within the river diversions;
- surface water and artificial water monitoring;
- the environmental performance of the Tailings Storage Facility (TSF);
- tailings pipeline integrity and design;
- the design and monitoring of the Overburden Emplacement Facility (OEF);
- the environmental performance of the Bing Bong dredge spoil ponds; and
- Bing Bong Port facility fugitive dust emissions.

It is stated that additional areas of the MRM operations will be focussed on during subsequent audits.

## **5 ISSUES IDENTIFIED FOR FURTHER INVESTIGATION AND REPORTING**

On 6 July 2009, the IM wrote to MRM notifying the company of two separate issues it believed required further investigation. This notification was made under clause 6.4 of the *Independent Monitoring Assessment Conditions* (IMACs). Specific issues identified in the correspondence were as follows:

- TSF Cell One – Seepage into Surprise Creek; and
- Salt discharge through dam walls at the Bing Bong Dredge Spoil Ponds.

On 7 August 2009, the department wrote to MRM requesting information on what action was being planned and/or undertaken to address the identified issues. On 20 August 2009, MRM wrote back to the department on the matters raised by the IM. In its letter of response, MRM committed to undertake (or had commenced) a range of actions in relation to the identified issues.

### **5.1 Issue 1- Cell One at the TSF and seepage into Surprise Creek**

Since the IM's site visit the following activities have taken place in regards to management of seepage at the TSF:

- an appropriate consultant was engaged and a report prepared;
- two additional recovery bores have become operational with the flow meter readings being measured and recorded on a weekly basis;
- a sump and additional pump has been installed in the location of the identified surface seepage and a flow metre has been installed with readings being recorded;
- surface water sampling is being undertaken at artificial sites in Surprise Creek, after originally stopping due to cease-to-flow conditions;
- dust suppression activities have been investigated on Cell One eliminating the need to use water from recovery bores; and
- the consultant has been contacted in regards to undertaking an electromagnetic survey of the TSF. The intention is to correlate these results with the groundwater monitoring program and compare previous and future surveys to highlight areas of seepage and to indicate the effectiveness of the seepage recovery system.

Measured volumes of seepage recovery are being recorded from flow metres being inspected every Thursday and results of this will be highlighted within the 2009 Water Management Plan (WMP). Since the IM's inspection, an additional two bores have been made operational along with a sump in the location of surface expression identified by the IM.

Surface water within Surprise Creek is monitored on a weekly basis when flowing at various locations and data can be seen in the last Environmental Monitoring Report. More recent data will be provided in the 2009 WMP to be submitted. Sampling also recommenced after cease to flow due to a recommendation made by the IM. The cessation of monitoring after cease to flow was a recommendation by the DRDPFR, which was acted upon by MRM.

## **5.2 Issue 2 – Salt discharge through dam walls at the Bing Bong Dredge Spoil Ponds**

Since the issuing of the IM letter the MRM has undertaken the following activities:

- A sampling program which involved taking soil samples in the vicinity of the dredge spoil in order to determine salinity levels and to understand the current movement of salt leaching from the dredge spoil in comparison to the surrounding area. Results from this monitoring are yet to be summarised and compared against a control location.
- Water sampling is also to be undertaken in the vicinity of the spoil and compared with several control sites around the Bing Bong dredge spoil area.
- With regard to a survey of height datum and reconstruction of the dredge spoil walls, a series of inspections have already taken place and work including spillway reconstruction and appropriate drainage lines will be completed by October 2009 before any further dredging takes place.
- With regard to analysis for oxidisable sulfur and pH, this was conducted on proposed dredged material and a summary of results is provided in an Environmental Management Plan for dredging submitted to the department.
- Aerial photographs have been taken over the MRM site and Bing Bong spoil region on various occasions since the commencement of the Mine in 1995. As a result of this, maps indicating possible impact lines will be generated.

## **5.3 Summary**

The commitments provided by MRM in its response to issues identified in the IM's notification letter are to be incorporated into the company's submitted MMP for the 2009/2010 operating year, and will be reviewed by the department.

## **6 TECHNICAL REVIEW: MRM ENVIRONMENTAL MONITORING**

Seven key areas were focussed on during the technical audit including:

1. Surface water and artificial water monitoring.
2. Groundwater monitoring.
3. Dust, soil and sediment monitoring.
4. Marine monitoring.
5. Flora and fauna monitoring.
6. River diversion hydraulics monitoring.
7. Civil works monitoring.

### **6.1 Water quality monitoring (ground and surface)**

Surface and groundwater monitoring programs and interpretation of the results by MRM have improved markedly over previous years and the department agrees with the IM in acknowledging and commending the operator for these improvements.

Extensive review and discussions have occurred between the department and the operator, in particular the requirement for substantial improvements to the AER, which has been conditionally approved in subsequent years based on stringent requirements to address information gaps and to demonstrate continuous improvement.

This process has resulted in substantial improvement in monitoring and evaluation of site environmental conditions by the operator and the approval of the last AER, which was required by the department to address the previous three years of conditional approval with the presentation of a thorough evaluation of the last three years of data.

It is anticipated that the new requirement for a detailed WMP in 2009 as a separate component of the MMP required for approval for authorisation under the *Mining Management Act* will drive further improvement.

### **6.1.1 Surface water and artificial water monitoring appraisal**

A number of issues are raised in section 8.2, which the department would like to contribute to. These include:

- Preference by the department for the operator to filter and preserve samples in the field.
- Sampling of water ways after cease to flow.
- Quality assurance and quality control processes.

#### **Filtration of samples in the field**

The IM concurs with the operator in relation to the request to cease field filtering of surface water samples if samples can be delivered to the laboratory within 24-48 hours of collection, however notes the department's preference for in-field filtering. The department confirms the requirement for in-field filtering and appropriate preservation on the basis that:

- it is often difficult to transport samples from a remote location to an analytical laboratory and have them processed within a 24-48 hour period; and
- significant changes to a sample may occur over a small period of time should the sample not be filtered and adequately preserved in the field, including precipitation of the sample and adsorption to the sampling container which could make the analysis of the depleted sample non-representative of actual site conditions.

#### **Sampling of water ways after cease-to-flow**

The department does not recommend the inclusion of cease-to-flow monitoring data in the general assessment of mine site operational performance as evaporative concentration after cease-to-flow will increase elemental concentrations and subsequent modelling and prediction of mine site performance will be skewed.

It is agreed however that clearly identified cease-to-flow samples, not included within the main data set, would be useful in determining the potential localised effects on biota within the isolated sections of the river or creek channel.

Additionally the sampling of selected waterways, at a reduced frequency after cease-to-flow, may be appropriate in instances where there is potential for hydraulic connectivity to mine structures (to identify seepage potential contributions e.g. Surprise Creek and the TSF).

### **Quality assurance and quality control processes**

The department supports the IM's recommendation that interpretation and discussion of quality assurance and quality control (QA/QC) procedures be provided.

The framework for the development of the WMP to be developed by the operator details specifically the requirement for an overview of quality control procedures for the following activities:

- sample collection and dispatch;
- calibration of field instruments;
- sample analysis;
- standards preparation; and
- data storage and verification.

These aspects are to be addressed as a requirement for Authorisation to operate under the *Mining Management Act* and are publicly available on the department's website under the heading of Water Management Plan Advisory Note.

### **6.1.2 Groundwater monitoring appraisal**

A number of issues are raised in section 8.3, which the department would like to contribute to, these include:

- Frequency of groundwater monitoring.
- Groundwater recommendations

#### **Frequency of groundwater monitoring**

In section 8.3 the IM notes a request made by MRM to the department for reductions in the frequency of monitoring groundwater from bi-monthly to quarterly, and then from quarterly to biannually. The IM records their objection to this and recommends that at a minimum, monthly monitoring should be undertaken, particularly around the TSF until a detailed hydrological evaluation is made and a conceptual model is completed by a qualified hydrologist.

It is the department's position that a minimum of quarterly monitoring would be supported if recommended by a qualified ground water hydrogeologist after extensive review of the previous groundwater data.

The Northern Territory has two distinct seasons and in the instance where bore water quality data has demonstrated stabilisation, the value of quarterly sampling is debatable. However, newly constructed bores should be sampled at an increased frequency until groundwater chemistry stabilises and adequate and representative seasonal data have been collected.

In the 2007 submission of the AER, the department identified the lack of interpretation of groundwater monitoring data as a significant omission with MRM subsequently informed that understanding groundwater hydrogeology and chemistry was considered by the department as being essential to identifying key mitigation strategies (such as the use of geo-polymer and interception bores at the TSF), and then monitoring the effectiveness of these strategies in reducing groundwater seepage pathways.

Additionally, an understanding of the background water chemistry will also enable the setting of target criteria against which the performance of these mitigation strategies can be assessed. It is essential that a hydrogeologist with substantial mine related groundwater chemistry experience is contracted to evaluate the current groundwater status and advise future monitoring programs, chemical analysis, monitoring locations and contribution of groundwater to base flow conditions in the surface water catchments surrounding the mine.

MRM engaged a consultant to prepare an updated groundwater survey for the TSF area and the department will seek commitments from the operator in the current WMP and MMP to undertake further hydrogeological investigations.

### **Groundwater recommendations**

The groundwater recommendations, excepting the monitoring frequency discussion provided above, are consistent with the department's articulated requirements to the operator in relation to previous submissions statutory documents and as such are supported and will be required to be addressed in subsequent statutory documentation as commitments for approval under the *Mining Management Act*.

## **6.2 Dust, soil and sediment monitoring**

### **Dust monitoring**

The department supports the IM's recommendation for the Bing Bong Port Facility and the ongoing development and improvement of dust management strategies at Bing Bong and notes the IM's acknowledgement that MRM have substantially improved their reporting of dust monitoring activities undertaken at the mine, TSF and Bing Bong in the 2007-2008 period when compared to the previous operational period.

### **Soil monitoring**

The department notes the IM's assessment that monitoring and interpretation of soil monitoring has undergone substantial improvement and agrees with the recommendations provided in relation to quality control and quality assurance procedures.

It must be noted that the inclusion of monitoring commitments, including sampling locations, frequency and analysis are expected to be included in the upcoming 2009 to 2010 period MMP as opposed to the 2008-2009 AER which has now been subsumed by the MMP (note - with the specific exception of water management planning which will be submitted as a stand alone document three months prior to ensure sufficient time for detailed assessment).

Additionally recommendations for soil remediation and hardstand repair and replacement at the Bing Bong Port Facility are supported.

### **Fluvial sediment monitoring**

The department supports the IM's recommendations in relation to fluvial sediment monitoring and adds that reference should be made to the Interim Sediment Quality Guidelines (ISQG) which correspond to threshold levels below where adverse biological effects are not expected.

The department also supports commitments be included in the upcoming 2009 to 2010 period MMP as opposed to the 2008-2009 AER which has now been subsumed by the MMP.

### **6.3 Review of marine monitoring**

The recommendations provided by the IM with respect to sea water quality monitoring, marine sediment monitoring in the swing basin and shipping channel are consistent with the expectations of the department and will be expected in the next submission of MRM's MMP.

### **6.4 Flora and fauna monitoring**

The department notes the IM's statement that it is satisfied that MRM has complied with, and implemented its environmental commitments detailed in the MMP with the 2005-2008 amended AER finalised in January 2009 as being a significant improvement on the previous report. It also notes however, that description of rehabilitation works has not shown equal improvement.

It has also been noted by the IM that some community members have raised concerns regarding potential impacts on populations of local agile wallabies in the vicinity of the Bing Bong dredge spoil area. Although not identified by the IM as an issue requiring urgent attention, the department will contact the mine operator to seek more information to determine whether further assessment is required.

### **Barney Creek rehabilitation**

With respect to the Barney Creek rehabilitation, formal comment provided to the operator regarding the 2005-2008 AER stated the department did not consider the rehabilitation complete and ongoing monitoring is expected to inform the success, or otherwise, of the revegetation activities. Additionally, further work is required to reach the densities and community composition committed to in the Public Environment Report (PER) and subsequent MMPs. It is expected that ongoing annual monitoring and maintenance will be required.

## **Rechannelling rehabilitation and stabilisation**

A reference to snag emplacement within the river diversion is made in Section 8.6.2. Formal comment provided to the operator regarding the 2005-2008 AER stated it was considered beneficial to include a sub-section on large woody debris emplacement and stabilisation success as well as ongoing (annual) channel morphology assessment. It is considered particularly important to measure the transition from engineered channel to 'natural' channel through habitat development and the re-establishment of natural river processes. Further discussion regarding the implementation of these practices is expected within the next MMP.

## **Bing Bong dredge spoil rehabilitation**

The department agrees with the IM that rehabilitation and revegetation of the Bing Bong dredge spoil area is not performing to expected standards. Formal comment provided to the operator regarding the 2005-2008 AER stated that it was considered unfortunate that the research into the dredge spoil revegetation was postponed until further notice due to proposed dredging activities.

Although it is not mandatory to undertake these studies, it was communicated that the department considered having prior knowledge of successful planting strategies and vegetation requirements should enable progressive rehabilitation. Further, that the potential establishment of trial plots will ensure that when full scale rehabilitation is undertaken it will not require an exhaustive phase of trial and error.

## **Bird monitoring**

The department agrees with the assessment of Charles Darwin University and the IM that there is little to be gained from the Migratory Bird Surveys. However should these surveys be discontinued an appropriate justification for the discontinuation or a redefinition of the current survey (away from the contaminated sediment effect) would be expected in the MMP with related Environmental Impact Statements and/or Public Environmental Report commitments rationalised or redirected to ensure that sensible, meaningful information is collected.

## **Additional biological monitoring not included within the audit assessment**

In addition to the fauna monitoring discussed within this section, the macroinvertebrate monitoring undertaken by the mine site is also considered an important tool in assessing and tracking ecosystem health. The monitoring should follow AusRivAS protocols mentioned within the 2005-2008 AER, but where possible should include a focus on AusRivAS habitats. In understanding that the rechannelled sections may not contain suitable edge habitat for some time, the use of microphyte and riffle habitats is an acceptable alternative, but the analysis should be customised to suit. The habitats would also have to be representative of both natural and modified stream/river sections to ensure inter-comparability.



## **Fish monitoring**

Although fish population monitoring has been undertaken biannually, further discussion regarding water quality, sediment analysis and macroinvertebrate assessment is recommended prior to seeking a commitment regarding heavy metal analysis of fish tissue. A commitment to further assessment will be expected within the upcoming MMP.

### **6.5 River diversion hydraulics monitoring**

The department notes the IM's discussion points relating to its review of the river diversion hydraulics monitoring with respect to:

- An overview of the 2008 operational period and reference to the comparison of the as-built works with the detailed design information and the observation that there appears to be no allowance in the original proposal of works for a re-run of the design hydraulic (HEC-RAS) models using the as-built details. The department supports the IM's recommendation that this modelling be included in the detailed reporting of the as-built works.
- Civil works descriptions of progress provided in the 2007-2008 MMP noting commitments made under Section 7.6.1 and Item 49 of the McArthur River Mine Commitment Summary table (included in the plan as Appendix B) regarding the monitoring of erosion and sediment control measures.
- Civil works descriptions for works completed in the 2006/2007 operational period listed in the 2005 – 2008 AER. The department notes and supports further assessment regarding the IM's recommendation of an annual review of the relative sizes of wet season flood events and associated review/comments about new erosion trends as a useful long term gauge of the performance of the diversion channels, particularly regarding channel bed and bank erosion issues. Additionally, the department supports further discussion regarding the inclusion of a review of the previous wet season's water levels within the McArthur River and Barney Creek channels to be included within the MMP.
- McArthur River flow records noting anomalies in river data recorded from upstream and downstream sites.
- Review of surface water extraction information in which the IM was supplied with insufficient information by the operator to enable it to determine with certainty that extraction did not exceed 20% of the flow encountered. To allow the IM to evaluate the extraction volumes against flow, MRM is required to provide sufficient information to the IM regarding the methodology of assessment with respect to the flow meter and the gauge board system. To provide additional verification, the operator is also required to provide relevant information with respect to pump operating times and associated pumping flow rates.
- Health, safety, environment and community checklists and the associated change in scoring system is to provide a more informative assessment of issues (such as weeds and erosion) than a simple binary system.

- Barney Creek and McArthur River diversion photos compiled to provide a valuable tool for reviewing short and long term changes along the water courses with photos taken before and after each wet season. The stated intention of the photographs within MRM's 2009 Environmental Monitoring Manual is to document erosion along the river channels and to identify any areas requiring additional works to repair existing damage and mitigate future erosion. Additionally, it is stated that a report will be produced by the operator detailing the level of works required including additional revegetation, earthworks and/or rock armouring.
- Wet season flood spill addresses the issue noted in the overview of the 2008 operational period with regard to a re-run of the design hydraulic (HEC-RAS) models using the as-built details.
- Barney Creek diversion work monitoring provides a discussion on the design flood rating of the diversion channel and recognises and lists the commitments provided in the 2006 PER, which will form part of the commitments assessed against in regulatory compliance auditing of the operation.

## **6.6 Civil works monitoring**

The department notes the IM's discussion points relating to its review of the civil works monitoring with respect to:

- A potential environmental exposure of the TSF pipeline over Barney Creek through inadequate bunding has been noted by the IM. This issue will be mitigated by the construction of a containment bund planned by the operator. However, the installation of flow meter equipment or other appropriate systems to monitor pressure within the pipe is sound and will be addressed as a component of the impending MMP.
- Monitoring of TSF with respect to geotechnical stability is discussed, as is anticipation of a rehabilitation proposal for the facility prior to its decommissioning. Importantly, the IM notes that the clay capping applied to approximately two thirds of the top surface of Cell One is for the purposes of dust suppression and as the department stipulates is not considered sufficiently engineered to represent the impermeable barrier component of a store and release capping layer.
- The department supports the IM's recommendation that a comprehensive assessment of the TSF be undertaken in accordance with relevant Australian National Committee on Large Dams (ANCOLD) guidelines.
- The department supports further discussion regarding recommendations made by Allan Watson Associates with respect to the installation of groundwater monitoring boreholes in the embankments (where not present) and the installation of survey pins at key locations around the dam perimeter. It is reasonable that these aspects be considered in the light of the ANCOLD assessment of the facility.
- The department supports increased operation monitoring in line with relevant ANCOLD monitoring guidelines.

- The recommendations provided by the IM regarding the geochemical assessment of the TSF are noted and will be assessed in the context of the assessment currently underway with respect to site hydrogeological modelling and the assessment of potential affects of seepage from the TSF Cell One in to Surprise Creek discussed in section 7.1.1 and being addressed under Section 6.4 of the *Independent Monitor Assessment Conditions*.
- The sump area at the toe of the Run of Mine (ROM) Pad was described at the time of inspection by the IM. The submission of a detailed water balance by the operator in the WMP is currently being assessed to ensure that mine structure (for example, sumps and ponds) and infrastructure (such as pumps and pipes) have sufficient capacity to adequately manage water on site.
- The geotechnical and erosional stability of the river diversion embankments are discussed by the IM including the adequacy and quality control with respect to rock armouring of the channel walls. The IM expects the condition of the banks to deteriorate on exposure to further wet seasons until they reach a general state of equilibrium with flood flow. It is observed by the IM that remediation of the banks is likely to be relatively expensive and is considered unwarranted unless there are areas of land behind the sections of bank that must be maintained. The department supports the recommendation that ongoing targeted monitoring of the integrity of the structures be continued while noting that there does not appear to be any obvious environmental hazards associated with geotechnical aspects that can be identified for the short to medium term.
- With respect to the erosional stability of the river diversions the department also supports the IM's recommendations for the operator to provide as-constructed drawings and reports. Further it supports the maintenance of key channel crests through adequate rock armouring and the continued visual monitoring of the diversion channels.
- On review of the construction of the OEF, it is summarised that there is not sufficient documentation on construction quality control/quality assurance to support or contest the adequacy of the clay liner. Consistent with the Precautionary Principle, the department supports the recommendation that the existing cells identified as potentially acid forming be assessed and an investigation and sampling program in conjunction with or alternate to the installation and monitoring of a network of bores be undertaken to verify that the clay liner meets design requirements.
- The department also supports the recommendation that the construction of any future cells must be consistent with the design requirements through a combination of a demonstrably high level of supervision, appropriate documentation and testing and/or intentional over-design.

- Additional discussion is provided regarding the geochemical classification of waste into potential acid forming (PAF) materials, non-acid forming (NAF) materials and others. This ensures appropriate placement and encapsulation of PAF materials to minimise exposure to water and oxygen which result in the formation of acid from the pyritic rock and would in turn leach metals from the rock interfaces to the surrounding water in potentially unacceptably high concentrations. The department supports further discussion regarding recommendations provided by the IM with the aim of ensuring appropriate management and long term containment of PAF materials.
- The stability and containment of the Bing Bong dredge spoil is discussed by the IM with the current condition and functioning of the banks drainage structures noted as poor. The integrity of the structure and the observed discharge of salts from the marine sediments resulting from the dredging of the Bing Bong Port facility are currently the subject of further assessment under Section 6.4 of the Independent Monitoring Assessment Conditions (IMACs), with the assessment to be provided on completion. To date a sampling program has been undertaken by the operator in the vicinity of the dredge spoil in order to determine salinity levels and understand the current movement of salt leaching from the dredge spoil in comparison to the surrounding area. The operator reports that reconstruction of the dredge spoil walls and a series of inspections have already taken place and work including spillway construction and appropriate drainage lines are proposed to be completed by October 2009.
- With regard to the Bing Bong dredge spoil area, the department supports the IM's recommendations regarding the review of the proposed future use of the facility and that an investigation and design program should be subsequently developed so that the existing structure can be remediated to an acceptable standard. Also following the remediation, a management plan is to be developed for continued operation including inspections, monitoring and usage strategies.
- Hydrocarbon management – the recommendation for a hydrocarbon audit and fuel line integrity testing to be undertaken by the operator is also supported.