

***Independent Monitor's
Environmental Performance
Report of the McArthur River Mine
for the 2012 and 2013 Operational
Periods***

**DEPARTMENTAL RESPONSE TO
THE ENVIRONMENTAL
PERFORMANCE REPORT**

September 2014

Executive Summary

The Independent Monitor's 2014 Environmental Performance Report for the McArthur River Mine during the 2012 and 2013 Operational Periods was submitted to the NT Government on 8 August 2014. A review of the Audit Report's findings was undertaken by the Department of Mines and Energy ("DME" or "the Regulator").

The DME review focused on the compliance and technical issues raised by the appointed Independent Monitor (IM) relating to the environmental condition, management and monitoring of the McArthur River Mine ("MRM") by McArthur River Mining Pty Ltd ("the Operator"), as well as the regulatory overview of the mine by the DME.

In relation to assessing the regulatory performance of the DME, the IM concluded in its 2014 Performance Report that the DME had provided extensive comments during its assessment of Mining Management Plans (MMP) and that the information requested by DME appeared reasonable and appropriate.

The IM did highlight a lack of timeliness for the DME's annual compliance audits and suggested improvements for future compliance audits including:

- Audit reports should be finalised within six weeks.
- All commitments made in the currently approved MMP are audited.
- DME should review the compliance audit protocol to include as part of its assessment of MMP compliance whether the Operator is also complying with regulatory guidelines.
- DME should define and document what constitutes "best practice" for specific areas of the operation and include this as part of the audit protocol.

The IM also noted that the DME did not have a system for tracking action on previous IM recommendations and recommended:

- DME request from MRM an action plan detailing how MRM will address the high priority recommendations including a timeline to complete these actions.
- DME request on a quarterly basis an update from MRM on the progress towards implementing the high priority recommendations.
- DME prepare an action plan detailing how the DME will address high priority recommendations including a timeline to complete these actions and report quarterly on progress.

Finally the IM noted that field reports were not provided for check monitoring undertaken by the DME's Environmental Monitoring Unit (EMU).

The DME accepts the recommendations and has already begun to address the majority of them with measures including: staffing changes and additional resources for the Compliance Audits, inclusion of a commitments tracking system in Mining Officers workflow and formalisation of EMU reporting to ensure consistent reporting of future check monitoring.

In the review of the Operator, the IM detailed 112 recommendations, a substantial increase over the 69 made in the 2012 IM report. There was also a shift towards a greater number of risks identified as "high" and an increase in the total number of gaps identified, from 40 in the 2012 IM report to 88 in the 2014 Environmental Performance Report.

This suggests that lower risks managed in the past have increased in likelihood and/or consequence and as a result, their risk rating has increased, making a greater proportion

higher for the 2014 assessment. It may also be possible that a driver behind the increase in “high” risk ratings and the number of gaps identified is due to the changes to the MRM waste classification system that has subsequently revealed an increase in the proportion of AMD (acid and/or metalliferous and saline drainage) producing material, up to 89% of the total waste rock mined. As a consequence there is insufficient non-AMD producing material available to construct the waste rock dump as per designs to effectively encapsulate the AMD producing material. It must be noted that at this time MRM does not have a cover design that DME would consider adequate to manage infiltration and erosion over an acceptable time period (hundreds of years). This has increased the risk around multiple aspects of the waste rock dump (Northern Overburden Emplacement Facility (NOEF)) that may result in a geotechnically unstable landform with impacts on groundwater, terrestrial and aquatic ecosystems over an extended time period into the hundreds of years.

The IM highlighted in its 2014 Environmental Performance Report the following issues of particular importance:

- Volume of water stored in TSF Cell 2.
- The detection of contaminants in the tissue of fish caught within the mineral lease.
- Construction methodologies and QC/QC procedures at both the TSF and NOEF.
- Seepage management of the TSF and PAF run-off dams and their impacts on ground and surface waters.
- Geochemistry of the tailings and waste rock and development of closure strategies.
- Rehabilitation progress of the McArthur River and Barney Creek diversion channels.

The DME welcomes the recommendations made in the IM's 2014 Environmental Performance Report. The Department is also supportive of the recommendations for further improvement put forward for both the Operator and the Regulator. Information and recommendations included in the 2014 Environmental Performance Report will be used by the DME in its review of the Operator's MMP covering the 2013-15 operational period and in DME's upcoming audit of the mine which is scheduled to take place in the latter half of 2014.

Having reviewed the findings of the 2014 Environmental Performance Report, the DME will act on the issues highlighted and has already commenced action in many cases. The Operator is also working to address the issues, particularly those associated with the new waste classification system and the difficulties in having substantially more AMD producing material than previously estimated.

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1 Background

In October 2006 the Northern Territory Government (NTG) approved the open-cut expansion proposal for the McArthur River Mine (MRM). A condition of the approval was the appointment of an Independent Monitor (IM) to oversee the environmental performance of the mine. The requirements of the IM are outlined in the Independent Monitoring Assessment Conditions (IMAC), which forms schedule 2 of Mining Authorisation 0059-02.

In accordance with the IMAC, the role of the IM is to assess the environmental performance of the mine by reviewing environmental assessments and monitoring activities undertaken by the mine operator, McArthur River Mining Pty Ltd (the Operator) and environmental assessments and audit activities undertaken by the Department of Mines and Energy (“DME” or “the Regulator”). The IM is not responsible for mine safety or social matters regarding the operation.

The expiration of the first five-year contract for the services of an IM in 2013 prompted a new tender procurement process. The tender selection was finalised in December 2013 and a new IM appointed, the ERIAS Group from Adelaide. Due to unforeseen delays in the procurement and tender assessment process, the annual Environmental Performance Report covering the 2012 operating period of the mine, which was to be released in December 2013, was not prepared. At the project inception meeting in February 2014, it was agreed by the Operator, the Regulator and the IM that one report would be prepared during 2014 incorporating the 2012 and 2013 operating periods of the mine. This would provide an up-to-date assessment of the environmental performance of the mine, and importantly, would ensure the IM was informed as to whether actions have or are planned to be taken to address any issues or matters of concern which might be raised by the IM during the review of the earlier period.

The IM has provided the 2014 Environmental Assessment Report covering the 2012 and 2013 operating periods of the mine (i.e. October 2011 to October 2013). To ensure the report is as up-to-date as possible, it also includes assessment of current activities of the mine, including comments from the IM's site visit in March 2014.

1.1 Objectives

The stated objectives of the IM's 2014 Environmental Performance Report included:

- Document the review of environmental performance.
- Report on progress from the previous IM assessment.
- Identify any urgent issues that require investigation and reporting.
- Identify areas of the Operator's and DME's environmental performance that require improvement and recommend actions to address these deficiencies.
- Acknowledge areas of MRM and DME environmental performance that are done well.

1.2 Assessment Scope

The IM's 2014 Environmental Performance Report outlined the scope of the assessment and began with Clause 4.1(a) of the independent monitoring assessment conditions.

The IM is required to monitor the environmental performance of the mine (including the Bing Bong Port) by reviewing:

- I. Environmental assessments and monitoring activities undertaken by the Operator.
- II. Environmental assessments and audits undertaken by the DME.

Issues relating to mine safety, social issues, personnel matters, administration matters or governance arrangements resulting from the operation of the mine in the McArthur River region, were not included in the assessment.

The assessment of environmental performance addressed a two-year operating period from October 2011 to October 2013 and included:

- An inception meeting with the Operator and the Regulator, in Darwin.
- A review of environmental assessments, monitoring activities and audits undertaken by both the Operator and the Regulator.
- Reviewing relevant research required to inform monitoring activities.
- Updating the previous IM's formal risk assessment and gap analysis (for the 2011 operational period).
- A site visit to both the mine site at McArthur River and the Bing Bong loading facility.
- Preparation of a draft and final report for the Minister for Mines and Energy on the environmental performance of the MRM operation (by both the Operator and Regulator).
- Preparation and distribution of a report to the Borroloola community and other key stakeholders on the environmental performance of the MRM operation. This includes a community presentation.
- Development and maintenance of a website for the display of the report, the response reports from the Operator and the Regulator, community report and any other relevant information.

1.3 Response to the Assessment Report

The IM's Environmental Performance Report of the McArthur River Mine for the 2012 and 2013 operational periods was submitted to the NT Government on 8 August 2014. A review of the Environmental Assessment Report's findings was undertaken by the DME.

The DME review focused on the compliance and technical issues raised by the appointed Independent Monitor (IM) relating to the environmental condition, management and monitoring of the McArthur River Mine ("MRM") by McArthur River Mining Pty Ltd ("the Operator"), as well as the regulatory overview of the mine by DME

2 Risk Assessment

A risk assessment was undertaken by the IM in accordance with ISO 31000:2009 – Risk Management Principals and Guidelines (Standards Australia, 2009) to assess the environmental risks associated with the MRM operation. A risk assessment is performed by the IM each year.

The stated objectives in the 2014 Environmental Assessment Report included:

- Identify environmental risks.
- Evaluate whether environmental monitoring and assessment practices undertaken by the Operator were adequate and appropriate to mitigate the risk of potential environmental impacts.

The risk assessment identified a total of 68 risks, of which:

- 1 was **extreme**. Immediate intervention required to eliminate or reduce risk at a senior management/government level.
- 31 were **high**. It is essential to eliminate or reduce risk to a lower level by the introduction of monitoring and assessment measures implemented by senior management.
- 29 were **moderate**. Corrective action required, and monitoring and assessment responsibilities must be delegated.
- 7 were **low**. Corrective action should be implemented where practicable, and risk should be managed by routine monitoring and assessment procedures.

The updated risk register is provided in Appendix 2 of the IM's 2014 Environmental Assessment Report.

This is a small reduction in the total number of risks compared to the 2012 IM report when a total of 70 risks were identified. A comparison between the results of the 2012 and the 2014 risk assessments (Table 1) indicates that there appears to have been a shift in the severity of risks associated with the site, with an increase in high risks.

Table 1 Comparison of Risk Ratings between 2012 and 2014 IM Assessment Reports

Risk Rating	2012 IM assessment	2014 IM assessment
Extreme	2	1
High	13	31
Medium	36	29
Low	19	7
Total	70	68

This suggests that lower risks managed in the past have increased in likelihood and/or consequence and as a result, their risk rating has increased, making a greater proportion higher for the 2014 assessment. This is particularly the case for the management of the tailings dam, revegetation of diversion channels and aspects of the waste rock dump.

It is likely that a driver behind the increase in “high” risk ratings is due to the changes to the MRM waste classification system that has subsequently revealed an increase in the proportion of AMD (acid and/or metalliferous and saline drainage) producing material, up to 89% of the total waste rock mined. As a consequence there is insufficient non-AMD producing material to construct the waste rock dump (including final cover and landform design) to effectively encapsulate the AMD producing material. Further, the Operator has to date not developed designs which demonstrate to the DME that factors including infiltration and erosion over the medium to long-term (tens to hundreds of years) will be effectively managed. These issues will require resolution so as to reduce the risk posed by a waste rock dump (Northern Overburden Emplacement Facility (NOEF)) including geotechnical instability leading to impacts on groundwater, terrestrial and aquatic ecosystems extending throughout the region.

Overall, the DME agrees with the output from the risk assessment and has undertaken actions in response to many of these risks, as detailed in later sections of this response report.

3 Gap Analysis

Gap analysis was undertaken as per previous assessments undertaken by the IM.

A total of 88 gaps were identified:

- **20 Category 1 gaps.** Monitoring to mitigate potential associated environmental risk is not undertaken
- **46 Category 2 gaps.** Monitoring is undertaken, but is not sufficient in design—that is, frequency, location, type and so on, are insufficient to identify or quantify potential environmental risks
- **22 category 3 gaps.** Monitoring is undertaken and is appropriate in design; however data/output information is not adequately assessed, interpreted or managed to appropriately mitigate potential environmental risks.

The 2012 IM assessment report identified a total of 40 gaps and it is likely that the increase in the total number of identified gaps is due to the increased risks presented by the changes in the waste classification.

The DME agrees with the gaps identified and has undertaken actions in response to these, as detailed in later sections of this response report.

4 Review of the Regulator, Department of Mines and Energy

The IM reviewed DME performance over the 2012 and 2013 operational periods which included:

- Assessment and approval of two MMPs and a number of MMP amendments.
- Provision of feedback to the EPA on the Phase 3 Environmental Impact Statement.
- Conducting two compliance audits.
- Undertaking two check monitoring visits at the McArthur River Mine Site and the Bing Bong Loading Facility.

Outcomes from the IM review and associated recommendations are detailed in the following sections.

4.1 Compliance Auditing

The IM assessed the 2012 and 2013 compliance audits undertaken by the DME. The comments of note by the IM include:

- In 2012 it took the DME seven months to deliver the final audit report and in 2014 the final audit report was not delivered three months after the audit (which took place in December 2013).
- The 2013 audit only measured compliance for 59 from a total of 194 commitments in the 2012-13 MMP without any explanation behind the rationale for selecting only those commitments.
- It was unclear to the IM how DME was assessing performance against “best practice” due to a lack of definition and documentation of “best practice” in the draft 2013 audit report.

The IM recommended:

- DME review its compliance audit protocol to include as part of its assessment of MMP compliance whether the Operator is also complying with regulatory guidelines i.e., ANZECC guidelines for water quality rather than simply completing an action i.e., groundwater monitoring being undertaken quarterly.
- DME should define and document what constitutes “best practice” for specific areas of the operation and include this as part of the DME audit protocol.
- DME establish a goal that audit reports are finalised within six weeks of the audit being conducted.

The DME has already begun to address issues associated with its compliance auditing with the following actions:

- A change in staff that will be undertaking the audit including provision for technical support staff to play a greater role during audits.
- A review of commitments detailed in the currently approved MMP (2012/13 MMP) with the intention to clarify, simplify and reduce the number of commitments which will in turn help to simplify the compliance audit and reduce ambiguity.
- Additional audit training for staff.
- Updates to the audit report template and audit procedures to reflect the feedback from the IM.
- A commitment to provide a six week turnaround from audit to completion of the final audit report. This will encompass better timing of the audit to ensure it does not occur immediately before the Christmas period where staff availability becomes an issue.

4.2 Assessments of Mining Management Plans

The IM reviewed the assessments of the 2011-12 and 2012-13 MMPs undertaken by the DME. The comments of note by the IM include:

- DME had provided extensive comments during its assessment of Mining Management Plans (MMP) and that the information requested by DME appeared reasonable and appropriate.
- The assessment process took nine months and five months for the 2011-12 and 2012-13 MMPs respectively.
- The IM supported a move to four year MMPs with Operation Performance (OPR) and Public Environmental Mining Reports submitted annually. The IM considered the move to a longer MMP period would enable a greater focus on the OPR and reduce repetition.
- The IM believed there is scope to reduce the number of commitments by focusing on improving environmental performance rather than a series of actions that may or may not lead to improved environmental performance.
- The IM noted that the DME has procedures for reviewing documents however, there is no step which requires DME to consider if the proponent should refer the proposal to the Commonwealth Department of the Environment under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act, 1999).

The IM recommended:

- DME to review in more detail MMP commitments being developed by MRM so that they are specific, measurable, attainable, relevant and time-based. Commitments need to address the key environmental issues / risks.
- DME revise the procedure for review of documents to include assessment of whether the project may trigger the EPBC Act. If the project in DME's opinion may trigger the EPBC Act, DME to advise MRM to refer the project.

During the assessment of every MMP or amendment submitted to the DME, Mining Officers are aware that timeframes for the assessment must be minimised and that requests for additional information or conditions of approval must be relevant, attainable and measurable. Documents as large and as complex as those presented by the Operator provide a considerable challenge to Mining Officers in order to assess in a timely manner and provide a concise set of comments and/or conditions. Often, information presented in these documents has been found to be out of date, contradictory or illegible. As a consequence comments and commitments can also include instructions to simply improve the documents readability and accuracy.

The DME has made efforts to categorise comments in terms of importance to ensure issues associated with environmental and operational performance are given the highest priority. Other issues such as contradictory statements and lack of clarity are given a lower priority while issues pertaining to the document itself such as the legibility of figures are given the lowest priority.

The DME will continue to refine its responses in future assessments however this does not replace the obligation of the Operator to provide accurate, succinct and well written documents that are based on comprehensive and appropriate designs and plans. The realisation in 2014 of substantial deficiencies in the waste characterisation, the uncertainties around the suitability and the placement of clays for the encapsulation of AMD generating material and the inadequate management of seepage from both the tailings dam and PAF run-off dams has not only triggered referral of the 2013-18 and 2013-15 MMPs to the EPA but has led to a protracted assessment process. The DME has had to assess a considerable volume of documentation which has not been consistent in its information or comprehensive enough to allow progress towards approval.

4.3 Environmental Monitoring Unit Check Monitoring

The IM noted that in the previous year the IM reviewed a field report for check monitoring at MRM prepared by the DME Environmental Monitoring Unit (EMU). The IM was not provided with field reports for 2012 or 2013 operational years.

Field reports were not completed for either of the years reviewed by the IM however this should not be interpreted that EMU has not undertaken its duties correctly or that the data collected during these check monitoring events has been ignored or is ineffective. A description of the check monitoring process may provide further clarification:

- EMU undertake ground and surface water sampling annually. The program is based on feedback from the DME Technical Support Unit which is provided to EMU prior to the completion of scheduling.
- There are too many sites to practically sample all locations every year hence the DME Technical Support Unit directs EMU to areas of concern in balance with consistently undertaking annual monitoring at some locations to allow for trend analysis.
- Often feedback from EMU is not simply based on field parameters from sampling locations but site observations as they move around the site. Observations such as dust management issues, additional seeps, dead vegetation, storage of chemicals, hydrocarbon stains and erosion have also been reported to Technical Support by EMU in the past.
- If matters are urgent then EMU immediately discusses options with Technical Support over the telephone. Issues less urgent are photographed and discussed upon return to Darwin.

An example is the seepage from cell 2 of the TSF.

EMU were directed to sample from groundwater monitoring bore GW7 during the 2014 check monitoring visit. Upon arrival EMU observed seepage from Cell 2 of the TSF. EMU discussed the matter with Technical Support by telephone and gathered further evidence and delivered it to Technical Support from the field by email. Technical Support then discussed the matter with the Director of Mining Compliance who requested additional information from the Operator. This has resulted in a formal investigation by the DME that is now under way.

EMU data is used regularly by Technical Support when analysis is undertaken on aspects of mine performance. Technical Support has a high level of confidence in data produced by

EMU; hence it is always part of analysis undertaken and complements the considerable volume of data produced by the Operator.

Formal field reports written by EMU have not consistently been undertaken. The DME has identified that formal field reports may assist in future auditing and are currently reviewing and updating a field report template for EMU. This new template aims to:

- Provide a delivery of the relevant information in a standardised format.
- Ensure EMU are able to provide factual, objective and robust observations without ambiguity.
- Provide a formal audit trail to refer to should further investigations follow from EMU observations.

All monitoring data produced by EMU is promptly entered into the DME database known as "DEEP" and is available for use immediately after entry. The data undergoes QA/QC prior to being finalised in the database to ensure accuracy.

Photographs taken by EMU are placed on the server in the appropriate folder upon return to Darwin in line with DME records management procedures.

Recently the DME has purchased both hardware and software that are intended to combine pencil and paper record keeping, GPS, mobile phone, camera, maps and aerial photography all into a single package. The electronic record keeping and logging in the field will enable EMU to upload field data, notes, photos and GPS tracks and waypoints without having to type them into excel back at the office. This will not only save time, it will enable EMU to communicate with Technical Support in the field better and remove transposition errors when typing hand written field sheet into excel.

4.4 Action and Tracking of IM Recommendations

The IM reviewed the progress of addressing recommendations made by the previous IM in the 2012 report. Comments of note include:

- A total of 69 recommendations were made by the IM in the 2012 report.
- Some of the high priority recommendations have not been completed in the 18 months since the assessment.
- The DME do not have a process in which to track the progress of the recommendations made by the IM and have left reviewing progress to the IM in the following annual site inspection and review.
- EMU check monitoring is not measuring TDS (therefore a ratio cannot be determined) and laboratory pH. In addition it is not clear to the IM if QA/QC analysis and interpretation is being undertaken.

The IM recommended:

- DME request from MRM an action plan detailing how MRM will address the high priority recommendations including a timeline to complete these actions.
- DME request on a quarterly basis an update from MRM on the progress towards implementing the high priority recommendations.
- DME should prepare an action plan detailing how DME will address high priority recommendations including a timeline to complete these actions and report quarterly on progress.

Commitment tracking at all mine sites has been a recent focus by the DME and as a consequence a tracking system has been incorporated into the workflow of Mining Officers. The IM is unique to MRM and will require additional modification to workflow procedures to

ensure recommendations by the IM are tracked. The DME commits to undertaking such an action.

The lack of formal tracking should not be interpreted that IM recommendations have been ignored or forgotten by the DME. Mining Officers have read previous IM assessment reports and where possible have incorporated recommendations into comments and conditions during MMP assessment. There have been occasions where immediate actions have been taken in response to IM recommendations such as:

- Investigation into the high concentrations of lead in fish at SW19 monitoring location within the mine site. The DME formed an intergovernmental Taskforce including Department of Health, Department of Primary Industry and Fisheries and NT Worksafe. The Taskforce has undertaken further field work to confirm the results of the Operator's sampling program and is undertaking a detailed assessment of all of the results received to date to establish the risks presented. This work is ongoing.
- A formal instruction was issued to the Operator to immediately reduce the volume of water and cease pumping all sources of water to cell 2 of the tailings dam (TSF) with the exception of tailings at normal slurry densities.

In terms of the comments with regard to EMU, formal field reports will highlight the high standard with which EMU operates. In the interim, the DME can provide assurance with regard to the following:

- Comprehensive QA/QC is undertaken by EMU which includes RPD analysis. All results are entered into the DME database which also undertakes analysis and highlights potential issues with sample results.
- EMU do not request laboratory pH as the holding time of six hours cannot be met due to the remoteness of the mine operation. EMU do undertake calibration of pH meters at the beginning and end of each day as well as recalibration with the appropriate standard during the day should a very high or low pH value be encountered.

5 Review of the Operator, McArthur River Mining

The IM has detailed a total of 112 recommendations in the 2014 assessment report. This is a substantial increase from the 69 recommendations in 2012. Recommendations were categorised as high, medium or low with high recommendations considered a priority and relate to the more significant risks and information deficiencies. The numbers of recommendations are summarised in Table 2.

Table 2 Recommendations made by the IM in the 2014 Assessment Report

Category	2012 Assessment Report	2014 Assessment Report
High	27	35
Medium	27	59
Low	15	18
Total	69	112

The increase in recommendations is likely to be a consequence of the increase risks posed by the change in the waste classification system and the understanding that there is not enough non-AMD producing material to effectively encapsulate the AMD producing material at the site. The DME makes comment in the following sections with regard to recommendations classified as high or those where the DME has already undertaken actions.

5.1 Mine Site Water Balance

The following recommendations were classified as high by the IM:

1. Changes in water chemistry - The water balance needs to assess the risks posed by possible deterioration in site runoff and seepage water quality.
2. Mine site water balance calibration - The uncertainty in model parameter estimation requires reduction. While this is implicit in all aspects of the water balance monitoring and modelling, high priority areas that need addressing are:
 - The groundwater inflow rate.
 - Seepage estimates.
 - Additional sensitivity analysis needs to be undertaken in the water balance modelling.

While the reduction in uncertainty is implicit in most of the recommendations, the key requirement here is that the reporting quantifies how the uncertainty is reduced in each successive year.

The DME instructed the Operator to undertake additional water balance modelling for the upcoming 2014-15 wet season to ensure there is adequate storage to retain all contaminated water on site. The Operator has provided the results of this modelling and the DME has subsequently asked for additional information regarding water balance calibration as well as other lower priority recommendations. The Operator is currently in the process of responding to this request for additional information and has also committed to providing a more comprehensive mine site water balance later in 2014.

The DME intends to ensure the Operator addresses all high and medium priority recommendations in the site water balance due in late 2014. Low priority recommendations will be addressed in site water balances during 2015 and beyond.

5.2 Surface Water Quality

The following recommendations were classified as high by the IM:

1. NOEF and TSF - The relevant monitoring programs (groundwater and surface water monitoring, and geochemical characterisation) should be reviewed to ensure that sufficient early warning is provided concerning potential impacts on surface water quality from NOEF and TSF leachates and runoff (or other potential failures of these project infrastructure components).
2. McArthur River SW11 - Particular attention should be paid to increasing sulfate concentrations (and EC values) at SW11 as the 2014 dry season progresses. If concentrations equal or exceed the trigger value (341 mg/L), a risk assessment should be undertaken concerning (i) possible implications (should this trend continue in future dry seasons), (ii) likely causes and, if found to be due to MRM operations, (iii) mitigation measures commensurate with the level of risk.

The DME is finalising feedback on the 2013-15 MMP and the detail to both of these recommendations has already been highlighted in this feedback.

The DME is also considering issuing an instruction to the Operator to undertake real time monitoring which should satisfy the medium priority recommendation to investigate the feasibility of real time in situ monitoring of rivers surrounding the mine site.

The DME will consider the remainder of the medium and low priority recommendations firstly to establish if current feedback for the 2013-15 MMP overlaps these recommendations and secondly to combine the remainder into effective instructions to the Operator.

5.3 Diversion Channel Hydraulics

The IM made only one recommendation classified as high for the Diversion Channel:

Geomorphology - A full geomorphic condition assessment and erosion mitigation study of both diversions is recommended as follows:

- The study should utilise on ground inspection in addition recent and future ALS survey.
- The study should be carried out for both the Barney Creek and McArthur River diversion channels with priority on the McArthur River diversion channel.
- The study should include the watercourses for at least 1 km up and downstream of the diversion channels.
- The study should aim to identify areas of erosion and deposition, the current geomorphic processes causing erosion, and to quantify the degree and rate of erosion along the entire reach.
- The study should draw upon the results of the “Phase 3 Development Project Surface Water Assessment” (WRM, 2012b) and the “review of the 'As-Designed' and 'As-Constructed' McArthur River and Barney Creek Diversions” (WRM, 2012a).
- Locations of channel constriction and/or high flow velocities should be prioritised, along with areas that have undergone erosion.
- The study should consider previous attempts at erosion control, including revegetation attempts.
- This study should then be used to assess the methods of erosion control that can be used and prioritise areas for corrective works.

The DME recognises that attempts to establish vegetation and large woody debris (vital aquatic habitat) in diversion channels may be fruitless without better understanding of the channel geomorphology and potentially some modification to manage flow velocities. The DME will instruct the Operator to undertake a study encompassing all the recommendations of the IM as well as to undertake monitoring and reporting on erosion.

5.4 Groundwater

The IM included a number of recommendations for groundwater with the following classified as high:

1. **Overburden Emplacement Facilities** - Assessment of seepage impacts from the NOEF to confirm the effectiveness of the PAF containment system.
This should include installation of monitoring bores around the current footprint and progressive installation of monitoring bores around the expansion area and completion of EM geophysical surveys.
The IM recognises that MRM has commenced installation monitoring bores in the area marked for NOEF expansion. However, there are no monitoring bores located along the northern, eastern and western perimeters of the facility, which could be used to assess the success of the PAF encapsulation system adopted by MRM. In addition a schedule should be prepared showing the progressive installation of future monitoring bores in the NOEF expansion area, which should correspond to the planned development of the facility.
2. **Overburden Emplacement Facilities** - The seepage from the SPROD needs to be addressed. MRM should commit to option(s) to prevent seepage at source. This work is likely to include a commitment to design and install a full liner at the dam.
The IM recognises that MRM has identified seepage from the SPROD as a major issue and during the review period has completed a cost benefit analysis on three remedial options.

3. **Tailings Storage Facility** - The seepage from the TSF Cell 1 needs to be addressed. MRM should commit to option(s) to prevent seepage at source, e.g. installation of a permanent cover designed to limit recharge to the deposited tailings or reprocessing of the tailings MRM has installed a temporary cover, which the available monitoring data suggest is (so far) ineffective in controlling recharge to the deposited tailings. The continued exceedances in salinity and sulfate concentrations in a number of monitoring bores contravene the groundwater trigger values for the mine site.
4. **Tailings Storage Facility** - The seepage along south eastern perimeter of the TSF Cell 3 (also known as the Water Management Dam WMD) needs to be addressed. MRM should commit to option(s) to prevent seepage under this section of the embankment which likely relates to the presence of higher permeability alluvium associated with the original Little Barney Creek channel. Preventative options include installation of an interception trench across the original channel and installation of recovery bores MRM has already installed a geopolymer barrier along the south eastern wall of the Cell 3 WMD and a recovery sump within the original Little Barney Creek channel. The continued exceedance in sulfate concentrations in bores GW04 and GW14 indicate these measures are inadequate. The importance in addressing the seepage issue is highlighted by MRM's intention to use the dam to store dirty water as part of their mine water management strategy
5. **Tailings Storage Facility** - The seepage from the south eastern corner of TSF Cell 2 needs to be addressed. MRM should identify suitable options to mitigate this seepage. Preventative options include installation of recovery bores to augment the existing interception trench and geopolymer barrier. The importance of addressing this issue is highlighted by MRM's intention of using the active TSF cell to store contaminated water as part of their mine water management strategy.

Overburden Emplacement Facility – The DME will instruct the Operator to undertake a review of groundwater monitoring at the Northern Overburden Emplacement Facility by an appropriately qualified and independent third party and report to the DME.

The DME will request a summary, including timeframes for a proposed solution for the SPROD and will require an appropriately qualified and independent third party to sign off on the design and oversee its implementation. The DME will also require further analysis on combinations of synthetic and clay liners, how a clay liner will be protected from drying whilst ensuring sufficient freeboard and the performance of clays in contact with AMD. There will also need to be evidence that suitable clay sources are available. Finally the DME will require all geotechnical and construction specifications to be clearly identified and summarised and a rigorous QA/QC program to be undertaken during construction to ensure it is as per specification and design.

Tailings Storage Facility - The DME assessment of the 2013-15 MMP has identified the inadequacies with the seepage interception infrastructure for TSF cells 1 and 2. The DME also considers TSF cell 3 to not yet be a properly constructed or complete cell ready to receive tailings or substantial volumes of contaminated water. As such the DME will be seeking detailed explanation on how TSF cell 3 will participate in the contaminated water circuit and how seepage will be prevented in the future.

The DME also considers the delay in the construction of TSF cell 4, a cell that MRM had committed to constructing with a clay and synthetic liner and built in seepage interception system, to be a major drawback to the management of contaminated water at the mine site. The DME will seek clarification on the timeframes and feasibility of the construction of TSF cell 4, particularly with the discovery of groundwater close to surface in the proposed footprint of TSF cell 4.

The DME is currently investigating the seepage from the TSF cell 2 lift and feedback from the IM assessment report has informed discussions with the Operator and the aspects of the TSF cell 2 lift that the investigation will focus on.

5.5 Geochemistry

The highest numbers of recommendations were associated with Geochemistry. The recommendations classified as high include:

1. **Overburden Emplacement Facility** - Ensure that PAF-HC and PAF-RE materials are excluded from below batter zones (which have higher erosion risk) and set back 100m from the outer face to control convective oxidation.
2. **Overburden Emplacement Facility** - Review geochemical classification criteria with the objective of potentially identifying opportunities to increase the amount of lower acid/salinity/metal leaching material to increase flexibility in scheduling and allow opportunities to improve the robustness of the dump cover.
3. **Overburden Emplacement Facility** - Review opportunities to further segregate mine materials during mining based on more detailed geological differentiation. Continue development of geochemical classification criteria to progress full incorporation into the geochemical rock type distribution model.
4. **Overburden Emplacement Facility** - Develop field reconciliation and NOEF field checks to reflect new geochemical criteria.
5. **Overburden Emplacement Facility** - Implement a system for tracking of waste rock geochemical and lithological types placed in the NOEF.
6. **Overburden Emplacement Facility** - Extend paddock dumping to PAF-HC in addition to PAF-RE materials, or devise an equivalent construction method that prevents development of coarse chimney structures and convective oxidation.
7. **Overburden Emplacement Facility** - Avoid the planned application of water and lime on spontaneously combusting materials, or trial on a small area before widespread use.
8. **Overburden Emplacement Facility** - Progressively place cover as soon as completed waste dump areas become available, and interim caps should be placed over active PAF dump areas prior to each wet season.
9. **Tailings Storage Facility** - Produce a final TSF cover design and carry out field trials to measure performance and develop construction methods. Include assessment of long term erosion and stability effects on the cover integrity.

Overburden Emplacement Facility – The DME has and will continue to work closely with the Operator to ensure the waste rock dump design and all aspects of waste classification, identification and placement can be demonstrated as being capable of creating a final landform that is stable and produces acceptable volumes of AMD in perpetuity.

The DME continues to work with the Operator on the waste classification system to ensure it is effective. To date, the Operator has identified that there is a sufficient source of non-AMD producing waste rock available to place as a base in the next proposed section of the NOEF (Central West).

However, there appears to be deficiencies in the classification and suitability of clays proposed to be used as a compact clay layer (CCL) beneath the new stages of the NOEF. There are also deficiencies in methodologies and QA/QC for the placement of the CCL and the design and layout of seepage and run-off management systems, which the DME continues to discuss with the Operator.

Many of the recommendations are a focus of both the DME and the Operator.

Tailings Storage Facility – The DME has identified that seepage management is a high priority at all cells of the TSF. The finalisation and construction of an effective landform and cover design for the TSF, particularly cell 1 in the short term may reduce the requirement for seepage management and should be a high priority for the Operator.

5.6 Geotechnical

A high number of recommendations were associated with Geotechnical aspects of the site. The recommendations classified as high include:

1. **Tailings Storage Facility** - For MRM and the TSF designer to provide design evidence and clear operating guidelines under which the TSF embankments are proven to be effective with respect to stability, seepage, erosion control, piping and any other action that may lead to an uncontrolled release of tailings or water. This should include limits on the depth and extent of the surface water pond. A related recommendation was made in the previous IM report relating to removal of excess water from Cell 2. This was rated as a high priority.
2. **Tailings Storage Facility** - For MRM to fulfil their commitments with respect to monitoring piezometric levels within the Cell 2 embankments so that design factors of safety can be confirmed that the dam is being operated safely. This recommendation was made in the last two IM reports (2012 and 2011). The 2012 IM report also requested that detailed stability analyses need to include monitored (as opposed to estimated) phreatic surfaces in the tailings and embankments. These items remain outstanding and were rated previously as high priority.
3. **Tailings Storage Facility** - MRM to update existing monitoring reporting to include piezometric levels, embankment settlements, pipeline wear, pond levels, deposited tailings, water reclamation and any other TSF monitoring data with respect to design. This assessment should also set safe operating limits for these parameters and triggers and actions as advised by the designer. If any of these triggers or limits are exceeded then the action taken needs to be documented in the monitoring report.
4. All future civil works should provide evidence of the designer's allowable frequency or distribution of compaction test failures or evidence of what specific action and retesting has been undertaken to rectify areas where tests have failed.
5. **Tailings Storage Facility** - The discharge lines should be extended to facilitate deposition around the entire Cell 2 perimeter. This will significantly improve control of the location and extent of the surface water pond.
6. **Overburden Emplacement Facility** - The IM has found some significant inconsistencies within the MRM specification, the application of the spec and assessment of test data. The IM also understands that the current specification is likely to be revised. The IM accordingly recommends that MRM conduct an immediate review of the specification to correct and clarify inconsistencies with specific attention to the placement moisture content range and the type and frequency of hydraulic conductivity testing. Any revised specification will need to be reviewed and agreed by the OEF designer.
7. **Overburden Emplacement Facility** - The IM has found many instances where material in violation of the construction specification is being accepted for dumping of PAF waste (e.g. memo dated 19/9/2013). The IM has also found that the specification pass/fail criteria are being incorrectly applied. In light of these the IM recommends:
 - MRM review all test data to properly assess locations and approximate volumes of placed materials that have not met the reviewed specification including testing frequency.
 - The OEF designer(s) to conduct a review of the above to ascertain whether the placed materials meet design requirements. If not, the OEF designer(s) should recommend remedial action that would be required such that OEF can function

as per the approved design and therefore it's intended purpose. A revised encapsulation design may be required to accommodate these shortcomings depending on the severity and extent of test failures.

- Full-time inspection and testing service on all earthworks (Level 1) to AS3798 should be carried out with the additional requirement that the testing authority (GITA) is independent of MRM (i.e. a Geotechnical Independent Testing Authority or GITA) and provides certificates verifying that the liner has been constructed in line with the spec and satisfies the nominated testing criteria as required by the Standard (AS3798). Future testing should comprise lot testing with a none to fail criteria.
- 8. **Overburden Emplacement Facility** – An interim clay cap should be constructed above PAF material prior to the wet season to minimise infiltration during this period. This action should be documented.
- 9. The foundation treatment should be documented and reviewed against the design (currently URS 2008). Construction records and reports on foundation treatment should be kept and made available to the IM.

Tailings Storage Facility – In response to the excessive seepage identified from TSF cell 2 on 5 June 2014, the DME instructed the Operator to provide the following within 24 hours:

1. A description and photographs of the situation at the location in the attached image including water quality data, water flow rate data and an assessment of the physical stability of the structure.
2. A plan and timetable of the actions proposed to manage the seepage waters and to mitigate the leakage from the structure.
3. A plan and timetable for a full review of the integrity and stability of the tailings dam to be undertaken by a suitably qualified independent expert engineer.

The DME was assured of the structural stability of the TSF (by an appropriately qualified 3rd party) and has asked for additional information as part of the formal investigation into the seepage. The IM recommendations have been considered with the TSF Cell 2 seepage investigation.

The DME issued the following instructions to the Operator on 14 August 2014:

- Limit the discharge of water into TSF Cell 2 to only water contained within the tailings stream (at normal operational slurry densities).
- Cease pumping water from all other sources into TSF Cell 2.
- Commence actions to reduce the water levels in TSF Cell 2 to a level where there ceases to be surface water in contact with the embankment internal walls.
- Deposit all tailings sub-aerially to allow proper beaching and drying between deposition cycles.
- Maintain surface water levels in TSF Cell 2 such that they do not come into contact with the embankment internal walls.
- Implement the recommendations contained in ATC Williams 2013 Annual Regulated Dam Safety Review, in particular with regard to installation of piezometers to monitor embankment conditions against design expectations.
- Provide the DME with documentation containing commitments from MRM to implementation of the above actions, together with a timetable for implementation of each action.

Overburden Emplacement Facility – The DME is awaiting a response from the Operator to a request for additional information with regards to multiple aspects of the NOEF design and construction, including:

- Further information on the waste classification system to ensure it is adequate.

- Deficiencies in the classification and suitability of clays proposed to be used as a compact clay layer (CCL) beneath the new stages of the NOEF.
- Deficiencies in methodologies and QA/QC for the placement of the CCL.
- Deficiencies in design and layout of seepage and run-off management systems.

Due to the issues with clay and seepage management, the DME has issued the following instructions to the Operator:

- The DME requires MRM to appoint an independent, appropriately qualified engineer previously approved by the regulator to provide certification for all design and QA/QC activities relating to the sourcing, placement and management of the clay base until it is permanently covered by waste rock. The independent engineer must sign off on the design as suitable and at the end of the placement certify that it has been constructed in full compliance with the design and provide QA/QC data to validate this certification.
- The DME requires further clarification on the design to address these issues. Considering the poor quality water these drains and sump are designed to intercept, the DME requires that the interception drains and sump are designed not to seep.
- The DME requires MRM to appoint an independent, appropriately qualified engineer previously approved by the regulator to provide certification for all design and QA/QC activities relating to the interception drains and sumps.
- Further the DME requires MRM to provide evidence that there is sufficient pumping capacity installed at the sump to comply with design parameters once they have been developed by the certifying engineer.

5.7 Closure Planning

The following recommendations were classified as high by the IM with regards to closure planning:

1. **Overburden Emplacement Facility** - Review the current dump design in relation to the sustainability and performance of the 0.6 m compacted clay infiltration/oxidation control layer. Test the sensitivities of the cover design to:
 - Changes in material properties.
 - Changes in depth of NAF cover as a result of erosion.
 - Changes in climate.
2. **Open Pit** - The seepage of contaminated water from the pit lake after closure should be assessed. This would best be carried out using a water and solute balance model for the pit void lake, which would include inflows, outflows, storage volumes, effects of salinity on lake evaporation rates and geochemical process associated with interaction between lake water and the pit wall rocks Under the 2011 West Australian mine closure guidelines, which MRM has adopted for closure planning purposes, an assessment of the pit lake condition is required to identify whether a groundwater sink or through flow cell will develop after closure
3. **Tailings Storage Facility** - An interim cover design has been developed for TSF cell 1. MRM currently do not have any plans for retreatment of Cell 1 however with further technological advances retreatment may be possible. An opportunity exists for MRM to develop its TSF closure strategy by implementing a final cover over either all or part of TSF Cell 1. The IM recommends that a final cover strategy trial be undertaken on Cell 1 for at least part of the area.

All of these recommendations are addressed to some extent by the draft Terms of Reference (TOR) for the Environmental Impact. The DME will ensure these recommendations are addressed when next reviewing the Operators closure plan.

5.8 Aquatic Ecology

The following recommendations were classified as high by the IM with regards to closure planning:

1. **Contamination of Biota** - The IM recommends additional aquatic fauna abundance, diversity and metal concentration monitoring along Barney, Little Barney and Surprise creeks to identify potential sources of contamination. This should include sites SW4, SW22, SW3, SW18, SW6 and SW28 until sources of contamination are determined. This monitoring can also be used to assess the effectiveness of the diversion channel rehabilitation
2. **New background lead isotope ratio** - Monitoring would benefit from the establishment of a more regionally relevant background level for lead isotopes, as for all monitoring sites, the average isotopic ratios were closer to the ore body than background levels. Establishing a regionally relevant background isotope ratio would be better for determining whether ore derived lead is entering aquatic fauna.

The DME supports these recommendations and will instruct the Operator accordingly. As described earlier, the DME formed an intergovernmental Taskforce including Department of Health, Department of Primary industries and Fisheries and NT Worksafe. The Taskforce has overseen further field work to confirm the Operator's results and is undertaking a detailed assessment on results to establish the risks presented. This work is ongoing and will continue to inform the taskforce which may lead to further instructions to the Operator.

6 Conclusions

The DME welcomes the recommendations made in the IM's 2014 Environmental Performance Report. The Department is also supportive of the recommendations for further improvement put forward for both the Operator and the Regulator. Information and recommendations included in the 2014 Environmental Performance Report will be used by the DME in its review of the Operator's MMP covering the 2013-15 operational period and in DME's upcoming audit of the mine which is scheduled to take place in the latter half of 2014.

Having reviewed the findings of the 2014 Environmental Performance Report, the DME will act on the issues highlighted and has already commenced action in many cases. The Operator is also working to address the issues, particularly those associated with the new waste classification system and the difficulties in having substantially more AMD producing material than previously estimated.