Mr Paul Ricketts

Fortescue Metals Group Ltd

Level 2, 87 Adelaide Terrace

East Perth WA 6004

19 December 2013

Dear Paul

Comments from peer review – Cloudbreak LOM

HydroConcept has completed a peer review of the FMG (Fortescue Metal Group) hydrogeological assessment relating to the Cloudbreak life of mine management scheme. The review was undertaken by Mr Seth Johnson (Principal Hydrogeologist) with a focus on ensuring the conceptualisation is a realistic representation of the water regime; the numerical modelling provides reliable predictive outputs; and the water resource management strategy integrates and considers the findings.

The document presents a technical discussion on the water management approach associated with the life of the Cloudbreak operation. It has been completed to a high standard and is acceptable for submission to the different Government agencies for their review and consideration.

There has been nearly ten years of field investigations and data collection along the Chichester Range associated with Cloudbreak, as outlined in Table 1. The collection of water level and quality data since 2008 has provided a useful dataset for understanding water system response to dewatering and injection, and calibration of the numerical model. The investigation methodologies employed are appropriate and align with industry standards.

The progressive improvement in understanding of the water resources has resolved the connectivity between surface water hydrology, flooding/drying cycles of the Fortescue Marsh, and water levels within the groundwater system. Recent studies of the ecohydrology by Equinox Environmental have better explained the water regime functioning and dependency of fringing vegetation at the Marsh edge. It has been found that the Mulga species are surface water dependent, Samphire species are tolerant to more than 3 m of drawdown, and surface water processes dominate compared to groundwater.

The interpreted conceptual hydrogeology is valid for the current knowledge of the system, and forms the basis of the numerical groundwater flow model. The hydrostratigraphy is well defined with descriptions and some appreciation of variability within each unit. There is recognition of the significance of hydraulic connectivity between the Oakover Formation and ore body, as this is important for understanding potential inflows of hypersaline water from beneath the Marsh resulting in higher volumes of dewatering, injection and recirculation. Areas of improvements to the conceptual model are detailed in Table 11.

There is a proven understanding of salinity distribution, based on interpretation of an airborne electromagnetic survey, density flow modelling, and actual data from monitoring bores. The spatial

HydroConcept Pty Ltd
U12a, 7 The Esplanade, Mt Pleasant WA 6153
Tel: 0401 35 15 10
Email: seth@hydroconcept.com.au

appreciation and ongoing monitoring of the transitional saltwater interface is critical for long-term maintenance of water quality in the mining operations.

Mine dewatering and reinjection has provided opportunities to gain understanding of hydraulic response, as well as operational learning about dewatering rates and design. The water level data that has been collected, particular in 2010, 2011 and 2012, has improved hydraulic parameter determination and these results have been incorporated into the LoM assessment

The water management approach employed by FMG is considered best practice for the mining industry. The system is extensive with a comprehensive network of dewatering and injection bores linked via pipeline conveyance. The use of managed aquifer recharge has proven to be an effective method for the mitigation and management of water levels beneath and at the edge of the Marsh.

Despite the lack of groundwater monitoring beneath the Fortescue Marsh, FMG have been able to develop a conceptualisation for water processes associated with the Marsh. The conceptual approach seems appropriate, logical and representative of hydraulic functioning and interactions between flooding and drying stages. Studies related to the Fortescue Marsh by UWA and Rio Tinto Iron Ore will provide opportunities to improve the conceptual understanding of Marsh functioning.

The numerical groundwater model is based on the conceptualisation. It was developed to the requirements of the Australian Groundwater Modelling Guidelines, and the use of finite element (FeFlow) enables consideration of density-driven flow. The model has been progressively reviewed, refined and calibrated for reliable predictions of abstraction and injection volumes, assessment of potential impacts, and sizing of the water management system.

The initial model developed in 2010 was reviewed by HydroConcept. Since then, the model has been slight refined with respect to recharge distribution and some hydraulic parameters. The limited changes highlight the robustness of the conceptual model, and that the numerical model is representative and provides meaningful predictions.

The model area is sufficiently large for no boundary effects and to not compromise model outputs in the vicinity of the Marsh. There is a high level of confidence in the numerical model simulations in terms of accuracy, usefulness for water management planning, and regulatory approval. The monitoring data provided in Appendix 4 highlights the good match between actual versus modelled water levels providing confidence in the representativeness of the model. Ongoing monitoring and progressive upgrading of the model is recommended and considered an important part of operational water management.

The model has been used for a range of water management scenarios. Given the variability in climate and lack of actual rainfall data in the project area, FMG has developed a synthetic rainfall data set using a stochastic approach. This aims to represent the variability in rainfall between years and over a long timeframe, and provides the basis for scenario evaluation between wet and dry seasons.

Below are a number of the key observations from the modelling process and generated model outputs that are of importance and significance for life of mine water management at Cloudbreak.

- Water levels at the edge of the Marsh are naturally variable. In places, the water level may range from near surface to 5 m below ground level, and change by 2 to 5 m in response to differing recharge scenarios.

- As the project develops, there will be substantial volumes and water handling requirements in terms of dewatering and injection. The average dewatering (110 GL/a) and peak dewatering volume of 136 GL in 2019 are significant and will require considerable management.
- There are four years (2017, 2019, 2021 and 2024) with large dewatering and injection volumes that will prove challenging for water management, in particular injection into the Oakover Formation. It is recommended that mine planning and scheduling be reviewed to reduce these higher volumes and have a more balanced dewatering rate.
- Water recirculation will need to be closely monitored and progressively assessed over time. Opportunities for different injection approaches to reduce double handling should be considered.
- Modelling of water levels, as well as operational data, has demonstrated that aquifer injection has minimised drawdown and is an effective mitigation tool for protection of the Marsh. Aquifer injection is an important management strategy that will be an ongoing requirement and obligation.
- Demand projections suggest that brackish water will need to be managed carefully. There is potential that mine planning and dewatering schedules will need to be aligned to ensure that brackish water availability is maintained. In light of this scenario, a range of contingency measures have been suggested for consideration.
- The overall water balance is largely driven by recharge and discharge processes at the Marsh. The modelling and ecohydrological studies have demonstrated that the Marsh is a surface water dominated system and that the fringing vegetation is dependent on sheetflow and streamflow for its survival. As such, mining activities are likely to have minimal impact on the Marsh at the regional scale.
- Post-closure recovery of water levels will take many decades to reach a new equilibrium. The rate of recovery will be largely dependent on recharge, as well as the hydraulic response to backfilled materials.
- An understanding of heterogeneity is a major challenge for representation with the numerical model – there have been improvements in this area since 2010. Appendix 8 highlights that the hydraulic conductivity of the backfill material is not a major consideration in water level recovery, when compared with other factors in the overall water balance.

The lack of monitoring beneath the Marsh is problematic with the peer reviewer stressing that Marsh can only be protected once its functioning is truly understood. It is recommended that FMG continue with ongoing development and calibration of the model to improve confidence in dewatering and injection volumes, as well as ensuring alignment with actual responses.

Conclusion

The Cloudbreak life of mine water management strategy builds on operational experiences, as well as nearly ten years of investigations and data collection. FMG appear committed to improve its understanding of the water resources and progressively integration of new knowledge into its predictive modelling. This approach has been demonstrated through the integration of modelling predictions into operational water management decision making, and ongoing calibration of model output with actual responses.

The numerical groundwater model is considered representative and is based on a robust conceptual understanding. There will be a need for ongoing model calibration against actual responses, as per

Appendix 4, and progressive improvement in understanding from operation observations, so that water management is as optimal as possible.

The predictions for the life of mine are within bounds and of sufficient accuracy for water management and mine planning. The volumes of dewatering and injection are significant and it is considered that ongoing monitoring and management will be critical for project success. This is highlighted as FMG were handling 59 GL in 2012, which less than half of the peak volumes in 2019 and 2021.

The peak volumes in 2017, 2019, 2012 and 2024 will create challenges with recirculation, injection capacity in the Oakover Formation and the conveyance system – efforts should be made to reduce these peaks. It will be important to ensure that the system has sufficient capacity to handle the necessary volumes of injection.

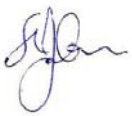
The connectivity of the Oakover and mineralised Marra Mamba Formations is important for understanding dewatering and injection volumes, as well as the extent of recirculation. The success of the injection process will be limited by the capacity of the Oakover Formation; as such the ongoing monitoring of aquifer response will be necessary. FMG have recognised the importance of saline water injection into the Oakover Formation as an integral part of continued operations with a recommended future work program, as outlined in Section 7.3, to confirm long-term injection rates and develop additional contingency measures.

FMG have demonstrated a whole of system approach, with consideration for interaction between the Cloudbreak and Christmas Creek operations. There are no immediate issues with cumulative impacts as Brockman Resources' Marillana and RHIO's Roy Hill operations are too distant.

There has been careful consideration of the Fortescue Marsh throughout the whole life of mine planning stage and in FMG's water management strategy. It is considered that impacts to the Marsh will be minimal and that injection is a valid mitigation approach. The peer reviewer would again reiterate the lack of monitoring beneath the Marsh is problematic and there should be ongoing discussion with Government agencies to approve the installation of a monitoring network.

The peer reviewer is satisfied that the 'Hydrogeological assessment of the Cloudbreak life of mine management scheme' report provides an accurate and representative appreciation of the water resources, and potential impacts associated with the future mining operations. There will be substantial challenges associated with mine dewatering and injection at Cloudbreak requiring pro-active management including monitoring, mitigation via injection and comparison between modelling predictions and actual data.

Yours sincerely



Seth Johnson
Principal Hydrogeologist / Director
B.App.Sc., M.Eng.Sc., RPGeo (10106), mIAH, mIAG

The peer review has been completed by Mr Seth Johnson, a Registered Practising Geoscientist (Number 10106), who is bound by the Australian Institute of Geoscientists' Code of Ethics. It has been produced independently being based on information provided by Fortescue Metals Group Ltd. All comments are considered accurate and provided in good faith.