INDEPENDENT REVIEW STATEMENT

To:	Citic Pacific Mining Management Pty Ltd
Attention:	Jillian Baroni, Senior Hydrogeologist
Date:	26 Novemer 2020
Subject:	**Independent review of groundwater model for Sino Iron 2020 dewatering model (v1.1 – FINAL)**

This memo summarises the outcomes of an independent review of the groundwater flow modelling studies relating to the Sino Iron project being developed by Citic Pacific Mining (CPM) near Cape Preston, about 80 km south-west of Karratha in the Pilbara region of Western Australia.

The groundwater flow model review was conducted in accordance with the best practice principles of the Australian Groundwater Modelling Guideline (Barnett et al., 2012). The 2012 guideline suggests a compliance checklist to summarise review outcomes, presented herein as Table 1 (see next page).

The main basis for the review was the LoM Dewatering Prediction groundwater modelling report (PSM, 2020). The review process involved the evaluation of the model design report with reference to the Australian Groundwater Modelling Guidelines (Barnett et al., 2012). The FEFLOW numerical model data files have not been inspected at this time.

Based on the overall outcome of the review process, it is my professional opinion that the groundwater flow modelling study has been undertaken consistent with best practice, including careful model design that allows for future aquifer system changes. The model is well designed and executed, achieving a model confidence level classification of Class 2, meaning it is fit for the purposes of determining short-term mine dewatering requirements and assessing project impacts.

This review also endorses the recommendations that further aquifer investigations are required to provide data in order to limit the assumptions and uncertainties relating to hydraulic connections / flow paths between the pits and recharge sources including the superficial aquifer, leakage from the tidal sections of the rivers and the coast.

As part of the proposed recharge source estimation study the sensitivity of the extent of drawdown to the hydraulic separation of the Alluvial and Yarraloola Conglomerate aquifers, due to the intervening Robe Pisolith / Trealla Limestone aquitards, should be considered as the available plots presented in the Figure 30 shows head differences of about 5 m, suggesting considerable resistance to induced downward fluxes.

Yours sincerely, CloudGMS Pty Ltd

Anthony Knapton (Principal Groundwater Modeller)

Declaration

For the record, the reviewer (Anthony Knapton) is a geophysicist, hydrogeologist and independent groundwater modelling specialist with more than 25 years' experience. Anthony is a co-author of the NWC groundwater modelling guidelines (Barnett et al, 2012).

Note that Anthony Knapton has previously undertaken modelling work for Citic Pacific at Sino Iron, although there is no conflict of interest in relation to this review task.

Table 1 - Groundwater Model Compliance Checklist: 10-point essential summary

Question	Y/N	Comments re Sino Iron project groundwater model
1. Are the model objectives and model confidence level classification clearly stated?	Yes	Short-term pit dewatering design development context in semi-arid area with river pools and GDEs. Class 2 model confidence level target. Review finds some elements of Class 3 achieved (conceptualisation; layer structure & spatial parameterisation; stream-aquifer features).
2. Are the objectives satisfied?	Yes	Competent model design, calibration & predictions for life of mine & post closure. Clear results (dewatering volumes and groundwater levels as contours at selected times) presented on key environmental, mining & closure issues, primarily dewatering infrastructure planning / design.
3. Is the conceptual model consistent with objectives and confidence level?	Yes	Conceptualisation is sound, consistent with available information and builds on previous studies, appropriate for project/study context.
4. Is the conceptual model based on all available data, presented clearly and reviewed by an appropriate reviewer?	Yes	Model report relies on previous investigations and updated understanding of geological structures based on drilling and geophysics. This review did not identify any lack of rigour in the investigation or material flaws in the modelling.
5. Does the model design conform to best practice?	Yes	The model software, design, extent, grid, boundaries, parameters and integrated qualitative uncertainty assessment conform to best practice in design and execution.
6. Is the model calibration satisfactory?	Yes	Adequate statistical calibration performance (10% NRMS or 5m RMS in context of 120m pit dewatering drawdown), although the bores used to determine calibration statistics are not identified. Reasonable time series matches for the selected bores presented, with seasonality and trends replicated. Generally overestimated drawdown, and the gradient between the alluvials and Yarraloola Conglomerate is not matched, this may influence that extent of final drawdown to the west. No matches to VWP data presented, although it was observed previously that the VWP data appears questionable and should be QA-ed. Simulated dewatering volumes consistent with observed volumes and cumulative totals although slightly underestimated. No quantification of numerical performance.
7. Are the calibrated parameter values and estimated fluxes plausible?	Yes	Appropriate level of complexity in parameter values and spatial distributions (effective implementation of conceptual model and use of data available, particularly new information regarding the location of faults). Calibration period (2010-2019) includes substantial hydrological variability and model fluxes are consistent with independent water balance estimates of recharge/throughflow and sump pump volumes, which reduces potential for model non-uniqueness problems.
8. Do the model predictions conform to best practice?	Yes	Prediction scenarios of (40-year) life of mine effects and subsequent long term (steady state) effects of post-mining, consistent with best practice. Detailed reporting of dewatering requirements and drawdown at periodic times on key receptors.
9. Is the uncertainty associated with the predictions reported?	Yes	Limited quantitative analysis of model structure and parameter uncertainty, Clear statements about the current uncertainty in the role of structural elements and the possible implications of different realisations. This review agrees with the recommendations that discovery / aquifer investigations are required to provide structural data and groundwater connectivity to surface water recharge sources to further constrain model calibration and thus reduce remaining uncertainties relating to hydraulic connections between the pit and the superficial aquifer and the influence of tidal / costal features. It should then be feasible to extend the uncertainty analysis.
10. Is the model fit for purpose?	Yes	My professional opinion is that the model is consistent with best practice in design and execution and is fit for the purposes of planning short-term mine dewatering strategies and impact predictions.

References

Barnett, B., Townley, L.R., Post, V., Evans, R.E., Hunt, R.J., Peeters, L., Richardson, S., Werner, A.D., Knapton, A. and Boronkay, A. (2012). Australian Groundwater Modelling Guidelines. Waterlines report 82, National Water Commission, Canberra. URL: http://archive.nwc.gov.au/library/waterlines/82.

PSM (2020) CITIC Pacific Mining Management Pty Ltd LoM Dewatering Prediction Report 20201119 PSM3058-049R.Rev1, 19 November 2020