



mine-dewatering conditions for a new mining strip. However, the available information did not provide sufficient certainty to develop a reliable mine water management plan.



Stacker, reclaimer and conveyor system (Source: FMG). © FMG

### GROUNDWATER MODELLING AS A BASIS FOR EFFICIENT MINE WATER MANAGEMENT

In order to optimize operations and understand the dynamics of the interface between the fresh, brackish and saline groundwater, FMG called on DHI to design a high spatial resolution salinity groundwater model (HSRSM) for the mining area. This would enable FMG to predict the movement of the saline/brackish groundwater interface as well as the quantity and salinity of dewatered groundwater in each mining pit under different mining plans. Moreover, the model can be used to assess the effects of various water management plans involving dewatering and water re-injection.

### DETAILED – BUT COMPUTATIONALLY FAST

A realistic prediction of the groundwater salinity interface relies on high spatial resolution but, at the same time, needs to have reasonable simulation times to allow for the models to be effectively used as a tool. The challenge was therefore to ensure that we could increase the resolution and accuracy of the model whilst keeping simulation run times reasonable and proportional to the increased complexity. The model simulation time is a critical element for project delivery that is often overlooked by modellers and project managers alike and can cause significant frustration to project managers later in the project delivery cycle. As expected the HSRSM model resulted in increased run times but provided greater precision and accuracy in its predictions.

### REALISTIC PREDICTION OF GROUNDWATER SALINITY IN HIGH RESOLUTION

The client had previously developed a density-driven groundwater flow and transport model. The clients model was used to predict mine dewatering volume and groundwater drawdown/mounding. The spatial resolution of these models was not sufficient to provide certainty with respect to predicted salinity changes associated with groundwater pumping from the mining pits. DHI performed a review and analysis of the FMG models and gained an understanding of the challenges to be resolved.

DHI's detailed modelling enables FMG to quantify the amount of available fresh or brackish groundwater and to predict groundwater salinity reliably. The three major processes considered were density-driven flow, mine dewatering and groundwater injection of saline and brackish water.

Ultimately, the model could be used to:

- design practical dewatering and reinjection solutions to meet specific water management goals;
- optimise designs for economic efficiency;
- evaluate potential effects of mining activities on environmental features such as the Marsh;
- understand and mitigate saline water ingress; and
- predict impacts of alternative hydrological or development scenarios to assist FMG in the decision making.

### OPTIMISED MINE OPERATION FOR THE SAKE OF ECONOMY AND ENVIRONMENT

FMG was able to continue planning mine dewatering and reinjection operations while ensuring the environmental safety of this precious region. The HSRSM modelling confirmed that the FMG modelling approach was sound and additionally minimized the uncertainty. The work contributed to minimizing the risk and the optimisation of the mining operations, both economically and ecologically. This will ensure that Pilbara's iron ore deposits, which contribute significantly to the economy of Western Australia, can be exploited without sacrificing the region's environmental values.

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