



A three-dimensional groundwater flow model was constructed for Sishen Mine. The purpose of the model is to predict the required dewatering rate and boreholes to maintain dry working conditions in the mine.

## Project Background

Sishen Mine in South Africa, one of the largest open pit iron mines in the world, is characterized by a complex, compartmentalized hydrogeologic setting that comprises numerous dykes, regional water-bearing faults and inter-bedded localized geologic units. The objective was to simulate the unique geologic setting for effective mine water management and dewatering planning at the mine.

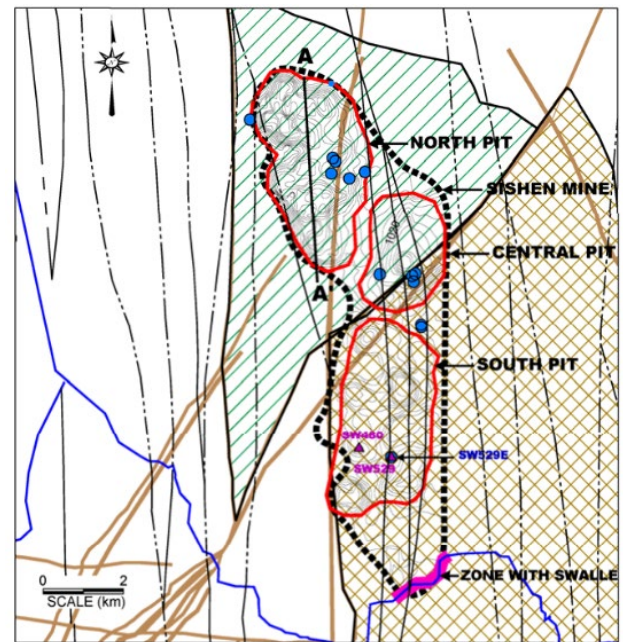


Figure 1. Sishen Pit configuration, dewatering wells, and hydraulic compartments.

## Model Description

A conceptual model was developed to assess the regional hydrogeologic setting before and during the course of mining. A three-dimensional (3D) finite-element groundwater flow model was constructed using *MINEDW* to accurately predict mine dewatering rates by integrating the conceptual

model with site characterization data, the mining development plan, and the mine closure plan. The model was calibrated to both pre-mining (steady-state) and transient conditions. In addition to water levels, residual passive inflow (RPI), which refers to the seepage rate into the pit under active dewatering conditions, was also used in the model calibration.

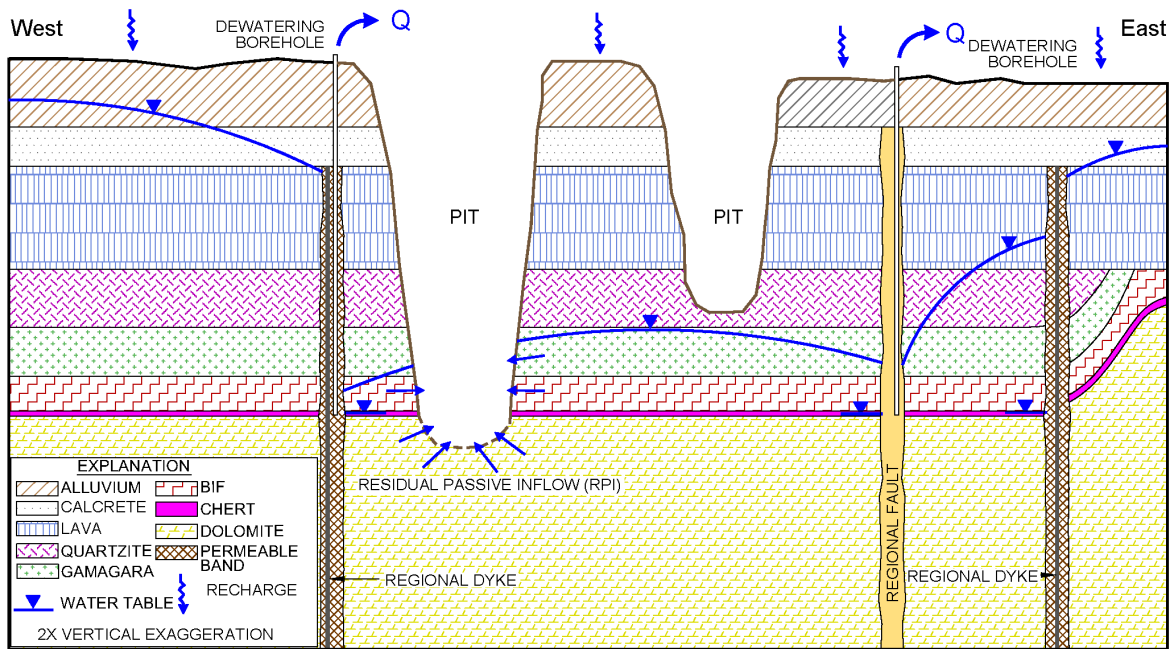


Figure 2. Geologic and hydrogeologic setting.

## Results

Itasca used the calibrated model to predict different dewatering options for various mining scenarios. Based on the model predictions, Itasca also made recommendations of monitoring borehole locations and additional dewatering boreholes for effective mine water management.

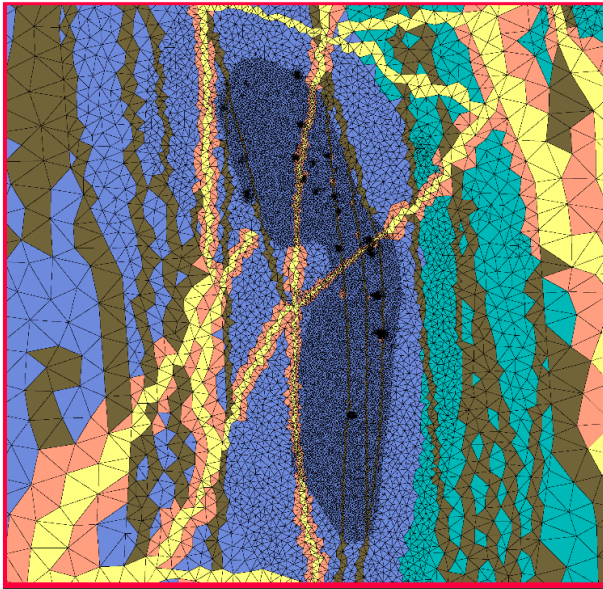


Figure 3. Plan view of model grid and geologic units of model layer 3.

## Summary

- The groundwater flow model incorporates the country rock model and the updated conceptual hydrogeologic model.
- This model was calibrated with data from observation boreholes.
- The calibrated model is used to predict groundwater dewatering requirements for future mining.
- The model can also be used for environmental purposes to predict the possible extent of the impact of mine dewatering.

## References

Liu, H., E. Nel, J. Kotze and D. Ding. (2013) "Mine Dewatering in a Compartmentalized Hydrogeological Setting at Sishen Mine in South Africa," in ***Reliable Mine Water Technology (Proceedings, International Mine Water Association 2013 Annual Conference, Golden, Colorado, August 2013)***, Vol. 1, 157–162, Sydney, Canada: IMWA.