**Optimising Drillhole Spacing using Conditional Simulation at the Invincible Gold Mine, Australia**

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# ABSTRACT

Mineral resources and mineral reserves are fundamental assets of mining companies and capital-intensive investments are made with respect to these. One critical risk exists in the uncertainty of the estimation and classification of resources and reserves. If after intensive capital investments, it is subsequently found that the expected mineral resources and mineral reserves are inefficiently estimated or classified, billions of dollars may be lost. This study presents a probabilistic model for informed decision on mineral resource classification, using conditional simulation techniques.

The case study investigates the optimisation of drillhole spacing for mineral resource to mineral reserve conversion for an extensional vein package within the Invincible South deposit at Gold Fields’ St Ives Gold Mine, to enhance resource classification aimed at reducing exploration costs. The study also investigates the optimal drillhole spacing for grade control.

Currently, conventional drill spacing for Indicated classification reserves conversion within extensional vein package bulk stopes, is at 40m x 40m and there is no standardised drill pattern for grade control.

Two project workflows were applied to address the above study goals. The first workflow involves using a conditional simulation approach to assess the impact of varying drillhole densities. One realisation was sampled using the elected test drill patterns (10m x 10m, 20m x 10m, 20m x 20m, 40m x 20m, 40m x 40m and 80m x 40m) to produce sets of drillholes. The drillholes were imported into Leapfrog Geo for geology interpretation specific to each set of selected drill spacing data. Gold estimates using 3D Ordinary kriging were derived in Datamine Studio RM within these respective geology interpretations and the corresponding sample data set. The estimates were compared using the 10m x 10m case as a baseline in deriving the probabilistic error model. The second workflow involves further empirical reconciliation of the model inventory within the same volume subsequently drilled at a 40m x 40m spacing and later infilled to 40m x 20m spacing, to further stress test the efficiency of the probabilistic error model.

Results from this study supports a 40m x 40m drill spacing to inform an Indicated classification under the assumption that drill angles are optimal. For the grade control, the study showed that a 20m x 10m drill spacing is optimal to predict grades and tonnes accurately enough on a quarterly basis. The findings of this study provide valuable insights for exploration strategy, resource estimation and classification at Invincible, highlighting the potential for significant cost savings and improved resource definition through targeted drilling programs.